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INDEX

Forty-second Quarto Volume—January 1, 1907, to June 30, 1907

AUTHORS

Adams, B. B., 586
Adams, Prof. H. C., 922
Adams, T. E., 905
Ashmead, P. H., 100
Arkenburgh, W. H., 610
Atkinson, A. S., 213
Atkinson, Roger, 66
Atterbury, W. W., 10

Baer, G. F., 204
Baldwin, Ward, 409
Barnum, M. K., 841
Beecham, W. E., 752
Blum, Dr., 460
Boissevain, D. G., 435, 538
Bond, J. E., 808
Bowen, C. H., 366
Brady, J. E., 367, 798
Brazier, F. W., 934
Browne, J. C., 925
Burnett, James, 49
Burton, T. L., 719
Bury, G. J., 504

Calhoun, W. J., 616
Caruthers, C. H., 39, 235, 552
Cellar, G. A., 937
Chadbourne, B. F., 221
Cleveland, Grover, 450
Coelho, F. R., 151
Cole, F. J., 181
Colombo, Senator, 559
Colvin, H. F., 640
County, A. J., 512
Crandell, C. A., 448
Crawford, C. G., 446
Creighton, G. W., 9
Cuenot, G., 363, 416, 453, 485, 517, 550, 588, 618, 654, 681, 713, 746, 801
Curtis, W. E., 657
Cushing, W. C., 363, 416, 453, 485, 517, 550, 588, 618, 654, 681, 713, 746, 801

Dailey, G. W., 938
Daly, J. M., 202, 293
Deems, J. F., 901
De Knight, E. W., 119
Demoulin, Maurice, 116, 186
Dennis, W. F., 437
De Witt, Philip H., 174
Diaz, President, 557
Dickerson, J. T., 922
Dixon, F. H., 66
Dolan, S. M., 216
Dominico, G., 48
Dring, W. A., 34
Droege, J. A., 232
Dudley, S. W., 804, 862
Dunham, W. E., 68

Ekstrom, A. R., 836
Elliott, A. J., 244
Elliott, Howard, 437
Elliott, W. H., 405
Emerson, Harrington, 105, 764
Emerson, T. M., 735

Faulkner, E. O., 47, 222
Felton, S. M., 436
Fink, Henry, 567
Finley, W. W., 113, 243, 651
Fish, Stuyvesant, 873
Fleming, Robert, 643
Fowler, G. L., 351, 575, 701, 767, 931, 935
Fowler, W. E., 925
Freire, J. J. Da Silva, 700
Fry, L. H., 802
Fulton, J. A., 506, 605, 700

Galbraith, J. N., 47
Garver, S., 640
Gibbs, George, 415
Godfrey, Edward, 639
Goodnow, C. A., 616
Gordon, Reginald, 69, 118
Gould, W. F., 180
Grunsky, C. E., 489
Guild, Governor, 861
Gutelius, F. P., 606

Hale, Arthur, 625
Harding, Russell, 73
Harmon, Judson, 690, 691
Harriman, E. H., 270, 298, 411
Harrington, J. L., 800
Hart, J. H., 74
Hatt, W. K., 580, 656
Hawks, J. D., 165
Hazleton, Hugh, 831
Henderson, C. R., 361
Henderson, G. R., 202, 795
Hibbard, H. Wade, 21
Hill, J. J., 86, 122, 913
Hillard, C. W., 299
Hodgson, D. B., 48
Hood, A. G., 940
Horn, H. J., 9
Hughes, Governor, 871
Hunt, Capt. R. W., 794
Hutchins, F. L., 136

Johnson, A. H., 233
Johnson, Henry, 241
Johnson, L. E., 436
Johnson, T. H., 669
Joline, A. H., 516

Kahn, O. H., 298
Kneass, S. L., 906
Kruttschnitt, J., 9, 141, 616
Kupka, P. F., 35

Latimer, J. A., 521
Lane, F. K., 813
Lewis, N. P., 686
Lindenthal, Gustav, 336
Love, A. J., 100
Lynch, W. J., 123

M'Ewen, T. S., 151
McIntosh, W., 932
McKeen, W. R., Jr., 778, 824
McLean, S. J., 313
McPherson, Logan G., 54
M'Veigh, E. J., 34
Manning, H. G., 787
Marchbanks, James, 49
Maroney, D. F., 266
Mayer, Joseph, 273
Mellen, C. S., 861
Moseley, Secretary, 886
Muhlfeld, J. E., 932
Murray, O. G., 436

Newcomb, H. T., 172
Noyes, C. F., 296

Ohmra, Takuichi, 48
Ott, O. W., 866

Paley, W. B., 144, 450
Parke, F. H., 804, 862
Parker, E. W., 940
Parsons, Hon. C. A., 830
Peabody, James, 494
Peck, G. L., 315
Peck, P. H., 931
Peckels, W. H., 709
Porter, R. P., 398
Potter, W. B., 416
Prout, H. G., 178
Prouty, C. A., 723, 753
Putnam, H. St. C., 134

Raymond, W. G., 614
Reeve, Sidney A., 8
Riddell, Judge, 748
Roesch, F. P., 904
Root, W. S., 617
Russell, W. B., 902

Sanborn, Judge, 626
Schaub, J. W., 939
Schidlovski, T., 49
Schmidt, Prof., 519
Schwab, C. M., 721
Shand, A. C., 403
Siemantel, G. D., 539
Sims, C. S., 474, 539
Smith, M. H., 301
Snyder, Carl, 462
Speer, Judge Emory, 515
Spooner, F. E., 583
Sprague, F. J., 169, 415
Spring, E. C., 154
Stillwell, L. B., 134
Stoney, E. W., 49
Storey, L. J., 602
Stucki, A., 649
Sugiura, S., 48
Symons, W. E., 103

Tait, Thomas, 49
Thayer, J. B., 311
Trautwine, J. C., Jr., 472
Turneaure, Prof., 443

Van Akin, S. L., Jr., 937
Vauclain, S. M., 416
Vaughan, H. H., 792, 905
Vermillion, P. B., 234

Waldo, F. L., 82
Waldron, F. W., 152
Walker, R. J., 830
Watson, Thomas, 50
Wells, M. E., 904
Wells, Reuben, 782
West, G. W., 907, 927
Wild, M. B., 168, 435, 504, 639, 884
Wilgus, W. J., 415
Williams, J. C., 764
Worthington, B. A., 201, 473, 572
Worthington, W. A., 435, 670

Yoakum, B. F., 754
Yorke, Lt. Col. H. A., 548

Zalinski, E. L., 716

GENERAL INDEX

[Illustrated articles are indicated thus; Editorials thus†; Contributions thus‡.]*

A

Abbott Rail Joint Plate, 373*
Accidents:
Alkmaar, South Africa, 423
Arbroath, Scotland, 27, 506
B. & O. at Terra Cotta, D. C., 1†, 12, 31†, 44, 76
B. & O. at Woodville, Ind., 470†, 477, 699†
British System of Investigation, 231†, 534†, 548
Canada R. R. Commission Report, 421
Can. Pac. at Chapleau, 560
Causes of, 66‡
C., R. I. & P., Alta Vista, Kan., 26, 37
C., C., C. & St. L. at Fowler, Ind., 470†, 477
C., C., C. & St. L. Explosion at Sanford, Ind., 121, 470†, 477
Damages from New York Central, 285
Dangers of Speed, 263†
D. & H. Record, 421, 536†*
Derailments, Due to Wrongly Placed Side Bearings, 823†
Erie Ferryboat Sunk, 26
Excessive Hours and Resulting Accident, 748
Govt. Bulletins: No. 21, 209†; No. 22, 697†, 707
Grand Trunk, Gourock, Ont., 748
Great Northern at Clontarf, 157
Indiana Legislation, 470†, 477
Investigation Bureau, 97†, 231†, 534†
Investigations of, 100‡
Monthly Summaries: Dec., 1906, 134†, 145; Jan., 1907, 263†; Feb., 1907, 399†; March, 1907, 535†; April, 1907, 668†
N. Y. C. & H. R. at Pittsford, 943
N. Y. C. & H. R. near Williamsbridge, 230†, 261†, 292†, 327†*, 414*, 415, 462, 473‡, 504†, 634†
N. Y., N. H. & H. near Hartford, 943
Ninth Ave. Elevated, 253
Penna. R. R., Mineral Point, 261†, 272, 403‡
Penna. R. R. near Atlantic City, 121
Prevented by Automatic Block Signals, 208
Prof. Dixon on, 665†
Road Crossing Accident, 56*
Safer Operation, 285, 315
Southern Ry. at Lawyer, Va., 8‡, 698†
Sou. Pac. at Colton, 493
Sou. Pac. at Honda, 691
Train Marker Practice, 527
Train Wreckers, Erie and Sou. Pac., 754
Train Wreckers, Penna. R. R., 493, 528
Accounting:
I. C. C. Revision, 32†, 557, 869, 883†, 913, 922
Adams & Westlake Co., Axle-Light Decision, 462
Adams Express Co.:
Dividend, 913
Whisky Traffic, 689
Adding Machine Attachment, 860
Adreon & Co., Back-up Valve, 870*
Advertisement, Erie Ticket Office, 594*
Africa:
Cape Colony Advisory Board, 636†
Congo R. R., 316
Otavi Railroad, 112
Protecting Piles from Teredo, 151*
Railroads in French West Africa, 574
Air Brake (See Brake).
Air Resistance in Tunnel, 269
Alabama:
New Railroad Laws, 459
State R. R. Commission, 371
Alan Wood, Iron & Steel Co., Steel Gondola, 206*
Alaska Central R. R., 213
American Car & Foundry Co.:
Steel Passenger Cars, Hudson Companies, 822†, 831*
Steel Passenger Car for Long Island R. R., 17*
American File Sharpener, 422*
American Flange Frog & Ry. Improvement Co., Flange Frog, 527*
American Guard Rail Fastener, 593*
American Locomotive Co.:
Changes in Officers, 285
Consolidation Locomotive, Nippon Tetsudo Kwaisha, 296*
Jamestown Exhibit, 559
Mogul Locomotive for Vandalia, 10*
Pacific Loco., Atlanta & West Point, 784*
Rotary Snow Plow, D., N.-W. & P., 114*
Ten-wheel Locomotive, Central of Peru, 262*
Ten-wheel Locomotive, St. L. & S. F., 572*
American Palace Car Co.:
Comb. Parlor, Sleeping and Dining Cars for Canadian Northern, 623*
American Railway Association:
Car Efficiency Committee, 98†, 567†, 581, 601†, 615
Clearing House and Car Pools, 98†, 567†, 581, 601†, 615
Fifty-cent Per Diem Rate, 533†
Spring Meeting, 601†, 615
Am. Ry. Engineering and Maint. of Way Assoc.:
Concrete and Steel Ties, 429†
Convention, 429†, 442*
Convention Exhibits, 452
Report on Economics of R. R. Location, 534†, 542
Turneaure Recording Extensometer, 444*
American Railway Master Mechanics' Association:
Atlantic City Convention, 882†, 901
Convention Exhibits, 858, 899
Convention Plans, 190, 230†, 697†
Discussion of Reports, 882†, 901
Program of Convention, 796
Topical Discussions, 906
Am. Soc. for Testing Materials, Discussion on Rails, 919†
Ann Arbor R. R., Safety Appliance Law Challenged, 478
Annual Reports (See also corporate names; also Accounting):
Summary of, 4†*
Argentine Republic:
Tie Conditions, 48
Arkansas:
New Railroad Laws, 459
Armbrust Brake Shoe, 873*
Asbestos Building Lumber, 158*
Association (See Association Names).
Assoc. of Ry. Telegraph Supts., Annual Meeting, 919†, 937
Assoc. of Transportation and Car Accounting Officers:
Plan for Freight Car Pool, 821†
Proposed Diversion Rules, 845
Committee Reports, 923
Atchison, Topeka & Santa Fe:
Attachment of Equipment, 155
Electric Traveling Roundhouse Crane, 871*
Employees' Merit Marks, 581, 754, 943
Fruit Traffic Agreement with Sou. Pac., 189
Harriman Interest, 33†, 52, 271
Northwestern Pacific R. R., 861*
Page Bascule Bridge, Chicago River, 836*, 922‡
Pension System, 19
Reading Rooms and Club Houses, 590*
Shop Belting Practice, 105*, 131†
Atlanta & West Point, Pacific Locomotive, 784*
Atlantic Shore Line, 178*
Atmospheric Railroad Traction, 144*
Attitude of R. R.'s (See Public, Relation of R. R.'s to).
Australia:
Tie Conditions, 49
Victoria Government Railways, 167†, 177*
Austrian State Railroads:
Four Cylinder Compound Locomotive, 69*
Suspension of Freight Service, 582, 686
Automatic Stops (See Safety Appliances).
Automobile, Penna. R. R. Committee Report on Foreign Use, 606

B

Baden State Railroads, Students on Locomotives, 83
Baggage Trucks, Electric, Penna. R. R., 315, 845*
Baker-Stewart Car Door Hanger, 156*
Baldwin Locomotive Works:
Consolidation Loco., Jamestown Exposition, 780*
De Glehn Comp., Paris-Orleans Ry., 761†, 774*
Fire, 190
Four Cyl. Bal. Comp., Italian State Rys., 50*, 585
Mallet Comp., Gt. Nor., 684*
Output, 26, 122, 221
Simple Consolidation, Italian State Rys., 51*, 585
Superheater, 780*
Baltimore & Ohio:
Collision at Terra Cotta, D. C., 1†, 12, 31†, 44, 76
Collision at Woodville, 470†, 477, 699†
Harriman Interest, 33†, 52
Inspectors of Yards and Stations, 881†
Rest Houses, 840
Scherzer Bridges, 372*
Washington Union Station, 483*
Bangs Automatic Oil Cup, 373*
Barnes Skimmer and Blow-off Valve, 799*
Barney & Smith Comb. Parlor, Sleeping and Dining Car for Canadian Northern, 623*
Bavarian State Railroads:
New Organization, 623
Steam Motor Car, 169*
Bearing (See Car).
Beef Exports, Effects of Attacks on Packers, 665*
Belgium:
Suspension of Freight Service, 686
Belting:
Shop Belting Practice, A., T. & S. F., 105*, 131†
Bessemer & Lake Erie:
Carnegie Steel Ties, 297
Bignall & Keeler Pipe Threader, 528*
Block Signal (See Signal, Block)
Boiler (See Locomotive Boiler)
Bonds (See Finance)
Boston, Effect of Per Diem Increase, 920†
Boston & Albany:
Mass. R. R. Comm. Report on Poor Service, 37
Boston & Maine:
Attitude Toward Electric Lines, 88
Car Recording at Local Stations, 136*
Position in New England, 602†
Purchase by N. Y., N. H. & H., 666†, 721, 861
Short-Term Notes, 132†
Working Regulations for Enginemen, 267
Bradford, B. C., Treacy Dipper Tooth, 627*
Brake (See also Safety Appliances):
Air Brake Control of Heavy Trains on Steep Grades, 719
Armbrust Brake Shoe, 873*
Buffalo Forged Steel Brake Head, 874*
Davis Brake Beam Testing Machine, 873*
Hand Brakes on Steep Grades, 715
Recent Developments in Air Brake Control Apparatus, 804*, 862*
Brakeman (See Employee)
Brazil:
Elevated Railroads, 121
Mallet Compounds in, 697†, 700‡
Bridge:
C., M. & St. P., Pacific Extension, 479
Columbia, 472‡*
Concrete Viaduct, Florida East Coast Extension, 584*
Developing an Impact Formula by Experiment, 324†
East River, N. Y. Connecting R. R., 750*
Extensometer, Turneaure Recording, 444*
Kansas City, Sixth Street Viaduct, 521*
Lehigh Valley over Susquehanna, near Towanda, 174*
N. Y. State R. R. Commission Rules, 285, 292†, 310
Page Bascule, Chicago River, 836*, 922‡
P., B. & W. over Susquehanna at Havre de Grace, 688*
Placing Double Track Through Plate Girders on Union Pacific, 338*
Quebec, 37*
Reinforced Concrete Floors for Through Truss Spans, 339*
Reinforced Concrete, over Cumberland River, 409*
Scherzer Bascule, 372*, 922‡
Strauss Bascule, 374*
British (See also England; also names of railroads):
Freight Cartage and Delivery, 300*
Freight Traffic, Working Statistics, 132†, 142
View of Stock Watering, 643
Brooklyn Rapid Transit Co.:
Coney Island Fare, 55
Rehabilitation, 635†, 644*, 670
Buda Fdry. & Mfg. Co.:
Ball Bearing Jack, 558*
Portable Drill Grinder, 526*
Buffalo Forged Steel Brake Head, 874*
Buffalo Forge Co.:
Compressed Air Forge, 494*
Draft & Heating Equipment, Erie Roundhouse at Susquehanna, 120*
Outdoor Forge, 88*
Building Material:
Asbestos Building Lumber, 158*
Cellular Steel, 373*
Reinforced Concrete Roofing Tile, 376*
Bumping Post, Symons Cast Steel, 54*
Burroughs Adding Machine Co., Adding Machine Attachment, 860
Business Situation (See also Finance; also Traffic).
Increased Commodity Costs, 623*
Increased Operating Expenses, 560
Outlook for 1907, 13
Railroad Conditions in South, 113
Unique Forces of Railroad Prosperity, 166†

C

Cable Way (See Hoisting and Conveying).
California:
New Railroad Laws, 459
California & Northeastern, 790*
Camden & Amboy; Early Equipment, 39*
Canada:
Broken Rails, 814
Canal System, 214*
Form of Railroad Accounting, 913
Passenger Rate Regulation and the Canadian Parliament, 313
Railroad Commission Accident Report, 421
Sunday Law, 269

Canadian Northern:
Combination Parlor, Sleeping and Dining Cars, 623*
Freight Congestion, 558
Ottawa Union Station, 745*
Purchase of Quebec & Lake St. John, 697†
Canadian Pacific:
Derailment at Chapleau, 560
Ottawa Union Station, 745*
Private Car "Killarney," 72*
Supply Cars, 812
Ten Wheel Locomotive, 186*
Toronto Union Station, 718*
Trackage Rights over O. R. R. & N., 469†
Canals:
Canadian, 214*
Cape Cod, 494
Isthmus of Corinth, 852
Panama (See Panama Canal).
Teltow, 118*
Tolls in Prussia, 684
Traffic Through Soo, 748
Cananea, Yaqui River & Pacific, 458*
Canton-Hankow R. R.:
Equipment, 1002*
General Summary, 908*
Cars:
Accidents Due to Defective Equipment, 66‡
Baggage, London & N.-W., 300*
Box, All-Steel, Union Pacific, 229†, 250*, 824‡
Coach, Steel, Long Island R. R., 17*
Combination Parlor, Sleeping and Dining, Canadian Northern, 623*
Dining, Sleeping and Parlor, Combination, Canadian Northern, 623*
Door Hanger, 156*
Electric, Erie, 313*
Fenders in Massachusetts, 372
Flat, Philippine Railways, 206*
Gasolene (See Motor Car).
Gondola, Low Side Steel, P. & R., 841*
Gondola, Steel, Alan Wood, Iron & Steel Co., 206*
Heating (See Heating).
Lighting (See Lighting)
Motor (See Motor Car)
Parcel-Sorting, London & N.-W., 300*
Parlor, Sleeping and Dining, Combination, Canadian Northern, 623*
Postal, Steel, Sou. Pac., 822†, 852*
Postal, Strengthening Ends of, S. A. L., 104*
Private Car "Killarney," Can. Pac., 72*
Rail Motor (See Motor Car)
Refrigerator (See Refrigeration)
Repairing, Comp. Cost, Steel and Wooden, 822‡
Repairs, Freight, Cost of, 841
Repairs, Increases in Price, 821†
Seal, Estell, 286*
Side Bearing, Proper Location, 823‡
Sleeping, All-Steel, Pullman Co., 541*.
Sleeping, Illinois Traction, 242*
Sleeping, Parlor and Dining, Combination, Canadian Northern, 623*
Steel and Wooden, Comp. Cost of Repairing, 822‡
Steel Box, Union Pacific, 229†, 250*, 824‡
Steel Coach, Long Island R. R., 17*
Steel Gondola, Alan Wood, Iron and Steel Co., 206*
Steel, Low Side Gondola, P. & R., 841*
Steel Passenger, Hudson Companies, 822†, 831*
Steel Passenger, Penn. R. R., 822†, 846*
Steel Postal, Sou. Pac., 822†, 852*
Steel Sleeping, Pullman Co., 541*
Supply, Can. Pac., 812
Truck (See Truck)
Wheel (See Wheel)
Car, Freight:
Alan Wood, Iron & Steel Co., Steel Gondola, 206*
Can. Pac., Supply, 812
Comp. Summary of Cars in Service, 682, 821†
P. & R. Low Side Steel Gondola, 841*
Philippine Railways, Flat, 206*
Repairs, Cost of, 841
Sou. Pac., Steel Postal, 822‡, 852*
Union Pacific, All-Steel Box, 229†, 250*, 824‡
Car, Passenger:
Canadian Northern, Combination Parlor, Sleeping and Dining, 623*
Canadian Pacific, Private Car "Killarney," 72*
C. R. I. & P., Ganz Steam Motor, 451*
Erie, Electric, 313*
Hudson Companies, Steel, 822†, 831*
Illinois Traction, Sleeper, 242*
London & N.-W., Baggage and Parcel-Sorting, 300*
Long Island R. R., Steel, 17*
Penna. R. R., Steel, 822†, 846*
Pullman All-Steel Sleeper, 541*
S. A. L., Strengthening Ends of Postal Cars, 104*
Car Accounting Officers (See Assoc. of Aransportation and Car Accounting Officers)
Car Service (See also Interstate Commerce Commission):
Austrian Freight Blockade, 582
Average Mileage of Freight Cars, 625
Coal Car Discrimination, B. & O., 591, 869, 913
Can. Nor. Tieup, 558
Car Efficiency Committee, Am. Ry. Assoc., 98†, 567†, 581, 601†, 615
Car Famines; Causes and Remedy, 230†, 234
Car Loading and Detention, C. M. & St. P., 190
Car Recording at Local Stations, 136*
Car Service Committee, Assoc. of Car Accountants, 821†, 845
Cars Shipped as Freight, 157
Clearing House and Car Pools, 98†, 567†, 581, 601†, 615
Coal Car Four Years on Road, 755
Car Service (*Continued*):
Comp. Summary of Freight Cars in Service, 682, 821†
Demurrage at New Orleans and New York, 461
Demurrage, Assoc. of Car Service Managers, 809
Demurrage, Grain, 689
Demurrage in France, 56
Demurrage in South, 493, 557
Demurrage, New York, 625
Demurrage, Ohio, 525
Diversion Agreement, 109
Diversion, Proposed Rules of Car Accounting Officers' Assoc., 845
Fifty Cent Per Diem Rate, 533‡, 920†
Freight Car Pool, Assoc. of Car Accountants, 821†
Germany, Car Shortage, 144
Graft, 123, 315
Hill on Car Shortage, 86
Hungary, Freight Blockade, 242, 408
Iowa Demurrage Bill, 190, 292†
Is Reciprocal Demurrage Just? 166†
Minimum Load, 809
Need of More Industrial Tracks, 64†, 73
North Dakota Car Shortage, 56
Ohio Rules, 869
Pennsylvania Railroad Statistics, 85
Per Diem Agreement, Withdrawal of Long Island R. R., 919†
Pres. Hill on, 122
Privileges to Shippers and Car Shortage, 230†, 244
Proposed Freight Car Diversion Penalty, 633†
Reciprocal Demurrage, 166†, 292†, 690
Reciprocal Demurrage Law, Washington, 943
Remedies for Car Shortage, 73, 266‡
Resolutions by National Board of Trade, 108
Switching Allowance, Gen. Elec. Co., 913
Switching Allowance, Solvay Process Co., 811
Unnecessary Empty Car Movements Between Chicago Terminals, 752
What Is a Box Car? 156
Working Statistics, Gt. Britain and America, 132†, 142
Terminal R. R. Allowances, 528
Car Shortage (See Car Service)
Card Index, Engineering Periodicals and, 21
Carrabelle, Tallahassee & Georgia; Foreclosure of, 1†
Cassatt, A. J., 20*, 47
Cattle:
Liability for Injuries to, 798
Reduction of Rates, 371
Transportation, 253, 371, 657, 809
Central Foundry Co., Cast Iron Pipe, 373*
Central R. R. of New Jersey:
Bronx Freight Terminal, 404*
Prosecution by U. S. Government, 908
Central of Peru, Ten Wheel Locomotive, 652*
Chesapeake & Ohio:
Union Station at Lexington, Ky., 75*
Chicago:
Unnecessary Empty Car Movements Between Terminals, 752
Chicago & Alton:
Harriman Reorganization, 270, 299, 643
Page Bascule Bridge, Chicago River, 836*, 922‡
Rebates, 557
Short-Term Notes, 132†
Chicago & North-Western:
Dinner to Operating Officers, 785
Harriman Interest, 33†, 52
Chicago & Western Indiana:
Short-Term Notes, 132†
Chicago, Burlington & Quincy:
Grade Separations at Chicago, 641*
Loss of Mail Contract, 121
Meeting of Assoc. of Operating Officers, 723
Reinforced Concrete Floors for Through Truss Spans, 339*
Chicago, Milwaukee & St. Paul:
Bridges on Pacific Extension, 479
Harriman Interest, 33†, 52
Chicago-New York Air Line, 810, 869
Chicago Pneumatic Tool Co.:
Chicago Giant Rock Drill, 156*
Little Giant Corner Drill, 88*
Chicago, Rock Island & Pacific:
Collision near Alta Vista, Kan., 26, 37
Ganz Steam Motor Car, 451*
Mail Contract, 121
Chicago Subway, 272
Chicago Traffic Club, 494
Chile, Railroads in, 157
China:
Canton-Hankow R. R., 908*
Chaochowfu & Swatow R. R., 316
Great Interior Trunk Line, 908*
Peking-Hankow R. R., 908*
Shantung R. R., Results of Operation, 1905, 207
Cinder (See Spark)
Cinn., New Orleans & Texas Pacific:
Cincinnati Freight Terminal, 76*
Cleveland & Marietta, Passenger Earnings, 633†
Cleveland & Pittsburg:
Grade Separation in Cleveland, 440*
Cleveland, Cincinnati, Chicago & St. Louis:
Collision at Fowler, 470†, 477
Explosion at Sandford, 121, 470†, 477
Coal (See also Fuel; also Freight Rates):
Anthracite Business, History of, 462
Anthracite Shipments in 1906, 25
German Production, 744, 862
Government Suit Against Anthracite Carriers, 908
I. C. C. Report on Coal Traffic, 137
Penna. R. R. Bituminous Tonnage, 123
Penna. R. R. Coaling Station at Denholm, 423
Plans to Prevent Famine, 657, 689
Production in 1906, 940
Sandusky Coaling Station, Penna., Lines West, 560
Coal (*Continued*):
Smoke Prevention, 32†
South Boston Coaling Station, N. Y., N. H. & H., 362*
Wheeling & Lake Erie Tests, 169
Construction, New:
Annual Construction Record, 324†, 379
Bay Shore and Dumbarton Cut-Offs, Southern Pacific, 328*
Economics of Railroad Location, 534†, 542
Florida East Coast Extension, 583*
Grand Trunk Pacific Location Surveys, 446
Klamath Falls Line, Sou. Pac., 790*
Southern Pacific Lines in Sonora, Mex., 458*
Uniformity in Specifications, 437
Continental Signal Co., 592
Conventions (See names of associations)
Conveying Machinery (See Hoisting and Conveying)
Cook Track Drill, 626*
Corporations, Benefits of, 54
Cost (See Business Situation)
Crane (See Hoisting and Conveying)
Crops (See Grain)
Cuba:
North Shore R. R., 254
Railroads in, 657
Curtain Supply Co., Ring Fixture, 870*
Curve (See Maintenance of Way)
Cylinder (See Locomotive Cylinder)
College (See Names).
Color Blindness (See Employee).
Colorado:
New Laws, 493, 525
Railroad Commissioners, 943
Colorado & Southern:
Electric Lines, Denver & Interurban Co., 900*
Colorado College Donation, 943
Columbia University:
Civil Engineering Dept. Changes, 755
Compressed Air; Atmospheric Railroad, 144*
Comstock Engine Co., Grapholl Cup, 559*
Concrete (See also Concrete, Reinforced):
Pile Protection in South Africa, 151*
Permanent Exhibition, 592
Waterproofing of Masonry and Concrete, 119
Concrete, Reinforced:
Bridge over Cumberland River, 409*
Floors for Through Truss Spans, 339*
Roofing Tiles, 376*
Telegraph Poles, 919†, 937
Tests of Bond Between Concrete and Steel, 70*
Ties, M. of W. Assoc. Report, 429†
Conductor (See Employee)
Connecticut:
New Railroad Laws, 753
Connecticut Railroad Commission:
Infirmities of, 65†, 198†, 261†
Responsibility for Trolley Inflation, 65†, 198†
Connecticut Ry. & Lighting Co., 198†
Connecticut State Commissions, 261†
Consolidated Ry. Elec. Lighting & Equip. Co., Axle-Light Decision, 462
Consolidated Steamship Co.:
Formation, 56, 627
Joy Line Purchase, 560
Offer to the New Haven, 197†
Terms of Consolidation, 874
Ward Line Purchase, 221

D

Dahl Automatic Drill Grinder, 26*
Damages (See Accidents).
Davis Brake-Beam Testing Machine, 873*
Decker, Martin S., 479*
Declimetre, 551*
Deepwater Railway, 325†, 340*
Delaware & Hudson:
Accident Record, 421, 536†*
Annual Report, 536†*
Delaware, Lackawanna & Western:
Annual Report, 265†*
Eight-Wheel Locomotive, 184*
Fast Freight Service, 212
Hoboken Terminal, 304*
Phoebe Snow on Her Travels, 123
Prosecution by U. S. Government, 908
Sugar Rebates, 253, 422
Delayage (See Car Service).
Demurrage (See Car Service).
Denmark:
Bonus for R. R. Extensions, 317
Denver & Interurban, 900*
Denver, North-Western & Pacific:
Mountain Scenery and Station, 749*
Rotary Snow Plow, 114*
Derail, Hayes Lifting, 376*
Detroit River Tunnel, Electric Traction, 690
Differentials (See Freight Rates).
Discipline (See also Employee):
Accident Investigations, 100‡
Complaint of Brotherhood of Locomotive Engineers, 469†
Indiana Legislation, 470†, 477
Influence of Trade Unions, 462, 665†
Phase of Surprise Checking, 197†
Surprise Tests, C. & N.-W., 53
Surprise Tests, Penna. R. R., 472†, 755
Door (See also Cars):
Wood Rolling, 423*
Drawbridge (See Bridge).
Drill. (See Machine Tools).
Duff Ball Bearing Jack, 690*

E

Earnings (See corporate names)
East Indian Railway:
Traffic and Rates, 34‡*
Economics:
Benefits of Great Corporations, 54
Education (See also names of schools, colleges and universities):
Altoona Technical School, 317
Apprentices, Mo. Pac., 216
College Men on the Pennsylvania, 371, 469†

GENERAL INDEX—Continued.

[Illustrated articles are indicated thus; Editorials thus†; Contributions thus‡.]*

Education (*Continued*):
Growth of Schools of Engineering, 197†
Scholarships, Penna. R. R. Employees' Sons, 493, 657
Students on Baden State Railroads, 85
Value of Good English to the Engineer, 800
Electric Railways (See also Electrified Steam):
Earnings in 1906, 560
Eminent Domain in Texas, 285
Express on, 526, 753, 809
Freight on, Pennsylvania, 526, 625
Interchange of Traffic with Steam Roads, 157, 721
Interurban Freight and Express, 154
Trolley Capital Inflation in Connecticut, 65†, 198†
Turkey, 585
Electric Traction (See also Locomotive, Electric):
Contact Wire Suspension, 273*
Costs, Compared with Steam, 131†, 134, 168‡, 415
Detroit River Tunnel, 690
Electrolysis, 421
Feed Cable Short Circuit, New York Central, 943
N. Y., N. H. & H. Overhead Construction, 220*
Simplon Tunnel Operation, 170*, 269
Teltow Canal, 118*
Electrified Steam Railroads:
Colorado & Southern, 900*
Comparative Costs, 131†, 134, 168‡
Italy, 108
Japan, 145
London Metropolitan, 207
London, Tilbury & Southend, 207
North-Eastern (Eng.), 276
Preparation for Electrification of New York Central Terminal, 366
Progress in 1906, 79
Prussia, 556
Results on New York Central, 568†
Sweden, 885
West Shore, N. Y. C. & H. R., 755
Employee (See also Wage Increases; also Strike; also Education; also Trade Unions; also Discipline):
Acquittal of Engineman in Woodville Collision Case, 699†
Age Limit, Penna. R. R., 189
Alcoholic and Non-alcoholic Drinks at Frankfort-on-Main, 244
Bettering Environment of Isolated Employees, 583†
Color Blindness and Night Signals, 601†
Commendation of Pennsylvania Employees, 292†
Conductors Bonded, Erie, 591
Conductor Convicted of Negligence, 748
Demands in Great Britain, 813
Employers' Liability Law, 26, 189, 315, 421, 515
Excessive Hours, 462, 748
Excessive Hours in a Block Signal Station, 502†
Hours of Labor, Connecticut, 625
Hours of Labor, Indiana, 591
Hours of Labor, Montana, 591
Hours of Labor, New York, 591, 625, 914, 943
Hours of Labor, West Virginia, 493
Labor Market, 525, 753
Medals for Heroism, 945
Merit Marks, A., T. & S. F., 581, 754, 943
Mexican Street Car Conductors, 627
Minimum Age Limit on P. & R., 501†
Number on German Roads, 579
Pensions, Penna. R. R., 315
Pension System, A., T. & S. F., 19
Pension System, Intercolonial Ry., 43
Pres. Finley to Southern Ry. Employees, 502†
Reading Rooms and Club Houses, A., T. & S. F., 590*
Relief Fund, Int. Rap. Transit, 157
Rest Houses, B. & O., 840
Rest Houses, Oregon Short Line, 689
Rest Houses, Penna. R. R., 316
Section Foreman's Work, 432†
Sixteen-hour Law, 3†, 9, 88, 253, 262†, 291†, 306, 313
Telegraph Operators, Seniority vs. Efficiency, 925
Towerman Convicted of Manslaughter, 253
Train Crew Bill, New York, 810, 869, 882†
Train Crews in Indiana, 221
Wide-Awake Station Agent, 361, 626
Working Regulations for B. & M. Enginemen, 267
Employers' Liability Law (See Employee).
Engine (See also Locomotive):
Lazier Gas, 560*
Producer Gas Power for Shops, 762†
Steam and Gas Compared, 649
Engineering and Maint. of Way Assoc. (See Am. Ry. Eng. and Maint. of Way Assoc.)
Engineering Periodicals and Card Index, 21
Engineering Societies (See United Engineering Societies).
Enginemen (See Employee)
England (See also British; also London; also names of railroads):
Maintenance Cost of Highways, 495
Practice in Accident Investigation, 231†, 534†, 548
Freight Pool, 31†
Railroad Inspection, 534†, 548
Telegraph Block System, 241
Erie R. R.:
Electric Car, 313*
Electrification of Suburban Lines, 79
Prosecution by U. S. Government, 908
Erie R. R. (*Continued*):
Rochester Division Electrification, 79
Short-Term Notes, 132†, 501†
Susquehanna Roundhouse, Draft and Heating, 120*
Ticket Office Advertisement, 594*
Vulcanized Ties, 100
Estell Car Seal, 286*
Explosives, 155, 755, 811
Exports:
Effect of Attacks on Packers, 665†
Grain in 1906, 88
Express:
Franks, 869
Interurban Freight and Express, 154
Liquor Shipments in Texas, 814
On Electric Lines, 526, 753, 809
Rate Reduction, 700
Extensometer, Turneaure Recording, 444*

F

Fare (See Passenger Rates)
Farrell, P. J., 479*
Fast Trains and Runs (See also Schedule):
Colorado & Southern, 493
Dangers of Speed, 263†
High Speed Mania, 586
New York Central Tests on Bedford Park Curve, 504‡
Federal (See Government)
Fencing, Stewart Iron, 628*, 690
Ferry, New York Municipal, 88, 810
File Sharpener, 422*
Finance (See also Accounting):
British View of Stock Watering, 643
Capitalization and Ton Mileage, 538‡
Connecticut Street Ry. Capitalization, 198‡
Dividend Changes and New Capital in 1906, 6†
Eminent Domain in Minority Shares, 99†
Harriman Influence, 335, 52
Harriman Investigation, 33†, 52, 270, 298
New Haven Four Per Cent. Notes, 229†
New Haven Debentures, 165†
Overcapitalization, 434‡, 474‡, 539†
Pennsylvania Five Per Cent. Notes, 229†
Policy and Finance versus Production, 8‡
Railroad Stocks in the Market, 470†
Rate of Return on R. R. Securities, 634†
Savings Bank Side of Railroad Baiting, 533†
Short-Term Notes, 132†
Short-Term Note Interest Rates, 501†
Shrinkage of Market Values, 429†
Stock Period of Financing, 63†
Summary of Annual Reports, 4†*
Trolley Capital Inflation in Connecticut, 65†, 198‡
R. R. Valuation as Basis for Rates and Capital, 295‡, 567‡, 730†
What is Stock Watering? 399†
Fire Extinguishers in Massachusetts, 800
Fire, Railroad Liability for Damage by, 367
Firebox (See Locomotive Firebox)
Fireman (See Employee)
Fish, Aerating Water in Tanks for Transportation of, 804
Flexible Compound, 461
Florida East Coast Extension, 583*
Florida R. R. Commission Report, 644
Foreclosures:
Carrabelle, Tallahassee & Georgia, 1†
Forge:
Buffalo Outdoor, 88*
Compressed Air, 494*
Forney, M. N., 943
Franklin Mfg. Co., Asbestos Building Lumber, 158*
Freight (See also Car Service):
British Cartage and Delivery System, 300*
Cost of Team Hauls of Agricultural Products, 493
East Indian Railway Traffic, 34‡*
English Freight Pool, 31†
Handling at New York, 617
Interurban Freight and Express, 154
Lackawanna Fast Freight Service, 212
Pennsylvania Interurbans, 526, 625
Profitable Weight and Speed of Freight Trains, 168‡, 198‡, 200‡, 230†, 232‡, 295‡, 433‡, 473‡, 504‡, 572‡, 639‡, 670‡, 884‡
Rates (See Freight Rates)
Rules for Tracing, 528
Soliciting Agents' Commissions, 869, 913
Uniform Classification, 570†
Freight House:
Cent. of N. J., Bronx, 404*
C. N. O. & T. P. at Cincinnati, 76*
Toledo, St. Louis & Western at Toledo, 885*
Freight Rates (See also Interstate Commerce Commission; also State R. R. Commissions; also Freight Rate Reduction):
Alabama & Vicksburg; Grain, 105
Bulletin of Traffic News for Shippers, 408
Central Vermont, Rebates, 913
Chicago & Alton Rebates, 557
C. R. I. & P., Rebates, 721
C. St. P. M. & O., Illegal, 557
Commodity Rates, 253
Commodity Rates, Minnesota, 810
East Indian Railway, 34‡*
Export Rates, 626
Gt. Nor., Sugar Rebates, 253, 525, 810, 869
Illegal, Indictments for, 657
Increased Commodity Costs, 623*
Increase, 189, 315, 461, 557, 657, 721, 809
Joint Rail and Automobile, 813
Freight Rates (*Continued*):
Lumber, 689
Modern Tariff Sheet, 735*
Necessity for Increase, 431†, 436‡
N. Y. Cent. Appeal in Sugar Rebate Case, 478
N. Y. Cent. Rebates to Gen. Elec. Co., 557
Shippers Convicted for Illegal Rates, 689
Special Rates for Fast Freight Movements, N. Y. C. Lines, 735*
Standard Oil Underbilling, 557
Valuation of Railroad Property, 293†, 567†, 730†
Freight Rate Reduction:
Alabama, 461
D. & H., 809
Georgia, 87
Iowa, 371
Kansas Roads, 55
Minnesota, 25, 557
Missouri Pacific, 625, 689
Missouri, 912
Nevada, 421
New South Wales, 56
S. A. L., 689
South Dakota, 315
Stockholders, not Shippers, Oppressed, 945
Freight Traffic (See also Traffic):
Freight Density on Northwestern Roads, 437
The Soliciting Agent Under Modern Conditions, 526
Working Statistics, Gt. Britain and America, 132†, 142
Freight Yards (See Yards and Terminals)
Frog, Graham Flange, 527*
Fuel (See also Coal):
Economy in Power, 649
Neely Oil-Burning Furnace, 764*
Rifled Pipe Line for California Oil, 786*
Russian Petroleum, 656

G

Gage:
Golden Steam Gage, 56*
Louisville & Nashville Change, 782*
Gaillard, Maj. D. Du B., 413*
Garrett, William A., 311*
Gas (See Fuel; also Engine)
Gasolene Car (See Motor Car)
General Electric Co.:
Annual Report, 668‡
Electric Automatic Block Signals for B. & O., 80*
General Railway Signal Co.:
Foot Power Generator for Controlled Manual Block Station, 180*
Georgia:
New Railroad Laws, 404, 459, 461
Germany:
Alcoholic and Non-Alcoholic Drinks at Frankfort-on-Main, 244
Car Shortage, 144
Coal Production, 744, 862
Dining Car Company, 145
Metal Ties, 733
New Passenger Tariff, 199†, 541
Number of Railroad Employees, 579
Superheaters, 409
Goethals, Lt. Col. G. W., 413*
Golden-Anderson Valve Specialty Co., Steam Gage, 56*
Gorgas, Col. W. C., 413*
Gould Lines:
Alleged Merger, 56
Union Station at Little Rock, 268*
Government Control of R. R.'s:
Objects and Effects of State Regulation, 651
Obliteration of State Lines, 8‡
Government Ownership:
Cape Colony Advisory Board, 636†
Dangers of Municipal Ownership, 398†
First Government Railroad, 35‡
Municipal Accounting, 88, 810
Operation of Road Offered to Missouri, 813
Government Rate Regulation (See also Freight Rates; Interstate Commerce Commission; Interstate Commerce Law):
Law of Supply and Demand, 873
Proposed Valuation of Railroad Property, 293†
Rate Law (See Interstate Commerce Law)
Secretary of Transportation, 814
Grade:
Compensation, Indianapolis Southern (Illinois Central), 323†, 332*
Gt. Nor. Profile Cascade Division, 684*
Profile of Park Ave. Tunnel, 650*
Western Pacific Profile, 510*
Value of Grade Reductions, 614
Grade Separation:
C. B. & Q., 16th St., Chicago, 641*
Long Island R. R., 123
New York State, 111, 421, 689
Penna. Lines West in Cleveland, 440*
P. B. & W. at Wilmington, 421
Graham, J. M., 914
Grain (See also Freight Rates):
Average Condition on April 1, 572
Chicago Elevator Charges, 753
Exports in 1906, 88
Visible Supply, 111
Grammer, Capt. George J., 208
Grand Trunk:
Collision at Gourock, Ont., 748
Ottawa Union Station, 745*
Sarnia Tunnel Electrification, 79
Toronto Union Station, 718*

Grand Trunk Pacific:
Location Surveys, 446
Great Britain (See British)
Great Northern:
Derailment at Clontarf, 157
Freight Traffic, 437
Mallet Compounds, 684*
Operation, Compared with Union Pac., 141
Profile, Cascade Division, 684*
Sugar Rebates, 253, 525, 810, 869
Grinder (See Machine Tools)
Guatemala:
Railroad Building, 625
Tie Conditions, 48

H

Hackensack Meadow Improvements, 755
Hapgoods, Railroad Dept., 156
Harriman Lines:
Comp. Cost of Repairing Steel and Wooden Cars, 822†
I. C. C. Investigation, 33†, 52, 270, 298, 809
Operation, Compared with Hill Lines, 141
Haswell, Charles Haynes, 686*
Hayes Lifting Derail, 376*
Hayti:
Railroad Extension, 158
Heating:
German Idea of American Car Heating, 297
N. Y. O. & W., Paint Shop, 835*
Hepburn Law (See Interstate Commerce Law)
High Duty Saw and Tool Co., Rotary Slotter, 304*
Hill Lines:
Operation, Compared with Harriman Lines, 141
Hoisting and Conveying:
Cranes for Panama R. R., 811*
Electric Traveling Roundhouse Crane, 871*
Long Cable Ore Conveyer, Argentina, 51
Sullivan Mine Hoist, 156*
Holland Sleeping Car, Illinois Traction, 242*
Housatonic R. R., History, 115
Hudson Companies, 721:
Steel Passenger Cars, 822†, 831*
Hungary:
Benzoelectric Motor Cars, 220, 248
Suspension of Freight Transportation, 242, 408
Hunkins-Willis Lime & Cement Co., Roofing Tile, 376*

I

Iceland Railroads, 221
Illinois:
New Railroad Laws, 222, 403, 459, 493
Illinois Central:
Burnside Shops, 842*
Cuban Service, via Southern Pacific Steamers, 36
Harriman Purchase, 33†, 52
Page Bascule Bridge, Chicago River, 836*, 922‡
Presidency, 271
Illinois R. R. and Warehouse Commission Report, 701
Illinois Traction Co.:
New Section Opened, 658
Sleeping Car, 242*
Illinois Tunnel Co., 272
Immigrant Traffic:
Handling at New York City, 307*
Immigrant Rates from New York City, 943
To Western States, 494
Independent Pneumatic Tool Co.:
Close Quarter Drill, 122*
India:
Signal Rules, 462
Tie Conditions, 49
Indiana:
Block Signal and Discipline, Legislation, 470†, 477
New Railroad Laws, 222, 459, 493, 609
Indiana State R. R. Commission, 470†
Indianapolis Southern (Illinois Central), 323†, 332*
Inland Waterways Commission, 421
Inspection, British Practice, 534†, 548
Interborough Rapid Transit Co. (See also N. Y. Subway):
Brooklyn Subway, 814
Judgment against Manhattan El. Ry., 753
Relief Fund, 157
Intercolonial:
Pension System, 43
Interlocking (See Signal, Interlocking)
Interstate Commerce Commission (See also Interstate Commerce Law; also Freight Rates):
Accident Investigation, 97†, 231†
As a Conciliator, 472†
Automatic Stops, Investigation of, 34†, 55, 277, 291†, 813
Block System, Interlocking, and Automatic Stops, Report on, 159, 277, 479, 507*, 544*
California Fruit Shippers, 636†
Coal Investigation, Report on, 137
Complaints by Telegraph, 636†
Decisions Under I. C. Law, 921†
Express Rate Reduction, 700
Form of Railroad Accounting, 32†, 557, 869, 883†, 913, 922
Harriman Lines, Investigation, 33†, 52, 270, 298, 809
Immigrant Rates, 943
Kansas Legislation and, 430
Penna. R. R. Special Investigating Committee, Final Report, 245, 281
Private Sidings, 914
Pullman Co. Rates, 913
Railroad Justified in Moving Station, 722
Rate Rulings, 57, 122, 158, 178, 285, 315, 421, 461, 557, 561, 591, 592, 657, 689, 721, 723, 754, 813, 821†, 870, 874, 914, 945
Interstate Commerce Commission (*Continued*):
Reconsignment at Kansas City, 874, 921†
Soliciting Agents' Commissions, 869, 913
Special Agents of, 421, 433†, 479*
Tariff Circulars, 178, 285, 461, 723, 914
Terra Cotta Collision Investigation, 31†, 44
Time for Filing Tariffs, 945
Trucking Firms, Discrimination, 945
Interstate Commerce Law:
As Amended, 66
Attitude of Roads Toward, 723
B. & O. Compliance, 158
Decisions Under, 921†
First Contested Case Under, 57
Interstate Overcharges, 294†
Maine View of, 221
Working of, 921†
Interurban Lines (See Electric Railway)
Iowa:
New Railroad Laws, 222, 459, 558
Proposed Car Service Bill, 190, 292†
Ireland, Fate of Old Railroads, 755
Iron and Steel:
Lake Superior Iron Ore Shipments, 299
Uses of Bessemer, 594
Irrigation, Nevada, 722
Isthmian Canal Commission:
Four Members, 143*
Reorganization, 155
Three Resignations, 261†
Italian Government Railways:
Dissatisfaction with, 559, 636†
Four-Cyl. Bal. Comp. Baldwin Locomotive, 50*, 585
Four Cyl. Bal. Comp. Locomotive, 147*
Lower Passenger Rates, 212
Simple Consolidation Baldwin Locomotives, 51*, 585
Suspension of Freight Service, 686
Italy:
Electrification of Steam Railroads, 108
Rehabilitation of Railroads, 116

J

Jack:
Buda Ball Bearing, 558*
Duff Ball Bearing, 690*
Japan:
Electrification of Steam Railroad, 145
New Government Roads, 403
Nippon Tetsudo Kwaisha, Consolidation Locomotive, 296*
R. R.'s in Saghalin, 687
Results of R. R. Operation, 1905, 188
Tie Conditions, 48
Jersey City & New Brunswick; Early Equipment, 39*
Johnson Water Column, 812*
Junction, Oldest in the World, 450

K

Kansas:
Legislation and Interstate Commerce Commission, 430†
New Railroad Laws, 222, 404, 430†, 459, 665†, 687
Railroad Valuation, 913
Rate Expert Wanted, 423
Kansas City, Sixth Street Viaduct, 521*
Kansas City Southern:
Dividend Declaration, 502†
Kansas City Terminal Ry., Proposed Union Station, 367
Kentucky & Tennessee Ry., Reinforced Concrete Bridge over Cumberland River, 409*
Kinnear Wood Rolling Doors, 423*

L

Labor (See Trade Unions; also Employee)
Lackawanna Steel Co., Abbott Rail Joint Plate, 373*
Lake Shore & Michigan Southern:
Buhrer Concrete Ties, 459
Short-Term Notes, 132†
Lamps (See Signal; also Lighting)
Lathe (See Machine Tools)
Lazier Gas Engine, 560*
Legal Decisions (See also Interstate Commerce Commission; also Legislation):
Eminent Domain in Minority Shares, 99†
Employers' Liability Law, 26, 515
G. C. & S. F. v. Tex. R. R. Commission, 285
Initial Carrier Responsible for Delays, 558
Interstate Overcharges not Collectible, 294†
Monthly Summaries: Dec., 1906, 44; Jan., 1907, 179; Feb., 1907, 306; Mar., 1907, 540; Apr., 1907, 712; May, 1907, 924
Pass Contract and Rate Law, 190
Safety Appliance Law (See Safety Appliances)
Legislation (See also Government Rate Regulation; also names of States; also Passenger Rate Reduction; also Freight Rate Reduction; also Employee):
Accident Investigation Law, 97†
Anti-Railroad State Legislation, 403, 430†, 459
Block Signals, 177
Block Signals and Discipline, Indiana, 470†, 477
Canadian Sunday Law, 269
Employers' Liability Law, 26, 189, 315, 421
Explosives, 155
Federal and State Laws, Possible Clash, 422
Hepburn Law (See Interstate Commerce Law)
Imaginary Railroad Lobby, 475‡
Legislative Centralization, 172
New Laws in 10 States, 403
New York Public Service Commissions Law, 315, 560†, 722, 731†, 736, 809, 869, 871, 881†
Pres. Baer's Letter to Pennsylvania Legislature, 204
Pres. Joline on Situation, 516
Prouty on Future, 753
Legislation (*Continued*):
Rate Law (See Interstate Commerce Law)
Sixteen Hour Law, 31, 9, 88, 263, 262†, 291, 303, 313
Lehigh Valley:
Bridge Over Susquehanna, near Towanda, 174*
Prosecution by U. S. Government, 308
Steel Tug, 526
Level of the Time of Louis XIV, 337*
Lexington & Eastern:
Union Station at Lexington, Ky., 75*
Lighting:
Electric Train Lighting, 856
Locomotive Electric Headlights in Texas, 435.
Live Stock (See Cattle)
Locomotive:
Articulated, Northern of France, 328
Catechism of, to be Revised, 666.
Comp. 4-Cyl. Bal. Austrian State Rys., 69*
Comp. 4-Cyl. Bal., Italian State Rys., 50*, 585
Comp. 4-Cyl. Bal., Ital. State Rys., 147*
Comp. 4-Cyl. Bal. National of Mexico, 140*, 283*, 412
Comp. 3-Cyl., Midland Ry. (Eng.), 710*
Consolidation, Baldwin, 780*
Consolidation, Italian State Rys., 51*, 585
Consolidation, Nippon Tetsudo Kwaisha, 296*
Cost of, 1890-1907, 761†, 802*
De Glehn Comp., Paris-Orleans Ry., 761†, 774*
Early Locomotive, Penna. R. R., 235*, 552*
Early Locomotives, Smith & Perkins, 552*
Early Locomotives, United R. R. of N. J., 39*
Eight-Wheel, D., L. & W., 184*
Eight-Wheel, 3-Cyl. Comp., Midland Ry. (Eng.), 710*
Firebox (See Locomotive Firebox).
Headlight (See Lighting).
History, Pennsylvania R. R. Improvements, 235*
Inside Connected, Midland Ry., 710*
Mallet Comp., Central of Brazil, 697†, 700‡
Mallet Comp., Gt. Nor., 684*
Metric Scale, Built to, 761†, 774*
Mogul, Vandalia, 10*
Narrow Gage, Nippon Tetsudo Kwaisha, 296*
National Characteristics, 116, 186*
Oil-Burning, 764*
Pacific, Atlanta & West Point, 784*
Pacific, National of Mexico, 140*, 283*, 412
Pacific, Northern Pacific, 184*
Prairie, Austrian State Rys., 69*
Six-Wheel, Midland Ry. (Eng.), 710*
Superheater (See Superheater).
Ten-Wheel, Can. Pac., 186*
Ten-Wheel, Central of Peru, 652*
Ten-Wheel, 4-Cyl. Bal. Comp., Italian State Rys., 50*, 585
Ten-Wheel, Paris-Orleans Ry., 761†, 774*
Ten-Wheel, St. L. & S. F., 572*
Three-Cyl. Comp., Midland Ry., 710*
Valve (See Valve and Valve Gear).
Locomotive, Electric:
Atlantic Shore Line, 179*
Comparative Effects of Steam and Electric Locomotives on a 3-Deg. Curve, 327†*, 414*, 473‡, 504‡
New York Central, Williamsbridge Derailment, 230†, 261†, 292†, 327†*, 414*, 415, 473‡, 504‡
Simplon Tunnel, 3-Phase, 171*
Steam vs. Electric, 66‡
Tractive Power, New Central, 650*
Locomotive, Freight:
Baldwin, Consolidation, 780*
Central of Brazil, Mallet Comp., 697†, 700‡
Central of Peru, 10-Wheel, 652*
Gt. Nor., Mallet Comp., 684*
Italian State Rys., Consolidation, 51*, 585
Midland Ry. (Eng.), 6-Wheel, 710*
Nippon Tetsudo Kwaisha, Consolidation, 296*
Northern of France, Articulated, 328
Southern of Peru, 10-Wheel, 652*
Vandalia, Mogul, 10*
Locomotive, Passenger:
Atlanta & West Point, Pacific, 784*
Austrian State Rys., 4-Cyl. Comp., 69*
Can. Pac., 10-Wheel, 186*
Central of Peru, 10-Wheel, 652*
D., L. & W., 8-Wheel, 184*
Italian State Rys., Baldwin 4-Cyl. Bal. Comp., 50*, 585
Ital. State Rys., 4-Cyl. Bal. Comp., 147*
Midland Ry. (Eng.), 8-Wheel, 710*
National of Mex., Pacific, 140*, 283*, 412
Northern Pacific, Pacific, 184*
Paris-Orleans Ry., De Glehn Comp., 761†, 774*
Penna. R. R., Smith & Perkins, 552*
St. L. & S. F., 10-Wheel, 572*
Southern of Peru, 10-Wheel, 652*
Locomotive Boiler:
Barnes Skimmer, 799*
Explosions, 762†
Tests of Mild Tube Sheets, 797*
Transmission of Heat Through Scale-Covered Tubes, 519*
Locomotive Cylinder:
Compression and Means for Relief, 787*
Locomotive Firebox:
Copper, Italian State Rys., 50*
Neely Oil-Burning Furnace, 764*
Use and Abuse of Fire Brick, 808
Locomotive Performance (See also Fast Trains and Runs):
Engine Failures and Their Report, 68, 98†
Gt. Nor. Mallet Compounds, 684*
New York Central Electric, 650*
Purdue Tests, 603†, 640‡
Steam vs. Electric, 66‡
Value of Grade Reductions, 614
Locomotive Rating (See Train)
London:
Experience with Electrification, 207
Traffic Problems, 294†
London & North-Western:
Baggage and Parcel-Sorting Cars, 300*
Earnings for 1906, 316
Freight Cartage and Delivery, 300*

GENERAL INDEX—Continued.

[Illustrated articles are indicated thus; Editorials thus†; Contributions thus‡.]*

London & South Western:
Interlocking at Hampton Court Junction, 476*
London, Brighton & South Coast, Oldest Junction, 450
London, Tilbury & Southend, Electrification, 207
Long Island R. R.:
Flatbush Avenue Terminal, 448*
Grade Separation, 123
Station Beautification, 690
Steel Passenger Coach, 17*
Withdrawal from Per Diem Agreement, 919†
Loree, L. F., 565†
Louisville & Nashville:
Change of Gage, 782*
Union Station at Lexington, Ky., 75*
Love Brake Shoe Co., Armbrust Brake Shoe, 873*
Lubrication:
Bangs Automatic Oil Cup, 373*
Graphoil Cup, 559*
Luce, E. F., & Co., Sand Dryer, 593*
Lumber (See also Timber; also Ties; also Building Material):
U. S. Production in 1905, 55

M

Machine Tools:
Chicago Giant Rock Drill, 156*
Close Quarter Air Drill, 122*
Cook Track Drill, 626*
Dahl Automatic Drill Grinder, 26*
Key Seating Machine, 810*
Little Giant Corner Drill, 88*
Motor Driven Rotary Slotter, 304*
Norton Car Wheel Grinder, 872*
Open Turret Lathe, 944*
Pipe Threading Machine, 528*
Portable Drill Grinder, 526*
Mail Contracts, 121, 190, 421, 526
Maintenance of Way (See also Rail):
Curve Measurement, Prussian State R. R.'s, 834
Declimetre, 551*
Economics of Railroad Location, 534†, 542
Economy in Track Work, 366
Extrahometre, 519*
Gasolene Weed Burner, Union Pacific, 648*
Holding Force of Spikes, 580*, 764‡
Norfolk & Western Improvements, 325†, 351*, 575*
Present Track and Its Future Development, 939*
Prussian Tests of Superstructure, 295†
Screw Spikes, 580*
Spike Strut Rail Fastener, 559*
Stresses in Track on Curves, 327†*, 414*, 473‡, 506‡, 540‡, 795*
Track Deformations and Their Prevention, 326†, 363*, 416*, 453*, 485*, 517*, 550*, 588*, 618*, 654*, 681*, 713*, 746, 801
Uniformity in Specifications, 437
Maintenance of Way Association (See Am. Ry. Engineering and Maint. of Way Assoc.).
Manhattan Elevated (See Interborough Rapid Transit).
Manning Compression and Water Relief Valve, 788*
Manning, Maxwell & Moore:
Dahl Automatic Drill Grinder, 26*
Marble, J. H., 479*
Maryland Ry. Supply Co., Spike Strut Rail Fastener, 559*
Massachusetts:
Anti-Merger Bill, 721
Fire Extinguishers on Railroads, 800
Railroad Delays in, 37
Massachusetts Railroad Commission:
Fire Extinguishers on Cars, 800
Report on Railroad Delays, 37
Safety Appliances, R. R. Comm. Annual Report, 205
Master Car Builders' Association:
Cast-Iron Car Wheels, 823†
Committee Reports, 853*, 887*
Convention, 925
Convention, Secretary Moseley's Speech, 886
Convention Exhibits, 858, 899
Convention Plans, 190, 230†, 697†
Convention Program, 841
Topical Discussions, 961
Master Mechanics' Assoc. (See Am. Ry. M. M. Assoc.)
McCrea, James, 21*, 52
Metropolitan Ry. (London), Electrification, 207
Mexico:
International Traffic, 754
Railroad Progress, 557
Rails and Locomotives Imported, 755
Southern Pacific Lines in Sonora, 458*
Tie Conditions, 47
Michigan:
New Railroad Laws, 404, 459
Railroad Commission, 945
Railroad Taxation, 155, 165†
Michigan Central:
Detroit River Terminal, Electric Traction, 690
Short-Term Notes, 132†
Middletown Car Works:
Flat Car for Philippine Rys., 206*
Low Side Steel Gondola, P. & R., 811*
Steel Gondola for Alan Wood Iron & Steel Co., 206
Midland Ry. (Eng.) Standard Locomotives, 710*
Milan-Varese R. R., Protected Third Rail, 151
Mileage (See Passenger Rate Reduction)
Mine Hoist (See Hoisting and Conveying)
Minnesota:
New Railroad Laws, 222, 403, 459
Valuation of Railroads, 592
Mississippi:
Railroad Valuation, 869
Missouri:
New Railroad Laws, 222, 404, 459
Missouri Pacific:
Education of Apprentices, 216
Suit to Dissolve Alleged Merger, 56
Mobile, Jackson & Kansas City:
Receivership, 1†
Montana:
New Railroad Laws, 460
Montana R. R. Commission, 285
Morocco, First R. R. Train, 89
Morse Lines (See Consolidated Steamship Co.).
Motor Car:
Benzoelectric in Hungary, 220, 248
Ganz Steam, C., R. I. & P., 451*
Gasolene, 761†, 778
New Zealand, 217
Penna. R. R. Committee Report, 606
Steam, Bavarian State R. R.'s, 169*
Mule, Electric, Teltow Canal, 118*

N

National R. R. of Mexico:
Four-Cyl. Bal. Comp. Pacific Locomotive, 140*, 283*, 412
National Steel Co., Cellular Steel, 373*
National Transcontinental (See Grand Trunk Pacific).
Nebraska:
New Railroad Laws, 222, 460, 493
Nevada:
New Railroad Law, 493, 543
New Hampshire:
New Railroad Laws, 460, 501†
New Jersey:
Railroad Commission, 560, 608
New Jersey R. R. & Transportation Co., Early Equipment, 39*
New Jersey Short Line, Strauss Bascule Bridge, 374*
New York & Ottawa, Ottawa Union Station, 745*
New York Central & Hudson River:
Annual Report, 604†*
Appeal in Sugar Rebate Case, 478
Collision at Pittsford, 943
Derailment near Williamsbridge, 230†, 261†, 292‡, 327†*, 414*, 415, 462, 473‡, 504†, 634†
Electric Operation, 155, 221, 254
Eleventh Ave. Subway, 721
Feed Cable Short Circuit, 943
Grand Central Terminal in 1906 and in 1911, 252*
Harriman Interest, 33†, 52
Independent Home and Distant Automatic Block Signals, 80*
O'Rourke Contract Canceled, 814
Preparation for Electrification, 366
Profile of Park Ave. Tunnel, 650*
Rates for Fast Freight Movement, 735*
Rebates to Gen. Elec. Co., 557
Results of Terminal Electrification, 568†
Short-Term Notes, 132†
Snow Test of Motor Car Trains, 211*
Steam and Elec. Loco. Terminals and Shops, Croton and North White Plains, 824*
Tariff Sheet, 735*
Telemagnophone, 935*
Tests on Bedford Park Curve, 504†
Track Circuits, 323†
Traction Power of Electric Locomotives, 650*
West Shore Electrification, 755
New York City:
Freight Handling, 617
Growth of Boroughs, 512*
Handling Immigrant Traffic, 307*
Municipal Ferry, 88, 810
Rapid Transit Lines in, 22*
Subway Connection between Brooklyn Bridges, 158, 721
New York City Railway, Fire, 524
New York Connecting Railroad, 512*, 750*
New York, New Haven & Hartford (See also Consolidated Ry.):
B. & M. Purchase, 666†, 721, 861
Collision near Hartford, 943
Debentures, 165†
Electric Operation, 721
Eminent Domain in Minority Shares, 99†
Expansion, 602‡
Four Per Cent. Notes, 229†
Housatonic R. R. History, 115
Morse Offer for Steamship Lines, 197†
Overhead Construction, 220*
Short-Term Notes, 132†
South Boston Coaling Station, 362*
Valuation of, by John F. Stevens, 567†
New York R. R. Club, New Meeting Place, 221
New York State:
Grade Crossing Elimination, 111, 421, 689
New Mileage, 122
New Railroad Laws, 403, 460
Public Service Commissions Law, 315, 569†, 722, 731†, 736, 805, 869, 871, 881†
Sleeping Franchises, 628
New York State R. R. Commission:
Annual Report, 102
Block System Recommendations, 292†, 310, 397†
Drawbridge Rules, 285, 292†, 310
New York Central Wreck, 634†
Report on Defective Rails, 667†, 674*
New York Subway:
Block Signals, I. C. C. Report, 545*
Fire Exits, 723
New York, Susquehanna & Western, Prosecution by U. S. Government, 908
New York Transportation Club, 121
New Zealand:
Arthur's Pass Tunnel, 527
Motor Cars, 217
Results of R. R. Operation, 797
Tie Conditions, 49
Niles-Bement-Pond Co., Turret Lathe, 944*
Nippon Tetsudo Kwaisha, Consolidation Locomotive, 296*
Norfolk & Western:
Improvements, 325†, 351*, 575*, 701*, 767*
Reinforced Cast Iron Wheels, 868*
Sunday Law Violation, 525
Yard Operation, 767*
North Carolina:
New Railroad Laws, 189, 460
North Dakota:
New Railroad Laws, 460
North-Eastern Railway (Eng.), Results of Electrification, 276
Northern of France, Articulated Locomotive, 328
Northern Pacific:
Freight Traffic, 437
Operation, Compared with Union Pac., 141
Pacific Locomotive, 184*
Purchase of Stock by Union Pacific, 299
Senate Investigation, 189
North Staffordshire Ry., Phillips Automatic Stop, 734*
Northwestern Pacific, 861*
Norton Car Wheel Grinder, 872*

O

Obliteration of State Lines, 8‡
Officer (See also Organization):
Altoona, Pa., as a Training School, 64†
B. & O. Inspectors of Yards and Stations, 881†
Character in a Railroad President, 568†
College Men on the Pennsylvania, 371, 469†
One Day with a Railroad Magnate, 55
Rate Expert Wanted, 423
Supply Department, 202‡
Supt. of Materials, P. & R., 26, 202‡
Traveling Freight Claim Agents, Southern Ry., 315
Value of Good English to the Engineer, 800
Ohio, Car Service Rules, 869
Ohlen Saws, 592
Oil (See also Fuel; also Lubrication):
Rifled Pipe Line and Pumping Plant, 786*
Oklahoma:
New Railroad Laws, 460
Oregon:
New Railroad Laws, 460
R. R. Commission, 87
Oregon Eastern, 790*
Oregon R. R. & Navigation Company:
Can. Pac. Trackage Rights, 469†
Oregon Short Line:
Rest Houses, 689
Salt Lake City Station, 101*
Orenburg & Tashkend, 448
Organization (See Officer)

P

Page Bascule Bridge, Chicago River, 836*, 922‡
Paine "Vise-Grip" Anti-Creeper, 870*
Paint:
Flexible Compound, 461
Panama Canal (See also Isthmian Canal Commission): 82*
Private Contract, 87, 158, 190
Panama Railroad: 82*
Cranes, 811*
Paris, Lyons & Mediterranean, General Manager, 785
Paris-Orleans Ry., De Glehn Compound Locomotives, 761†, 774*
Pass:
Contract not Affected by Rate Law, 190
Damages for Revoke of, 158
Latest Fashions, 89
New Hampshire, 461
Passing of the, 25
The Legislative Pass, 397†
Union Pacific in Nebraska, 811
Passenger Rates (See also Interstate Commerce Commission: also Pass; also Passenger Rate Reduction):
Advertising Tickets, C., I. & L., 943
East Indian Railway, 34‡*
Excess Cash Fares, 63†
Excursion, Ohio, 625
German Passenger Tariff, 199†
Immigrants on Roads Out of New York, 943
Increase, London, 869
Increase, P. & R. Commutation, 753, 809
L. C. C. and Pullman Co., 913
Necessity for Increase, 431†, 436‡
Penna R. R. Commutation, 810
Rate Regulation and the Canadian Parliament, 313
Second-Class Fares, 809
Transportation of Newspaper Employees, 158
Passenger Rate Reduction:
Alabama, 221, 371, 461, 689
Arkansas, 221, 753, 869
B. & M., 25, 189, 814
Can. Pac., 421
Canada, 55
C., C. & L., 809, 913
Cleveland & Marietta, 633†
D. & H., 809
Effects in South, 735

Passenger Rate Reduction (*Continued*):
Florida, 625
Georgia, 461, 869
Germany, 306
Grand Trunk, 421
Illinois, 657, 689, 809, 869, 913
Indiana, 189, 286, 526, 721, 809, 869
Interchangeable 2-Cent Mileage, 80
Iowa, 221, 869
Italian Roads, 212
Kansas, 461, 657, 814, 943
Maine Central, 814
Michigan, 526, 560
Mileage, Penna. R. R. and Lines West, 525
Mileage, Trans-Missouri, Interchangeable, 525
Minn. & St. Louis, 525, 591
Minnesota, 286, 526, 591, 625, 913
Mississippi, 461, 526, 809
Missouri, 189, 221, 286, 869, 912, 920†
Montana, 591, 753
Nebraska, 286, 315, 371, 869, 913
Nevada, 943
New Hampshire, 814
New South Wales, 56
New York, 753
North Carolina, 689, 721, 809
Ohio, 633†, 657, 809, 914
Party Tickets, 657, 689, 753
Pennsylvania, 526, 560, 753, 810
Reported Offer of Texas R. R.'s to Prevent, 536†
Sleeping Cars, 155, 810
Stockholders, not Shippers, Oppressed, 945
Texas, 536†, 602†
Virginia, 625, 689, 721, 722
West Virginia, 221, 286, 560
Wisconsin, 253, 286, 913
Passenger Traffic (See also Traffic):
East Indian Railway, 342*
Passengers, Compared with Grain, 628
Transatlantic in 1906, 113
Pay (See Wages Increased).
Peking-Hankow R. R., 908*
Pennsylvania:
History of First Government Railroad, 35‡
New Railroad Laws, 403, 460
Pres. Baer's Letter to Legislature, 204
Proposed Legislation, 105, 204
Railroad Commission, 371, 814, 943
Pennsylvania Railroad:
Age Limit, 189
Altoona as a Training School, 64†
Annual Report, 401†*
Atlantic City Wreck, 121
Baggage Handled, 525
Building Steel Cars, 155
College Men on, 371, 469†
Commendation of Employees, 292†
Denholm Coaling Station, 423
Derailment at Mineral Point, 261†, 272, 403‡
Electric Baggage Trucks, 315, 845*
Final Report of Special Investigating Committee, 245, 281
Five Per Cent. Notes, 229†
Forest Culture, 690, 814
Freight Car Movement, 525
Freight Cars and Traffic Statistics, 85, 592
History of Some Subsidiaries, 35‡
Increased Operating Expenses, 560
Locomotive Experiments and Improvements, 235*
Motor Cars and Automobiles, Committee Report, 606
Natural Snow Fences, 814
New Track Mileage, 526
New York City, Extension into, 512*
Number of Shareholders, 721
Replacing Church, 593
Rest Houses, 316
Signals for New York Terminal, 558
Smith & Perkins Locomotives, 552*
Steel Passenger Cars, 822†, 846*
Steel Ties, 272, 403‡
Surprise Checking, 472†, 755
Technical School at Altoona, 317
Train Wreckers Near Pittsburg, 493, 528
Washington Union Station, 483*
Pennsylvania Lines West (See also names of subsidiaries):
Coal Handling at Sandusky, 560
Grade Separation in Cleveland, 440*
Reinforced Concrete Telegraph Poles, 919†, 937
Torrence Road Passenger Station, 733*
Penna., New Jersey & New York, 512*
Penna., New York & Long Island, 512*
Pension (See Employee).
Per Diem (See Car Service).
Permanent Way (See Maintenance of Way).
Peru:
Projected Road, 157
Petroleum (See Fuel).
Philadelphia & Reading (See also Reading Co.):
Low Side Steel Gondola, 841*
Pres. Baer's Letter to Pennsylvania Legislature, 204
Prosecution by U. S. Government, 908
Raising Minimum Age Limit, 501†
Supt. of Materials, 26, 202‡
Philadelphia & Western, 753
Philadelphia, Baltimore & Washington:
Havre de Grace Improvements, 688*
Track Elevation at Wilmington, 421
Upward-Indication, Three-Position Signals, 368*
Philadelphia Traction Trouble, 123
Philippine Rys.:
Flat Car, 206*
Phillips Automatic Stop, 734*
Picked up on the Road, 574
Pile:
Teredo in South Africa, 151*
Pioneer Cast Steel Truck Co., Symons Cast Steel Bumping Post, 54*
Pipe:
Rifled Pipe Line for California Oil, 786*
"Universal" Cast Iron, 373*
Pittsburg Steel Fdry., Truck Side Frame, 871*
Pneumatic Tools (See Machine Tools)
Policy and Finance Versus Production, 8‡
Porto Rico, Railroading in, 494
Pratt & Whitney Turret Lathe, 944*
Presidents' Mission to Washington, 422*
Pressed Steel Car Company:
Steel Passenger Cars, Hudson Companies, 822, 831*
Prince Edward Island Ry., Pension System, 43
Price (See Business Situation).
Prosperity (See Business Situation)
Prussia:
Canal Tolls, 684
Hours of Labor, 316, 374
Railroad System, 732
Prussian State Railroads:
Changes in Organization, 34†, 650
Curve Measurement, 834
Electrification, 556
Growth of Traffic, 141
Increased Wages, 606
Signals, 709*
Tests of Mild Tube Sheets, 797*
Tests of Track Superstructure, 295†
Public, Relation of Railroads to:
Corporate Frankness, 502†
Courtesy as an Asset, 229†, 243
Grover Cleveland on, 450
Judson Harmon on, 691
Vice-President Thayer on, 311
Public Service Corporation, New General Manager, 495
Pullman Co.:
All-Steel Sleeping Car, 541*
I. C. C. Jurisdiction, 913
Texas Rate Reduction, 155
Purdue University:
Locomotive Performance, 603†, 640‡

Q

Quebec & Lake St. John, Purchase by Canadian Northern, 697†
Quebec Bridge, 37*

R

Rail (See also Superelevation; also Maintenance of Way):
Abbott Rail Joint Plate, 373*
Am. Soc. for Testing Materials, Discussion, 919†
Anchor Guard Rail Clamp, 593*
Compression of Ingots by Wire Drawing, 699†, 716*
Continuous Rail for Uniform Track Structure, 503†, 606‡, 640‡
Corrugation on English Electric Lines, 786
Defective, 667†, 674*, 699†, 721, 729†, 814
Harmet Process, 699†, 716*
New York Central Test of Snow-Covered Third Rail, 211*
Proposed 100-lb. Section, 794*
Protected Third-Rail, Milan-Varese R. R., 151
Sales for 1908 Delivery, 813
Split Rails at Highway Crossings, 34‡
Stanford Rail Joint, 627*
U. S. Production, 158
"Vise-Grip" Anti-Creeper, 870*
Railroads (See also Public, Relation of R. R.'s to):
Harriman on Present Situation, 411
Mileage and Statistics of the Railroads of the World, 921†
Review of Year 1906, 1†
Some Railroad Problems, 311
Summary of Annual Reports, 4†*
Railroad Commissions (See State R. R. Commissions).
Railway Auto Car Co., Ganz Motor Car for C., R. I. & P., 451*
Railway Signal Association:
Committees for 1907, 58
January Meeting, 58, 81
May Meeting, 673
Rate Law (See Interstate Commerce Law).
Reading Company:
Prosecution by U. S. Government, 908
Rebates (See Freight Rates)
Receiverships:
Mobile, Jackson & Kansas City, 1†
Refrigeration, 74
Reinforced Concrete (See Concrete, Reinforced).
Rensselaer Polytechnic Institute:
New Buildings, 913
New Mechanical and Engineering Courses, 421
Reports, Annual (See individual companies)
Restraint of Trade, Bridge Companies Fined, 315
Review of the Railroad Year, 1†
Rivers, Inland Waterways Commission, 421
Roadbed (See Maintenance of Way).
Robertson Sand Dryer, 593*
Rogers, H. A., Co., Track Drill, 626*
Roundhouse:
Erie at Susquehanna, Draft and Heating, 120
Rules (See Accidents; Employee; Signals)
Russia:
Automatic Coupler, 440
Moscow Fuel Famine, 708
Petroleum, 656
Proposed Extension of Trans-Siberian, 119
Tie Conditions, 49
Ryerson Key Seating Machine, 810*

S

St. Joseph & Grand Island, Acquisition by Union Pacific, 33‡, 52, 298
St. Louis & San Francisco:
Ten-Wheel Locomotive, 572*
St. Louis Car Co.:
Electric Car for Erie, 313*
St. Louis, Iron Mountain & Southern:
Suit to Dissolve Alleged Merger, 56
Union Station at Little Rock, 268*
St. Louis Southwestern:
Union Station at Little Rock, 268*
St. Louis Terminal R. R., 810
Safety Appliance (See also Brake):
Ann Arbor, 591
Automatic Coupler, Russia, 440
Cost on Harriman Lines, 720
Investigation of Automatic Stops, 34‡, 55, 277, 291†, 313
Law Challenged by Ann Arbor, 478
Mass. R. R. Comm. Annual Report, 205
Phillips Automatic Stop, 734*
Progress of Invention in Mississippi, 159
Safety Appliance Law Violations, 221, 253, 689
Schlemmer Case, 331
Salton Sea, 197†, 217*, 489*
Sand Dryer, 593*
San Pedro, Los Angeles & Salt Lake:
Relations with Southern Pacific, 33†, 52, 271, 658
Salt Lake City Station, 101*
Saws, Ohlen, 592
Schedule (See also Fast Trains and Runs):
Adjustment with Connecting Roads, 627
By Popular Vote, 754
Canada, Speed over Crossings and Drawbridges, 371
Speed Limits, New York Central Elec. Zone, 316
Western Schedules Lengthened, 526, 591, 657, 753, 869
Scherzer Bascule Bridges, 372*, 922‡
Schools (See Names)
Seaboard Air Line:
Block System, 155
Strengthening Ends of Postal Cars, 104*
Section Foreman (See Employee)
Semaphore (See Signal)
Shaughnessy, Sir Thomas, 945
Shaw Electric Crane Co., Cranes for Panama R. R., 811*
Ship (See also Names of Companies):
Building in 1906, 159
Development of Steam Turbine, 830*
Hamburg-American, New Steamship, 123
Holland-America Steamship Rotterdam, 87
International Mercantile Marine Co., New Steamships, 812
Japanese S. S. Co. Profits, 158
New Record Across Pacific, 189
North German Lloyd, New Steamship, 913
Salving of the Suevic, 940*
San Francisco Dry Dock, 253
Steamship Milwaukee, 942*
Tonnage at New York, 285
Transatlantic Passenger Traffic in 1906, 113
Turbine Steamship Governor Cobb, 248*
Shipper (See Car Service)
Shonts, T. P., 189, 286
Shops:
A. T. & S. F. Shop Belting Practice, 105*, 131†
Ill. Cent. at Burnside, 842*
New York Central Repair Shops, Croton and North White Plains, 824*
Output, 539†*
Paint, N. Y. O. & W., Heating and Ventilation, 835*
Producer Gas Power for, 762†
Southern, at Princeton, 842*
Wabash at Decatur, Ill., 102*
Siberia:
Railroad Traffic During War, 65†
Signal (See also Railway Sig. Assoc.):
Color Blindness and Night Signals, 601†
German Comment on American, 460
India, 462
Monnot Wire, 673
New American Semaphore Code, 233‡
Prussian State R. R.'s, 709*
Train Markers, 527
Signal, Block (See also Ry. Sig. Assoc.):
Accidents Prevented by Automatic, 208
Effects of Foreign Current on Automatic, 81
Excessive Hours of Signalmen, 502†
Foot Power Generator for Controlled Manual Block Station, 180*
Independent Home and Distant, N. Y. C. & H. R., 80*
Indiana Legislation, 470†, 477
I. C. C. Report, 159, 277, 479, 507*, 544*
Legislation, 177
Mileage Worked by, 280
New and Old Problems, 405, 653
New Orleans & North-eastern, 628
N. Y. State R. R. Commission Recommendations, 292†, 310, 397†
N. Y. Subway, I. C. C. Report, 545*
North Staffordshire Ry., 734*
Penna. R. R. New York Terminal, 558
Permissive, 292†, 310, 397†
Permissive, J. J. Hill on, 34†
Permissive, N. Y. N. H. & H., 525
P. B. & W., Upward-Indication, Three-Position, 368*
Prussian State R. R.'s, 709*
Seaboard Air Line, 155
Telegraph Block System in England, 241
Three-Position Automatic, B. & O., 80*
Track Circuits, New York Central, 323†
Ulster & Delaware, 558
Upward Inclination, 81
Without Flagmen or Train Orders, 254
Signal, Interlocking (See also Ry. Sig. Assoc.):
Electric, 610*
I. C. C. Report, 277, 479, 544*
London & South Western at Hampton Court Junction, 476*
Penna. R. R. New York Terminal, 558
Philadelphia, Baltimore & Washington, 368*
Signalman (See Employee)
Simplon Tunnel:
Electric Operation of, 170*, 269
Traffic, 885
Smith & Perkins Locomotives, 552*
Smokeless Locomotive, Belgium, 526

GENERAL INDEX—Continued.

[Illustrated articles are indicated thus: Editorials thus†; Contributions thus‡.]*

Smoke Prevention in Cities, 32†
Smoke, Timmis Consuming System, 110*
Snow Plow, Rotary, D. N.-W. & P., 114*
Sonora Railway, 458*
South Carolina:
  New Railroad Laws, 460
South Dakota:
  New Railroad Laws, 222, 460, 506
South Manchuria R. R., 157, 625
South, Railroad Conditions in, 113, 502†
Southern Railway:
  Collision at Lawyer, Va., 8‡, 87, 698†
  President Finley on Conditions, 113
  Pres. Finley to His Traffic Men, 229†, 243
  Princeton Shops, 842*
  Short-Term Notes, 162†
  Traffic and Operating Conditions, 97†, 113
  Traveling Freight Claim Agents, 315
Southern of Peru, Ten-Wheel Locomotive, 652*
Southern Pacific (See also Harriman Lines):
  Acquisition by Union Pacific, 298
  Bay Shore and Dumbarton Cut-Offs, 328*
  Cuban Service, via Illinois Central, 36
  Derailment at Colton, 493
  Derailment at Honda, 691
  Dividend Declaration Compared with Kansas City Southern, 502†
  Fruit Traffic Agreement with A. T. & S. F., 188
  Great Salt Lake or Lucin Cut-Off, 691
  Klamath Falls Line, 790*
  Land Sale, 155
  New Line Across Irrigated Land, 722
  New Lines in Sonora, 458*
  Northwestern Pacific R. R., 861*
  Passenger Station at Oakland, 516*
  Relations with San P., L. A. & S. L., 33†, 52, 271, 658
  Rifled Pipe Line for California Oil, 786*
  Safety Devices, 720
  Salton Sea, 197†, 217*, 489*
  Steel Postal Car, 822‡, 852*
  Strike of Firemen, 55, 157
  Yard at Visitacion Bay, San Francisco, 12*
Spark, Timmins Consuming System, 110*
Speed (See Fast Trains and Runs)
Spike (See Maintenance of Way)
Spokane & Inland, 79
Spokane International, 469‡
Stanford Rail Joint, 627*
State Ownership (See Government Ownership)
State R. R. Commissions (See also names of states):
  Political Commissions, 65†, 198†, 261†
Station (See also Yards and Terminals: also Freight House):
  Beautification, Long Island R. R., 690
  D. N.-W. & P., Corona, Col., 749*
  Gould Lines at Little Rock, 268*
  Harriman Lines at Salt Lake City, 101*
  Justification for Moving Station, 722
  Kansas City, Proposed Union Station, 367
  Lexington, Ky., Union, 75*
  Ottawa Union, 745*
  Penna. Lines West, Torrence Road, 733*
  Southern Pacific at Oakland, 516*
  Texas & Pacific, Sweetwater, Tex., 108*
  Toronto Union, 718*
  Washington Union, 483*
  Y. & M. V., Vicksburg, 685*
Station Agent (See Employee)
Statistics of Freight Traffic in Great Britain and America, 132†, 142
Steamer (See Ships)
Steam Shovel Dipper Tooth, 627*
Steel (See Iron and Steel)
Steel-Concrete (See Concrete, Reinforced)
Stevens, John F., 413*
Stevens, John F., Valuation of N. Y. N. H. & H., 567†
Stewart Iron Fencing, 628*. 690
Stickney, C. A., Co., Water Column, 812*
Stock (See Finance)
Storekeeper (See Officer)
Strauss Bascule Bridge, 374*
Street Railways (See also Electric Railways):
  Capitalization in Connecticut, 65†, 198†
  Rapid Transit Lines, New York City, 22*
  Subway (See Subway)
Strike:
  Buffalo Docks, 721
  Erie Machinists, 754, 809, 943
  L. & N. Machinists, 809
  New York Longshoremen, 721
  N. Y. N. H. & H., 721
  Rogers Locomotive Works, 869
  Southern Pacific Firemen, 55, 157
  Toledo Ry. & Terminal, 87
Subway:
  Battery to Brooklyn, 814
  Connection Between Brooklyn Bridges, 158, 721
Sullivan Mine Hoist, 156*
Superelevation:
  Fallacies of, 506‡, 540†, 605‡, 639†*, 669‡*, 700‡
Superheater:
  Baldwin, 780*
  Germany, 409
  Grant to Dean Goss for Investigations, 153
  History and Results, 792
  History and Tests, 181*
Sweden:
  Electrification, 885
Switzerland:
  Increased Wages, 582, 680
Symons Cast Steel Bumping Post, 54*

T

Taxation (See also Legal Decisions):
  Manhattan Elevated Ry., 155
  Michigan, 155, 165†
  Nebraska, 493
  Railroad Valuation, 730†
  Results in 1905, 132†
  Un. Pac. and C. B. & Q. in Nebraska, 285
Technical Publicity Assoc., 316
Tehuantepec National, 88, 157
Telegraph (See also Assoc. of Ry. Telegraph Superintendents):
  Early Forms, 593
  Reinforced Concrete Poles, 919†, 937
Telegraph Operator (See Employee)
Telemagnophone, 935*
Telephone:
  Two Companies in New York City, 56
Teltow Canal, 118*
Tennessee:
  New Railroad Laws, 460
Teredo in South Africa, 151*
Terminal (See Yards and Terminals)
Terminal R. R. Assoc. of St. Louis, 810
Texas:
  Attitude Toward Railroads, 602†
  Electric Headlights on Locomotives, 435‡
  Eminent Domain for Electric Rys., 285
  Liquor Shipments, 814
  New Railroad Laws, 403, 422, 460, 587, 591
  Projected Roads, 157
  Pullman Rate Reduction, 155
  Railroads, Yoakum on, 754
Texas & Pacific:
  Annual Report, 570†*
  Station at Sweetwater, Tex., 108*
Texas Central, Sleeping Cars, 869, 942
Third Rail (See Rail)
Ticket (See Passenger Rates)
Ticket Office Advertisement, Erie, 594*
Tidewater Railway, 325†, 340*
Tie (See also Timber):
  Buhrer Concrete, 459
  Carnegie Steel, B. & L. E., 297
  Concrete and Steel, M. of W. Assoc. Report, 429†
  Conditions in Certain Foreign Countries, 47
  Cuban Varieties, 657
  Effect of Steaming and Preserving, 656
  Holding Force of Spikes, 580*, 764‡
  Longitudinal Steel, 336*
  Mahogany in Mexico, 57
  Metal vs. Wood in Germany, 733
  Preservation by Crude Oil, 222
  Saw Instead of Hew, 691
  Vulcanized, 100
Timber (See also Tie; also Lumber):
  Forest Service Tests, 755
  Lumber Production in U. S. in 1905, 55
  Natural Snow Fences, 814
  Penna. R. R. Forest Culture, 690
  Preservation, U. S. Forest Service, 446
Timetable (See Schedule)
Timmis Bogie Lead, 276*
Timmis Smoke Consuming System, 110*
Tires (See Wheel)
Toledo Ry. & Terminal Strike, 87
Toledo, St. Louis & Western, General Office Building and Freight House at Toledo, 885*
Tonnage Rating (See Train)
Tonopah & Tidewater R. R.: 78*
  Joint Rail and Automobile Rates, 813
Tool (See Machine Tool)
Track (See Maintenance of Way)
Track Elevation (See Grade Separation)
Tractive Power (See Locomotive Performance)
Trade Unions (See also Strikes):
  Bribery, Erie Machinists, 943
  Brotherhood of Locomotive Engineers, 262†, 469†
  Engineemen Complaining of Good Discipline, 469†
  Influence on Discipline, 462, 665†
Traffic (See also Freight Traffic; also Passenger Traffic; also Business Situation):
  Bulletin of Traffic News for Shippers, 408
  Capitalization and Ton Mileage, 538‡
  Economics of Traffic Agreements, 262‡, 271
  Hill on Railroad Situation, 86
  Interchange with Electric Lines, 157, 721
  London Traffic Problems, 294†
  Outlook for 1907, 13
  Pres. Finley to His Traffic Men, 229†, 243
Train:
  Markers, 527
  Profitable Weight and Speed of Freight Trains, 168‡, 198†, 200‡, 230†, 232‡, 295‡, 435†, 473‡, 504‡, 572‡, 638‡, 670‡, 884‡
Train Lighting (See Lighting)
Train Load (See also Train):
  Figures for 17 Roads, 44
Trainmen (See Employee)
Train Robberies:
  Nor. Pac., 650, 869
  Penna. R. R., 943
  Seaboard Air Line, 25
Train Service (See Schedule)
Train Wrecker (See Accidents)
Tramps, Punishment of, 881†, 913
Tramways (See Electric Railroad: Street Railways)
Transatlantic Passenger Traffic in 1906, 113
Transcontinental Electric R. R., 158
Treacy Steam Shovel Dipper Tooth, 627*
Trestle (See Bridge)
Trolleys (See Electric Railways)
Trolley Wire (See Electric Traction)
Truck:
  Cast Steel Side Frame, 871*
  Electric Baggage, Penna. R. R., 845*
  Evolution of Car Trucks, 103
  Timmis Bogie Lead, 276*
Tunnel:
  Air Resistance in, 269
  Arthur's Pass, New Zealand, 527
  Belmont (N. Y.), 721
  Hudson Companies (See Hudson Companies)
  Penna. R. R. Extension into New York, 512*
  Simplon (See Simplon Tunnel)
  Subway (See Subway)
Turbine (See Ship)
Turkey:
  Electric Railway, 585
  Hedjaz Railroad, 800
Turneaure Recording Extensometer, 444*
Two Cents a Mile (See Passenger Rate Reduction)

U

Union Pacific (See also Harriman Lines):
  All-Steel Box Car, 229†, 250*, 824‡
  Dividend Declaration Compared with Kansas City Southern, 502†
  Gasolene Motor Cars, 761†, 778
  Gasolene Weed Burner, 648*
  Method of Placing Double Track Through Plate Girders, 338*
  Northern Pacific Stock Purchase, 299
  Operation, Compared with Hill Lines, 141
  Purchases of Railroad Stocks, 33†, 52, 270
  St. Joseph & Grand Island Acquisition, 298
  Safety Devices, 720
  Salt Lake City Station, 101*
  Southern Pacific Acquisition, 298
Union Switch & Signal Company:
  Annual Meeting, 424
  Penna. R. R. New York Terminal Equipment, 558
  Ulster & Delaware Equipment, 558
United Engineering Societies, Dedication of Building, 514
United Railroads of New Jersey:
  Early Equipment, 39*
United States Steel Corporation:
  Annual Report, 401†
  Defective Rails, 667†, 674*, 699†, 721
  Duluth Plant, 494
  Earnings, 159
Universities (See Names).
University of Illinois, School of Ry. Engineering and Administration, 842
Utah:
  New Railroad Laws, 460

V

Value (See Finance).
Valuation of Railroad Property, 293†, 567†, 730†
Valve:
  Barnes Blow-Off Valve, 799*
  Early Use of Balanced Slide Valves, 180
  Inside Clearance, 603†, 640‡
  Manning Compression and Water Relief, 788*
  "Security" Back-Up, 870*
  Walschaert Gear, 556, 573*
  Zara Throttle, 147*
Vandalia:
  Mogul Locomotive, 10*
Ventilation, N. Y., O. & W. Paint Shop, 835*
Vermont:
  New Railroad Laws, 432†
Viaduct (See Bridge).
Victoria Government Railways, 167‡, 177*
Virginia Corporation Commission Report on Lawyer Collision, 698†
Virginia Locomotive Works, 552*
Vision (See Employee).

W

Wabash:
  Decatur Shops, 102*
  Suit to Dissolve Alleged Merger, 56
  Two-year Notes, 501†
Wage Increases:
  A. C. L., 121, 689
  Atlanta & West Point, 689
  B. & A., 55
  B. & M., 55
  B. & O., 221
  B. & O., 493
  C., B. & Q., 87, 809
  Cent. of Georgia, 689
  Cent. of N. J., 221
  C. H. & D., 557
  Chicago Street Rys., 525
  C., N. O. & T. P., 155
  D. & H., 493, 913
  C. & N.-W., 121
  D., L. & W., 221
  Erie, 221
  Georgia R. R., 221, 689
  Georgia, Southern & Florida, 689
  Interborough Rapid Transit, 155
  Intercolonial, 869
  Lehigh Valley, 221
  L. & N., 285
  L. S. & M. S., 371
  Mex. Cent., 87
  Mich. Cent., 869
  Mobile & Ohio, 689
  N. & W., 371

Wage Increases (*Continued*):
N. Y. C. & H. R., 25, 155, 221
N. Y., N. H. & H., 55, 637, 689, 809
Penna. R. R., 221, 285, 292†, 371
Prussia, 606
S. A. L., 689
Southern, 189, 689
Southern Pacific, 371, 558, 657
Swiss State R. R.'s, 582
Toledo & Ohio Central, 87
Union Pacific, 657, 753
Western Roads, 525, 527
Waiting, 422*
Walter, Alfred, 247*
Walter, L. M., 479*
Washington Correspondence, 80
Water Column, Johnson, 812*
Waterproofing of Masonry and Concrete, 119
Weed Burner, Gasolene, Union Pacific, 648*
West Jersey & Sea Shore:
Additional Equipment, 123
Atlantic City Wreck, 121
West Virginia:
New Railroad Laws, 460
Western Pacific:
Grades, 510*
Oakland Terminals, 190
Western Ry. Club Library, 222
Westinghouse Air Brake Co., Recent Developments in Air Brake Control Apparatus, 804*, 862*
Westinghouse, Church, Kerr & Co., Erie Electrification, 79
West Shore R. R. (See N. Y. C. & H. R. R.).
Wheel:
Cast Iron, M. C. B. Recommendations, 823†
Reinforced Cast Iron, N. & W., 868*
Solid Steel for Passenger Cars, 935
Wheeling & Lake Erie:
Fuel Tests, 169
Improvements, 253
White Star Line, Changes in Ports, 55
Whiting Fdry. Equip. Co., Traveling Roundhouse Crane, 871*
Wire (See Electric Traction; also Signal)
Wisconsin:
New Railroad Laws, 222, 404, 460, 869
Railroad Commissioners' Report, 622
Wood (See Timber).
Works (See Shops).
Wreckers (See Accidents)
Wyoming:
Railroad Valuation, 730†

Y

Yale, Julian L., & Co., Cast Iron Pipe, 373*
Yards and Terminals:
Cent. of N. J., Bronx Freight Terminal, 691*
D., L. & W. at Hoboken, 304*
Grand Central Terminal, N. Y., in 1906 and in 1911, 252*
Long Island R. R., Flatbush Ave., 148*
N. Y. Cent. Steam and Elec. Loco. Terminals, Croton and North White Plains, 824*
N. & W., Bluefield and Williamson, 575*
N. & W., Roanoke, Portsmouth and South Norfolk, 701*
N. & W. Yard Operation, 767*.
Penna. R. R. at New York, 512*
St. Louis Improvements, 810
So. Pac. at Visitacion Bay, San Francisco, 12*
Western Pacific at Oakland, 190
Yazoo & Mississippi Valley Passenger Station at Vicksburg, 685*
Year 1906, Review of, 1†

Z

Zelnicker, Walter Q., Supply Co., Sleeping Cars for Illinois Traction Lines, 242*

NEW PUBLICATIONS.

Allgemeine Eisenbahnkunde, 637.
American Electric Railway, 638
Annual Report of the Smithsonian Institution for 1905, 434.
Combustion and Smokeless Furnaces, 637
Concrete and Reinforced Concrete Construction, 669.
The Crisis at Panama, 66
Design of a Railway Bridge Pier, 732
The Design of Steel Mill Buildings, 433
The Design of Walls, Bins and Grain Elevators, 732
The Earning Power of Railroads, 638
Engineering Index, 100
Engineering Index, Annual for 1906, 699
Facts About the South, 669
Grain Charts, 232
Handbook of Mathematics, 433
Interstate Commerce Acts Indexed and Digested, 232
Light Locomotives, 538
Locomotive Performance, 605
Mathematical Drawing, 434
North American Railroads, Their Administration and Economic Policy, 669
Official Industrial Guide and Shippers' Directory, 266
Open-Hearth Steel Castings, 732
Overhead Contact Lines, 732
The Peabody Atlas of Coal Mines and Coal Railroads, 266
Proceedings of the Fourteenth Annual Convention of the Traveling Engineers' Association, 538
Proceedings of the Fourteenth Annual Convention of the National Railroad Blacksmiths' Association, 66
Railroad Pocket-Book, 571
The Railway High Speed Mania, 571
Railway Problems, 571
Railway Signal Association, 200, 295
Reinforced Concrete, 232
Symmetrical Masonry Arches, 99
The Steam Engine and Other Heat Motion, 700
Ten-Wheel Type Locomotives, 200
Text-Book on Geodesy and Least Squares, 571
Thermal Conductivity of Concrete, 732
Three Acres and Liberty, 538
Universal Dictionary of Mechanical Drawing, 638
Valve Gear for Steam Engines, 638

PERSONAL.

[*Portraits are indicated thus**.]

Bartlett, Henry, 92*
Batchelder, Frank C., 90
Biles, George P., 126*
Bronson, Miles, 425*
Brown, S. W., 816*
Bury, G. J., 287

Cameron, Charles C., 224
Carry, E. F., 596*

Dailey, Eugene, 224
Davant, Thomas S., 876
Decker, M. S., 479*
Dickinson, John T., 286*

Farrell, P. J., 479*
Forney, M. N., 943

Gaillard, Maj. D. DuB., 413*
Garrett, W. N. A., 311*
Goethals, St. Col. G. W., 413*
Goodyear, C. W., 816*
Gorgas, Col. W. C., 413*
Graham, J. M., 914
Greig, A. S., 876*
Grover, A. J., 495

Hansel, Charles, 90
Harriman, Frank B., 126*
Hawks, George F., 464*
Hopson, John P., 724*

Kipp, A. R., 875

Lindsay, C. E., 725
Long, S. C., 629*
Loree, L. F., 568†
Lovejoy, J. R., 376

McBride, W. J., 595
McCabe, D. T., 125
McCrea, James, 21*, 52
MacDowell, William G., 876
Maher, N. D., 947*
Marble, J. H., 479*
Miller, A. A., 126
Miller, Henry, 756*
Mitchell, A. E., 817*
Morrow, R. T., 629
Mullin, William J., 318

Naugle, John A., 946*
Newbert, John V., 725
Nutt, Henry C., 915*

Page, O. H., 224
Pardee, Alfred, 125

Rohwer, Henry, 659
Shaughnessy, Sir Thomas, 945
Shonts, T. P., 189, 286
Slack, Frederick T., 426*
Spaidal, Fred M., 125
Stevens, John F., 413*

Taylor, Edward B., 125*
Trapnell, William, 126

Van Tassel, George, 426*

Walter, L. M., 479*
Ward, J. E., 756
Waite, H. M., 377
Wheatley, A. W., 815
Wells, Reuben, 595*
Whittelsey, T. F., 318*
Williams, W. H., 816*

OBITUARY.

[*Portraits are indicated thus**.]

Blair, Hon. Andrew G., 160
Boyd, Gen. Joseph F., 464
Burkhalter, M. H., 946

Cassatt, A. J., 20*, 47
Clark, Francis L., 815

Denegre, E., 463
Dodd, T. W., 90
Dowdell, A., 223

Eldridge, A. R., 124
Erbelding, George, 90

Goodyear, Frank H., 692
Grammer, Capt. George J., 191*, 208
Grant, John A., 875
Griffin, Gen. Eugene, 562
Guilford, Nathan, 692*

Haswell, C. H., 686*
Haven, Nathaniel, 124
Henry, C. S., 191
Howett, W. A., 255
Hughes, W. A., 376

Jaeger, Henry T., 425

Keep, Albert, 692

Lewis, Wm. H., 464
Livermore, Major C. F., 124
Lomlin, Arthur V., 376
Lord, E. P., 724

MacArthur, Archibald, 813
McGovern, P. J., 815
Mackenzie, Alexander W., 875
McMillan, W. C., 424, 463
Mills, Arthur, 27
Mitchell, Mrs. A. E., 124
Musson, James W., 124

Niver, William K., 529

Russell, E. G., 628
Rutherford, R. H., 464
Ryan, R. X., 529

Sayre, Robert H., 58
Scattergood, T., 595
Sergeant, H. C., 191
Shunk, William F., 946
Smith, Major William L., 287, 317*
Smith, Nicholas T., 596, 628
Somers, Edgar L., 596
Sullivan, J. D., 562
Sykes, M. L., 562

Thrall, William A., 287*

Van Dusen, Frank, 317

Walker, John A., 815
Walter, Alfred, 223, 247*
Whitcomb, Isaac A., 596
White, Jonah H., 160
Willcox, David, 629*
Winston, J. B., 724

Yard, E. J., 464, 529

ELECTIONS AND APPOINTMENTS.

Aberdeen & Rockfish, 464
Alabama Great Southern, 59, 126 (2), 192
Algoma Central & Hudson Bay, 192, 497
Ann Arbor, 497, 629, 659, 693
Arkansas Southeastern, 659
Arkansas Western, 947
Astoria & Columbia River, 495, 529
Atchison, Topeka & Santa Fe, 59, 126, 127, 191, 193, 495, 659, 725, 877, 947
Atchison, Topeka & Santa Fe (Coast Lines), 160, 495
Atlanta & West Point, 58, 191, 256, 597
Atlanta, Birmingham & Atlantic, 59, 224, 529, 562, 597, 916
Atlantic Coast Line, 58, 224, 255
Augusta Southern, 58

Baltimore & Ohio, 58, 90, 124, 126 (2), 160, 193, 255, 256, 287, 692, 877, 915 (2), 947 (2)
Baltimore & Ohio Southwestern, 255
Baltimore, Chesapeake & Atlantic, 58
Bangor & Aroostook, 256, 876
Beaumont & Great Northern, 529
Beaumont, Sour Lake & Western, 59, 660
Bennettsville & Cheraw, 376 (2), 497
Bessemer & Lake Erie, 256, 660
Birmingham & Atlantic, 875, 876, 877
Birmingham Southern, 693
Boston & Albany, 318, 562
Boston & Maine, 59, 90
Birmingham & Atlantic, 58
Boston & Albany, 464, 529
Boyne City, Gaylord & Alpena, 59
Brimstone Railroad & Canal, 495
Broxton, Hazlehurst & Savannah, 659
Buffalo & Susquehanna, 92, 630, 756, 757
Buffalo, Rochester & Pittsburg, 425
Butte, Anaconda & Pacific, 915

Canadian Northern, 660, 876
Canadian Northern Ontario, 58, 125
Canadian Pacific, 58, 224, 125, 126, 160, 255, 256, 287, 319, 377, 496, 529, 597, 629, 876, 877
Central of Georgia, 59, 90, 287, 464, 597, 876, 877
Central New England, 817
Central of New Jersey, 126, 160, 562, 563, 659
Chattanooga Southern, 659
Chesapeake & Ohio, 59, 256, 377, 659, 692, 693, 757, 946
Chicago & Alton, 58, 192, 256, 692, 725, 816
Chicago & Calumet River, 497
Chicago & Eastern Illinois, 465, 597, 692
Chicago & Illinois Midland, 496
Chicago & North-Western, 125, 256, 497, 659
Chicago, Burlington & Quincy, 59, 91, 224 (2), 287, 428, 563, 725, 816
Chicago, Cincinnati & Louisville, 59, 692
Chicago Great Western, 192, 193, 224, 692, 877
Chicago, Indiana & Southern, 127, 192, 529, 660
Chicago, Indianapolis & Louisville, 877
Chicago, Milwaukee & St. Paul, 59, 126, 497, 724, 947
Chicago, Rock Island & Gulf, 58, 90, 193, 597
Chicago, Rock Island & Pacific, 28 (2), 90, 125, 192 (2), 193, 377, 464 (2), 465, 497, 562, 563, 692, 757 (2)
Chicago, St. Paul, Minneapolis & Omaha, 192, 496, 659
Chicago Terminal Transfer, 597
Chicago, Ziegler & Gulf, 495, 497
Chihuahua & Pacific, 464, 724
Cincinnati & Muskingum Valley, 193
Cincinnati, Lebanon & Northern, 497
Cincinnati, New Orleans & Texas Pacific, 58, 127 (2), 192, 224, 287, 464, 465 (2)
Cincinnati Southern, 125
Cleveland, Akron & Columbus, 124, 126
Cleveland, Cincinnati, Chicago & St. Louis, 287, 464, 497, 876, 947
Coal & Coke, 59
Colombian Pacific, 255
Colorado & Southern, 59, 125, 496, 529
Colorado & Wyoming, 659
Colorado Midland, 947
Colorado Southern, New Orleans & Pacific, 59, 255, 497, 692, 876
Corvallis & Eastern, 946
Crystal River, 659
Cumberland Valley, 377, 530

Deepwater, 125
Delaware & Eastern, 124
Delaware & Hudson, 126, 287, 318, 376, 529, 562, 629, 692, 757, 875
Delaware, Lackawanna & Western, 255
Denver & Rio Grande, 28 (2), 59, 90, 287, 464, 529, 562, 816, 877, 947
Denver, Enid & Gulf, 192
Detroit & Toledo Short Line, 192
Detroit, Toledo & Ironton, 192, 255, 377, 497, 562, 659, 693, 757
Dublin & Southwestern, 659
Dunkirk, Allegheny Valley & Pittsburg, 92
Durham & Southern, 426, 497

East Tennessee & Western North Carolina, 659
Elmira & Eastern Transportation Co., 192
El Paso & Southwestern, 318, 464, 877
Erie, 28, 91, 92, 125, 127, 192, 193, 224, 256, 319, 425, 496, 497, 529, 562, 597, 629, 660 (3), 693, 724, 757, 817, 915, 916, 947 (2)

Flint River & Gulf, 876 (2)
Flint River & Northeastern, 192
Fonda, Johnstown & Gloversville, 124, 757
Fort Smith & Western, 496, 497
Fort Worth & Denver City, 193, 496, 597

Galveston, Beaumont & Northeastern, 192
Galveston, Harrisburg & San Antonio, 28, 59, 464, 496, 497
Galveston, Houston & Henderson, 125, 597
Georges Creek & Cumberland, 256
Georgia, Florida & Alabama, 125, 224, 287, 497, 660
Georgia Northern, 192
Georgia Railroad, 319
Georgia Southern & Florida, 59
Gila Valley, Globe & Northern, 660
Grand Rapids & Indiana, 124
Grand Trunk, 28, 59, 125, 127, 160, 192, 224, 464, 495, 496, 562, 597, 629, 660, 947
Grand Trunk Pacific, 529, 660
Great Northern, 28, 90, 318, 425, 464, 495, 563, 597, 692, 725, 757, 877
Gulf & Interstate, 318, 915 (2)
Gulf, Colorado & Santa Fe, 28, 59, 529, 877
Gulf, Opelousas & Northeastern, 629, 630

Halifax & Southwestern, 193
Hidalgo & Northeastern, 816, 947 (2)
Hocking Valley, 193, 496, 915
Houston & Shreveport, 464
Houston & Texas Central, 377, 464
Houston, East & Western Texas, 464

Illinois Central, 59, 90, 126, 127, 160 (2), 192, 193, 224 (2), 529, 562, 725, 876, 915
Illinois, Iowa & Minnesota, 255, 318 (2)
Illinois Valley Belt, 318
Interborough-Metropolitan Co., 124, 562
Interborough Rapid Transit, 124, 562, 946
Intercolonial, 496
International & Great Northern, 224 (2), 256, 597
Interoceanic of Mexico, 816, 947 (2)
Iowa Central, 947
Isthmian Canal Commission, 125, 287, 496, 877, 915, 947

Jackson & Northern, 660

Kalamazoo, Lake Shore & Chicago, 192
Kanawha & Michigan, 193, 496
Kansas City, Mexico & Orient, 877
Kansas City Southern, 125, 224, 377, 529, 562
Kentwood & Eastern, 318

Lake Erie & Western, 90, 92, 497
Lake Erie, Alliance & Wheeling, 92
Lake Shore & Michigan Southern, 59, 92, 224, 318, 660, 757, 816, 876
Las Vegas & Tonopah, 497
Lehigh & Hudson River, 59
Lehigh & New England, 425, 660
Lehigh Valley, 92, 160, 161, 425, 530, 724, 725
Licking River, 192 (2), 876
Litchfield & Madison, 496
Little Rock & Hot Springs Western, 160
Live Oak, Perry & Gulf, 876
Long Island, 125, 464
Loring & Western, 192
Louisiana & Northwest, 597
Louisiana Railway & Navigation Co., 496, 692
Louisville & Atlantic, 59
Louisville & Nashville, 90, 256, 319

Macon, Dublin & Savannah, 90
Maine Central, 597
Manhattan Elevated, 562
Manistee & Grand Rapids, 915
Manistee & North-Eastern, 816
Manistique, Marquette & Northern, 660
Marcellus & Otisco Lake, 287
Maricopa & Phœnix & Salt River Valley, 496, 497
Maryland, Delaware & Virginia, 59
Merchants' Despatch Transportation Co., 90
Mexican Central, 28, 59 (2), 224, 256, 425, 496, 497, 529 (2), 597, 660, 692, 725, 757 (2), 946
Mexican International, 724, 757, 816, 876, 947
Mexican Railway, 192, 319, 693
Michigan Central, 630, 660, 724, 816, 916
Midland Valley, 59, 125, 377
Minneapolis & Rainy River, 915
Minneapolis & St. Louis, 947
Minneapolis, St. Paul & Sault Ste Marie, 692
Mississippi Central, 127, 255, 497, 597, 629, 916
Mississippi River, Hamburg & Western, 497
Missouri & North Arkansas, 464, 497
Missouri, Kansas & Texas, 90, 224, 255, 256, 377, 425, 465, 630, 660, 817, 876
Missouri, Kansas & Texas of Texas, 126, 192, 529, 817, 876, 915
Missouri Pacific, 126, 192, 224 (2), 256, 376, 377, 425, 497, 597, 660, 817, 876
Mobile & Ohio, 58, 255, 319, 660
Mobile, Jackson & Kansas City, 27, 287 (2), 465, 529, 660 (2)
Montana Central, 28
Mt. Jewett, Kinzua & Riterville, 28

Napiersville Junction, 816
Nashville, Chattanooga & St. Louis, 91, 597
National Lines of Mexico, 817, 947 (2)
National R. R. of Mexico, 256, 597, 757, 947 (2)
Natural Bridge Railway, 318
Nevada Northern, 464
Nevada Railroad, 319
New Orleans & North Eastern, 255, 816
New Orleans, Fort Jackson & Grand Isle, 660
New Orleans Great Northern, 816
New Orleans Terminal, 255, 465
Newton & Northwestern, 660
New York & Ottawa, 876, 947
New York Central & Hudson River, 91, 127, 224, 318, 319, 425, 529, (2), 563, 597, 629, 630, 660, 693, 725, 817, 947 (2)
New York Central Lines, 725, 757
New York, Chicago & St. Louis, 28, 377
New York City Railway, 562
New York, New Haven & Hartford, 27, 28, 58, 90, 126, 224, 256, 318, 529, 597, 660, 692, 724, 757, 817 (2), 876, 877, 916
New York, Ontario & Western, 947
New York, Philadelphia & Norfolk, 464
New York State Railroad Commission, 255
Norfolk & Southern, 192, 193, 256, 465, 660
Norfolk & Western, 125, 318, 496, 816, 876 (2), 947
Northern Central, 58
Northern Pacific, 28, 92, 224, 377, 426, 496, 529, 530, 597, 630, 660, 693, 724, 725 (2), 817, 915 (2), 947
Northwestern Pacific, 160, 192, 287 (3), 288, 597

Ocilla & Valdosta, 562
Oklahoma Central, 497
Orange & Northwestern, 660
Oregon Railroad & Navigation, 192, 947
Oregon Short Line, 28, 59, 192, 193, 287, 318
Overton County, 90

Pacific & Idaho Northern, 126
Pacific Coast Co., 496
Panama Railroad, 529, 915
Pan-American, 192, 915
Peach River & Gulf, 693
Pecos System, 496
Pennsylvania, 28, 125, 161, 465, 496, 497 (2), 530, 629, 725, 817
Pennsylvania Company, 160, 224
Pennsylvania Eastern, 224
Pennsylvania Lines West, 28 (2), 58, 126, 160, 193, 224, 256, 496, 530
Pennsylvania, New York & Long Island, 496
Peoria & Pekin Terminal, 256
Philadelphia & Reading, 28, 496, 692
Philadelphia, Baltimore & Washington, 192, 496, 497
Phœnix & Eastern, 660
Pittsburg & Lake Erie, 192, 318
Pittsburg, Binghamton & Eastern, 562, 692
Pittsburg, Chartiers & Youghiogheny, 318
Pittsburg, Cincinnati, Chicago & St. Louis, 160
Pittsburg, Westmoreland & Somerset, 660
Pittsburg, Wheeling & Kentucky, 496, 692
Portland & Rumford Falls, 193
Portland & Seattle, 529
Pullman Company, 377, 496, 498

Quincy, Omaha & Kansas City, 192

Raleigh & Charleston, 125
Richmond, Fredericksburg & Potomac, 877
Rio Grande Junction, 192
Rio Grande, Sierra Madre & Pacific, 496, 757
Rio Grande Southern, 660
Rio Grande Western, 465, 529, 947
Rock Island, Arkansas & Louisiana, 90
Rock Island Company, 255, 816, 876
Rock Island Lines, 90
Rutland Railroad, 426, 497, 530

St. Joseph & Grand Island, 562, 816
St. Louis & San Francisco, 28, 127, 255, 496, 757 (3), 816, 915, 947
St. Louis, Brownsville & Mexico, 877
St. Louis, El Reno & Western, 496
St. Louis, Iron Mountain & Southern, 28, 947
St. Louis Southwestern, 287, 465
St. Louis, Watkins & Gulf, 497
St. Paul Union Depot, 529
San Antonio & Aransas Pass, 127
San Pedro, Los Angeles & Salt Lake, 630, 693.
San Pete Valley, 915
Santa Fe Central, 193
Santa Fe, Prescott & Phœnix, 59 (2), 376, 377
Savannah & Statesboro, 192
Seaboard Air Line, 90, 127, 192, 256, 287 (2), 318, 377, 426, 529, 660
Sierra of California, 876
Sonora Railway, 126, 318
South & Western, 192, 426
South Buffalo, 92
Southern, 28, 90, 192, 224, 287, 318, 319, 426, 496, 497, 530, 563, 629, 817, 876
Southern Pacific, 59, 126, 161, 193, 224, 287, 288 (2), 497, 529, 530, 562, 563, 629, 630, 692, 816, 877, 915

Tacoma Eastern, 192
Tavares & Gulf, 287, 464
Tehuantepec National, 28, 59, 529, 660, 693, 757, 816, 916
Temiskaming & Northern Ontario, 90, 160
Texarkana & Fort Smith, 660
Texas & Gulf, 529
Texas & Pacific, 425, 497, 629, 693
Tidewater, 126, 563
Toledo & Ohio Central, 193, 497, 724
Toledo, St. Louis & Western, 877
Tonopah & Goldfield, 757
Tonopah & Tidewater, 256, 319
Tremont & Gulf, 192, 193
Trinity & Brazos Valley, 126, 192, 256, 496, 497, 725 (2), 817

Union Pacific, 28, 59, 91, 92, 126, 160, 192 (2), 193, 288, 529, 725, 757, 817

Vandalia, 90, 126, 160, 693
Vera Cruz & Pacific, 193 (2), 816
Versailles & Sedalia, 725

Wabash, 756
Warren & Ouachita Valley, 692
Washington & Columbia River, 915
Washington, Idaho & Montana, 877
Washington Terminal Co., 877
West Virginia, 97
Western & Atlantic, 947
Western Maryland, 256, 425, 496, 817, 877
Western Pacific, 287, 318
Wheeling & Lake Erie, 127, 160, 161, 757
Wichita Falls Railway, 877
Wichita Valley, 496, 877 (2)
Williamsville, Greenville & St. Louis, 660
Wilmar & Sioux Falls, 28
Wiscasset, Waterville & Farmington, 125
Wisconsin & Northern, 256
Wisconsin Central, 193 (2), 630 (2), 660 (2)
Wrightsville & Tennille, 660

Yazoo & Mississippi Valley, 28, 529, 817, 877

Zanesville & Western, 193

RAILROAD CONSTRUCTION.

[*Maps are indicated thus**.]

Abilene & Northern, 93
Abitibi & Hudson Bay, 598
Alabama Northwestern, 466
Alabama Terminal, 531
Alabama Western, 196
Alaska Central, 564
Alaska Railroads, 226
Altoona & Logan Valley (Electric), 195
American-Mexican, 29
American Railroad of Porto Rico, 60, 531
Anderson & Saline River, 93
Antoine Valley, 759
Apalachicola Northern, 60
Appomattox & Charlotte, 93
Arizona & Colorado, 29
Arizona, New Mexico & Colorado, 427
Arizona Roads, 759
Arkansas Central, 226
Arkansas, Louisiana & Gulf, 94, 598
Arkansas, Oklahoma & Western, 320
Arkansas Pacific, 94
Arkansas Valley, 60
Asheville & Henderson, 499, 598
Astoria & Columbia River, 60, 631
Atchison, Topeka & Santa Fe, 29, 60, 195, 226, 320, 466, 499, 598, 662, 878, 948
Atchison, Topeka & Santa Fe (Coast Lines), 662, 759
Athabasca Railroad, 196, 226
Atlanta & St. Andrews Bay, 195
Atlanta, Birmingham & Atlantic, 29, 162, 564
Atlanta, Stone Mountain & Lithonia, 499
Atlantic & Lake Superior, 948
Atlantic & North Carolina, 195
Atlantic & Western, 60
Atlantic, Northern & Southern, 226, 320, 726
Atlantic, Quebec & Western, 948
Au Sable & North-Western, 320
Auburn, Mechanics Falls & Norway (Electric), 466

Bakersfield & Ventura, 878
Baltimore & Ohio, 289, 531, 759, 948
Baltimore & Ohio Southwestern, 727
Bangor & Aroostock, 427
Barker & Clark's Gap, 564
Barnwell & Searchlight, 598
Baton Rouge, Hammond & Eastern, 598, 727, 878
Bay Shore Railway, 61
Beaumont & Great Northern, 29
Beaumont & Saratoga Transportation Company, 60
Bessemer & Lake Erie, 631, 662, 727
Big Fork & International Falls, 917
Biloxi Great Northern, 949
Birmingham, Columbus & St. Andrews Bay, 61
Black Mountain, 128
Blaney & Southern, 631
Bloomington Belt Traction, 258
Blue Valley, 662
Bonnerville & Southwestern, 61
Boston & Albany, 289, 320
Boston & Maine, 195, 466
Boston & Providence Interurban, 759
Boston Elevated, 662
Boston Subways, 162
Bostwick, 819
Brandon & Laurel, 320, 564
Brazos Valley, Brenham & Gulf, 598, 878
Brooklyn, N. Y., Roads, 226
Brooklyn Rapid Transit, 564, 917
Brownsville, Masontown & Smithfield (Electric), 29
Brunswick & Middletown, 531
Buffalo & Depew (Electric), 949
Buffalo & Lake Erie Traction, 128
Buffalo & Susquehanna, 162, 289
Buffalo Creek & Gauley, 128, 226
Buffalo, Genesee & Rochester (Electric), 759, 949
Buffalo, Rochester & Eastern, 631
Buffalo, Rochester & Pittsburg, 258
Bullfrog-Goldfield, 878
Burrs Ferry, Browndel & Chester, 128, 289, 694

Cache Valley, 61
Cairo & Tennessee River, 878
Cairo & Thebes, 694
California Midland, 466
California Northeastern, 61
Canadian Northern, 195, 289, 466, 499, 531
Canadian Northern Quebec, 258
Canadian Pacific, 61, 162, 195, 466, 564, 598, 662, 727, 759, 917, 949
Canadian River, 94
Cananea, Yaqui River & Pacific, 61, 694, 878
Canyon City & Royal Gorge, 321
Carlyle & St. Louis, 598
Central & Southeastern, 195
Central California Traction, 258
Central of Georgia, 226
Central Ontario, 29
Central Railway of Oregon, 61, 467
Centralia & Sandoval (Electric), 949
Chandler & Shawnee, 427
Charlotte Harbor & Northern, 61
Chattanooga, Waycross & Jacksonville, 467
Chenango Valley (Electric), 663
Chesapeake & Ohio, 694
Chesterfield & Lancaster, 61, 321
Chester, Perryville & Ste. Genevieve, 195
Chewahwah Valley, 29
Chicago & Eastern Illinois, 663
Chicago & North-Western, 321, 531, 878
Chicago, Burlington & Quincy, 162, 321, 467
Chicago, Cincinnati & Louisville, 499
Chicago City Railway, 564, 664
Chicago, Indianapolis & Evansville, 878
Chicago, Lake Shore & South Bend (Electric), 162, 427
Chicago, Milwaukee & Gary, 663
Chicago, Milwaukee & St. Paul, 499
Chicago, Ottawa & Peoria, 631, 819
Chicago, Rock Island & Gulf, 29
Chicago, Rock Island & Pacific, 61
Chicago, South Bend & Northern Indiana (Electric), 226
Chicago Union Traction, 694
Choctaw, Newcastle & Western, 226
Cimarron & Northwestern, 226, 631
Cincinnati & Birmingham Air Line, 61, 162
Cincinnati, Bluffton & Chicago, 289
Cincinnati, Georgetown & Portsmouth (Electric), 94
Cincinnati Intersecting, 467
Cincinnati, Toledo & Detroit Short Line, 321
Clear Fork & Oceana, 564
Clear Lake & Southern, 94
Cleveland & Sharon Traction, 467
Cleveland, Brooklyn & Elyria (Electric), 599
Cleveland, Cincinnati, Chicago & St. Louis, 29, 599, 878
Coal River, 30
Coalinville, Alton & St. Louis, 61
Coast Line Railway, 61
Colorado & Southern, 94, 599
Colorado, Columbus & Mexican, 61
Colorado, Oklahoma & Gulf, 499
Colorado Roads (Electric), 631, 759
Colorado, Texas & Mexico, 61, 599
Columbia, Kenton & Lima (Electric), 631
Columbia River, Outlook & Northwestern, 289
Columbus, Urbana & Western, 631
Connecticut Roads (Electric), 226
Consolidated Railway (N. Y., N. H. & H.), 467
Copper River & Northwestern, 599
Corbin & Nashville, 499
Corvallis & Eastern, 94
Council City & Solomon River, 30
Cullman Southwestern, 289
Cumberland River & Nashville, 61, 564

Danville & Mt. Morris, 94
Davenport & Burlington Interurban, 467
Dayton, Lebanon & Cincinnati, 599
Deepwater, 30
Delaware & Hudson, 94, 258, 819
Delaware, Megantic Springs & Northern, 631
Denison, Bonham & New Orleans, 695
Denver & Gulf, 663
Denver & Rio Grande, 531, 599
Denver City Tramway, 258
Denver, Enid & Gulf, 321
Denver, Laramie & Northwestern, 499
Denver, Northwestern & Pacific, 30, 226
Detroit Terminal, 917
Doniphan, Kensett & Searcy, 61
Douglas & Coos (Electric), 917
Due West, 819
Duluth & Iron Range, 499
Duluth & Northern Minnesota, 61, 599
Duluth, Missabe & Northern, 30
Duluth, Rainy Lake & Winnipeg, 61, 128, 195

East St. Louis & Suburban, 599
Eastern Sierra & Pacific, 128
Eastern Tennessee & Western North Carolina, 94
Eddy Lake & Northern, 61
Eldorado & Wesson, 94, 258, 917
Elk Valley & Oneida, 427
Elkin & Allegheny, 949
El Paso & Southwestern, 467
El Reno, Oklahoma & Shawnee, 663
Erie, 258, 467, 599, 759, 917
Erie & Jersey, 467, 759
Erie Terminal, 258
Eureka Hill, 695

Fairchild & Northeastern, 499
Fallon Railway, 61
Florida East Coast, 226
Franklin & Clearfield, 94
Frederick & Middletown (Electric), 949
Frederick Interurban (Md.), 949
Fredericksburg Terminal, 727
Freeo Valley, 162
Frio Valley, 727, 917
Front Royal, Rappahannock & Tidewater, 162

Galveston & Houston (Electric), 599
Galveston Terminal Company, 128, 531
Genesee River, 467, 917
Geneva, Phelps & Newark (Electric), 128
Georgia & Florida, 695
Georgia Coast & Piedmont, 94
Georgia, Florida & Alabama, 61
Georgia Roads, 467
Gila Valley, 61
Glenfield & Western, 819
Glenville & Kanawha, 94
Gotebo & Southwestern, 695
Grand Rapids Terminal Belt, 258, 878
Grand Trunk, 128, 499, 531, 917
Grand Trunk Pacific, 61, 162, 226, 289, 467, 564, 663, 695, 727, 819, 917, 949
Gray's Harbor & Puget Sound, 162
Great Northern, 258, 564, 878
Great Southern, 227
Great West, 562
Green Bay, Oshkosh, Madison & South-Western, 258
Greensboro, Seaboard & Great Western, 599
Greensburg & Western (Electric), 227
Greenville & Knoxville, 727
Greenville & Newman, 227
Greenville, Elizabeth & Wolf's Mill, 695
Greenwich & Johnsonville, 128
Gulf & Northwestern, 94
Gulf, Beaumont & Great Northern, 565
Gulf, Beaumont & Kansas City, 565
Gulf, Brownwood & Cisco, 128
Gulf, Colorado & Santa Fe, 128, 565, 878
Gulf, Hutchinson & Northwestern, 94
Gulf Line, 819
Gurdon & Fort Smith Northern Railway, 227

Halifax & Southwestern, 195
Hamilton & Northern, 599
Harbor Springs, 128
Hidalgo & North Eastern, 599
Hoboken & Manhattan, 227
Hoboken Manufacturers' Railroad, 727
Hornell & Dansville, 819
Hornell, Bath & Lake Keuka (Electric), 949
Hudson & Manhattan, 227, 917
Hudson Bay Pacific, 949
Huron & Ontario (Electric), 467

Idaho, 663
Idaho & Wyoming, 917
Illinois & Fox River Central, 727
Illinois Central, 195, 499, 695, 878
Illinois, Indiana & Gary, 663
Illinois, Iowa & Minnesota, 467, 663
Illinois Traction, 531, 663
Ilwaco Railroad, 727
Ilwaco Railway & Navigation, 61
Imperial Valley, 878
Indiana Roads (Electric), 663
Indianapolis, Crawfordsville & Western Traction, 759
Indianapolis, Logansport & Chicago, 128, 663
Indianapolis, Huntington, Columbia & North-Western, 289
Interborough Rapid Transit Company, 917
Inter-California, 61
Intercolonial, 195, 663
International Traction, 427
International of New Brunswick, 163
Ithaca & Seneca Falls Interurban, 258
Ithaca-Owego, 819

Jasper & Eastern, 128, 878
Jefferson & Braddock Heights Company (Electric), 949
Johnson City Southern, 128
Joplin & Pittsburg, 949

Kalamazoo, Lake Shore & Chicago, 949
Kanawha & West Virginia, 227, 695
Kansas City & Springfield Southern, 163
Kansas City, Lawton & Pacific, 94
Kansas City, Mexico & Orient, 30, 663, 949
Kansas City, Oklahoma & Gulf, 531
Kansas City Southern, 258, 917
Kansas Traction, 759
Kentucky & Tennessee, 163
Kentucky Highlands, 565
Kentucky Midland, 94
Kentucky North & South, 94, 917
Keweenaw Central, 917

Lake Champlain & Lake Placid Traction, 599
Lake Charles & Northern, 467
Lake Charles & Southern, 878
Lake Erie & Pittsburg, 163, 227
Lake Erie & Youngstown, 531
Lake Erie, Fremont & Southern (Electric), 819
Lake Shore & Michigan Southern, 94, 163
Las Vegas & Tonopah, 94
Lawton, Wichita Falls & Northwestern, 727
Leetonia Railway, 759
Lewiston & Southeastern (Electric), 227
Lewiston, Augusta & Waterville (Electric), 565
Lima, Kenton & Marion, 631
Little Kanawha, 321
Live Oak, Perry & Gulf, 94
Long Island, 227, 531, 759, 819
Lorain & Ashland, 94
Lorain & West Virginia, 727
Lotbiniere & Megantic, 94
Louisiana & Arkansas, 30, 227
Louisiana & Pacific, 878
Louisiana East & West, 94, 663
Louisiana Railway & Navigation, 321, 565
Louisiana Roads, 467
Louisville & Great Western Traction, 227
Louisville & Nashville, 30, 289, 727, 878, 949
Lynchburg Belt Line & Connecting Railway, 759

McCloud River, 61
Macon, Americus & Albany (Electric), 565
Maine Roads (Electric), 467
Mangham & Northwestern, 94
Manila & South-Western, 227
Manila Railroad, 663
Manufacturers' Railway, 599, 663
Manufacturers' Terminal, 531
Marengo & Midland (Electric), 467
Mascoutah & Belleville, 163
Memphis & Gulf, 727
Memphis & State, 499
Memphis, Covington & Northern, 499
Memphis Railroad Terminal, 427
Memphis Terminal, 565
Messabe Southern, 94
Mexican Central, 289, 599, 631
Mexican International, 321
Mexican National, 128
Mexican Roads, 290, 599, 631, 663, 759
Mexico, Ferry & Santa Fe Traction, 663, 727
Middletown & Cecilton, 227
Midland Valley, 599
Milwaukee & Northern (Electric), 949
Milwaukee & Rockford, 663
Mineola, Roslyn & Port Washington Traction, 467
Minidoka & Southwestern, 30
Minneapolis & Rainy River, 30
Minneapolis, St. Paul & Sault Ste. Marie, 427, 631
Minnesota & International, 917

RAILROAD CONSTRUCTION—Continued.

[Maps are indicated thus.]*

Mississippi & Alabama, 195
Mississippi Central, 695
Mississippi River & Bonne Terre, 878
Mississippi Roads, 321, 427
Mississippi Southern, 499
Missouri & North Arkansas, 163, 917
Missouri, Arkansas & Southwestern, 531
Missouri, Kansas & Texas, 759
Missouri, Oklahoma & Gulf, 878
Missouri Pacific, 227, 258, 531, 599, 695, 878, 917
Missouri, Tennessee & Georgia, 599, 663
Mobile & Western, 163
Mobile, Jackson & Kansas City, 467, 663
Moncton, N. B., 195
Mono Lake, 467
Montana Railroads, 467
Monterey, Fresno & Eastern, 631
Morehead & North Fork, 163, 227
Morganfield & Atlanta, 727
Morgantown & Kingwood, 695
Mount Hood Railway & Power Company, 878

Napa & Vaca Valley, 258
Napierville Junction, 819
Nashville & Columbia (Electric), 427
Nashville Interurban, 599
Natchez, Columbia & Mobile, 94
Natchitoches East & West, 565
National Lines of Mexico, 759
National of Mexico, 599
Naugatuck Valley (Electric), 227
Nebraska, Kansas & Southwestern, 227
Nevada Roads, 727
New Jersey Short Line (Electric), 258
New Iberia, St. Martinsville & Northern, 565
New London & East Lynne Street Railway, 128
New Orleans Great Northern, 695, 879
New Park & Fawn Grove, 879
New River, Holston & Western, 163
New York & Jersey, 227
New York & Pennsylvania Traction, 565
New York & Pittsburg Air Line, 427
New York, Auburn & Lansing, 94, 227
New York Central & Hudson River, 321, 427, 759
New York, Chicago & St. Louis, 30
New York City Roads, 163
New York Roads, 819
New York City Subways, 917
New York City Tunnels, 727, 759
New York Connecting, 259
New York, New Haven & Hartford, 128, 427, 467
New York Northern (Electric), 259
New York Subways, 467, 531, 599, 632, 695, 727, 819
Niagara Peninsula, 321
Niagara, St. Catharines & Toronto, 61, 917
Norfolk & Southern, 195, 427, 499
Norfolk & Western, 163, 565, 759
North & South Texas, 94
North Alabama, 30
North Coast, 599
North Dakota, 427
North Louisiana, 427
North New Mexico & Gulf, 129
North Shore, 290
Northern Empire, 819, 949
Northern of Maine, 321
Northern Pacific, 917
Northwestern Pacific, 195, 565

Ocean & Northern, 467
Ocean Shore, 290, 321
Ocean Shore & Eastern, 321
Ohio & Pacific Belt, 819
Oklahoma & Golden City, 468
Oklahoma & Texas, 632
Oklahoma Central, 94
Oklahoma City Rapid Transit, 565
Oklahoma Empire, 819
Oklahoma, Texas & Western, 427
Omaha & Nebraska Central (Electric), 227
Opelousas, Gulf & Northeastern, 163, 565
Oregon & Eureka, 30
Oregon & Southeastern, 94, 531
Oregon & Washington, 321
Oregon Eastern, 259, 290
Oregon Electric, 259
Oregon Railroad & Navigation, 61, 321, 499, 695, 727
Oregon Roads, 468
Oregon Short Line, 30, 94, 259, 879, 917
Oregon Western, 61
Orford Mountain, 30, 195, 468
Orrville, Doyleston & Barberton (Electric), 599
Owen Sound & Meaford, 663
Owensboro & Rockport Terminal & Bridge Co., 468, 727

Pachuca, Zomapan & Tampico, 565
Pacific, Omineca & Northern, 663
Pacific Railway & Navigation, 632, 879
Paducah Southern, 227
Pan-American, 663, 917
Panhandle Electric & Power Company, 917
Panhandle Short Line, 565
Parral & Durango, 531
Pearl River Valley, 565, 599
Peninsular, 599, 727
Penn Eastern, 819
Pennsylvania, 195, 259, 321, 427, 499, 599, 632, 695, 759
Pennsylvania Lines West, 727
Pennsylvania, New York & Long Island, 427
Pennsylvania System, 427
Pensacola & Northeastern, 531
Pensacola, Alabama & Tennessee, 695
Pensacola, Alabama & Western, 531, 949
Perkiomen Traction,
Perla Northern, 949
Philadelphia & Reading, 565, 663
Philadelphia & Westchester Traction, 695
Philadelphia & Western, 663
Philadelphia, Norristown & Northern, 290, 321
Philadelphia Rapid Transit, 428
Philipsburg Railroad, 129
Pike-Little Creek, 663
Pine Bluff North & South, 759
Pine Mountain, 30
Pittsburg & Lake Erie, 129, 499
Pittsburg, Cincinnati, Chicago & St. Louis, 728
Pittsburg, Johnstown, Ebensburg & Eastern, 428
Pittsburg, Summerville & Clarion, 259
Plant City, Arcadia & Gulf, 30
Plum Valley Railway, 531, 695
Pontiac Central, 163, 321
Portage Bay & Cobalt, 428
Portland & Rumford Falls Railway, 566
Portland & Rumford Falls, 321, 468, 565
Portland Eastern, 879
Portland Terminal, 61
Poughkeepsie & Eastern, 468
Pound Gap-Elkhorn, 94
Powells Valley, 94
Prescott & Northwestern, 61, 879
Pullman, La Crosse & Columbia River (Electric), 917
Puyallup Valley Northern Rapid Transit, 290

Quebec & James Bay, 259
Quebec & Lake Champlain, 428
Quebec & Lake St. John, 259
Quicksand-Hyden, 819,

Raleigh & Pamlico Sound, 195
Raleigh & Southwestern, 695
Raleigh & Western, 163
Ragmondville & Waddington, 321
Richmond & Chesapeake Bay (Electric), 129
Richmond & Hamilton Interurban, 468
Rio Grande, Sierra Madre & Pacific, 195, 819
Riverside & Gulf, 728
Rockford Belt, 663
Rockingham & Caswell, 532
Rock Island, Arkansas & Louisiana, 61
Rockwood & Bakersville, 819
Rocky Ridge, 599, 663
Rogers Southwestern, 129
Rumford Falls & Rangeley Lakes Railroad, 566
Russell Fork, 663

St. Joseph & Nodaway Valley, 949
St. Joseph Valley Traction, 290
St. Louis & Illinois Belt, 663
St. Louis & Oklahoma Southern, 259, 499
St. Louis & San Francisco, 129, 499, 599, 949
St. Louis, Bartlesville & Pacific, 259
St. Louis Belt & Terminal, 94
St. Louis, Brownsville & Mexico, 819
St. Louis Electric Terminal, 532
St. Louis, Hillsboro & Southern (Electric), 321
St. Louis, Iron Mountain & Southern, 499
St. Louis, Rocky Mountain & Pacific, 30, 196, 499, 632
St. Louis Southwestern, 819
St. Louis Southwestern Railway of Texas, 321
St. Louis, Springfield & Oklahoma, 695
St. Louis, Springfield & Oklahoma Western, 321, 499
St. Louis, Terre Haute & Quincy Traction, 632
St. Louis, Vandalia, Terre Haute & Eastern Traction, 129
St. Mary's & Kingland, 819
St. Mary's & Western Ontario, 227, 468
St. Paul Terminal, 428
Saline Valley, 600
Sandusky, Fremont & Southern, 532
San Joaquin Valley Western, 321
San Juan de Oaxaca, 259
Sebasticook & Moosehead, 290
Sacramento & Vallejo, 227
Sacramento Southern, 61
Salt Lake & Ogden, 94
Salvatierra & Western, 949
San Diego & Arizona, 94
San Diego Eastern, 94
Santa Fe Liberal & Englewood, 95
Santa Fe, Raton & Des Moines, 95
Santa Fe, Raton & Eastern, 95
Saratoga & Encampment, 728
Saskatchewan Central, 566
Saskatchewan Valley & Hudson's Bay, 195, 227
Savannah & Southwestern, 566, 695, 728
Savannah, Augusta & Northern, 129, 917
Seaboard Air Line, 195, 468, 532
Seward Peninsula, 228
Shawnee Central, 759
Sheboygan Heat, Light & Traction Company, 949
Shelby Long Fork, 95
Sherbrooke & Quebec, 195
Shreveport, Alexandria & Southwestern System, 879
Shreveport Northeastern, 259
Sibley Lake, Bisteneau & Southern, 95
Sierra Madre & Pacific, 195, 819
Sierra Pacific, 129
Somerset, 428
Sonora Railway, 195
South & Western, 163, 428, 728
South Carolina Public Service Corporation, 228
South Dakota Central, 62, 663
South Texas Gulf, 321
South Wilmington & Southern, 228
Southern, 30, 129, 468, 499, 566, 632, 695, 879
Southern Development Company, 760
Southern Kansas of Texas, 663
Southern Pacific, 62, 195, 259, 290, 468, 695, 819
Southwest Railway, 568
Spokane & Inland, 321, 695
Spokane & Inland Empire, 290
Spokane Falls & Northern, 290
Spokane International, 879
Springfield, Beardstown & Quincy (Electric), 819
Springfield, Clear Lake & Rochester (Electric), 95
Springfield Southwestern, 228, 695
Stephensville, North & South Texas, 259
Steuben Traction Company, 163
Stewartstown, 879
Suffern Railroad, 600
Susquehanna (Electric), 695
Susquehanna & New York, 600, 819
Syracuse & Chittenango (Electric), 664

Tampa Northern, 95
Taylor, Brenham & Houston, 321
Tecumseh-Norman Traction, 163
Temiskaming & Northern Ontario, 30, 163, 259, 468, 600, 695
Tennessee & North Carolina, 95, 600, 663
Tennessee Coalfields & South Atlantic Transcontinental, 322
Tennessee Railway, 95
Tennessee Roads, 322
Terre Haute-Merom Traction, 879, 949
Texas & Gulf, 566,
Texas & Pacific, 566, 663
Texas Central, 949
Texas Railroad, 499
Texas Roads, 259, 290
Texas Southeastern, 95
Texas State, 428, 600
Texas Traction, 428
Tidewater, 30
Tidewater Development Company (Electric), 428
Toledo & Defiance, 428
Toledo & Indiana, 600, 664
Toledo & Ohio Central, 728
Toledo, St. Louis & New Orleans, 500
Toledo, Wabash & St. Louis (Electric), 500, 532, 760
Tonopah & Goldfield, 468, 760
Tonopah & Greenwater, 290
Topeka-Southwestern, 500
Toronto, Niagara & Western, 228
Trinity & Brazos Valley, 129

Umatillo Central, 62
Union Pacific, 95, 468, 819, 879
Utica Southern (Electric), 129

Vancouver Railroad, 632
Vancouver, Victoria & Eastern, 259
Vandalia, 195, 820
Velasco, Brazos & Northern, 532
Virden & Taylorville Traction, 566
Virginia & Carolina Coast, 195
Virginia & Southwestern, 129
Virginia-Carolina, 322
Virginia Northern, 500

Wabash, 259, 468, 500, 728
Wabee & Wawasee, 322
Wagner, Lake Shore & Armour, 664, 760
Walsenburg & Western, 428
Washington, Idaho & Montana, 30
Washington Roads (Electric), 949
Washington, Westminster & Gettysburg, 129
Waterloo, Perla & Southwestern, 879
Waupaca & Green Bay, 228
Waynesburg & Monongahela, 879
West End Terminal, 664
West Point Railway (Electric), 228
West Shore Traction, 500
West Virginia Connecting, 566
Western Allegheny, 632, 664, 695, 728
Western Oklahoma, 949
Western Pacific, 30, 129, 259, 566
Wheeling & Lake Erie, 760
Wichita Falls & Northwestern, 728, 879
Williamsburg & Iowa City (Electric), 500
Winnipeg & Lakes (Electric), 196
Winnipeg & Northwestern, 163, 196, 322, 566
Wiscasset, Waterville & Farmington, 428
Wisconsin & Northern, 30, 259
Wisconsin Central, 95
Wisconsin Valley (Electric), 322
Wolcottville & Coldwater, 600, 664
Wolf, Megantic & Lotbiniere, 259
Woodville, 820
Wyandotte & Lawrence, 468

Yankton Southern, 917
Yellowstone Park, 30, 566, 879
York County Traction Company, 879
Yosemite Valley, 228
Youngstown & Ohio River, 129, 228

RAILROAD CORPORATION NEWS.

Alabama Central, 163
Alabama Great Southern, 259
Alexander & Eastern, 95
Alexander & Rich Mountain, 95
Astoria & Columbia River, 129
Atchison, Topeka & Santa Fe, 62, 95, 129, 163, 290 428, 500, 600, 632
Atlanta, Birmingham & Atlantic, 163, 879
Atlantic City & Suburban Traction, 695
Atlantic Coast Line, 62, 129, 322
Augusta, Winthrop & Gardiner Street Railway, 728

Baltimore & Ohio, 62, 129, 290, 532, 566, 664, 918
Bangor & Aroostook, 468, 949
Bay Shore Terminal, 228
Belvidere Delaware, 500
Bennington & North Adams (Electric), 129
Bennettsville & Cheraw, 428
Birmingham Terminal Co., 259
Boston & Maine, 95, 224, 532, 696, 820, 879, 949
Boston & Philadelphia Steamship Co., 468
Boston Elevated, 566
Boston, Revere Beach & Lynn, 918
Brooklyn Heights Railroad, 322
Brooklyn Rapid Transit, 322, 664, 728
Brooklyn Union Elevated, 322
Buffalo & Lake Erie Traction, 322
Buffalo & Susquehanna, 196, 224, 532, 949
Buffalo, Rochester & Pittsburg, 532, 600, 880

California Northwestern, 95
Canada Coal & Railroad Co., 918
Canadian Northern, 322, 728
Canadian Northern Quebec, 500
Canadian Pacific, 163, 224, 500
Cape Breton Coal, Iron & Railway Co., 129
Catskill Electric Railway, 378
Central of Georgia, 163, 259, 950
Central New England, 259, 950
Central Vermont, 532
Chartiers Railway, 224
Chateaugay & Lake Placid, 62
Chattanooga Southern, 632
Chesapeake & Ohio, 196, 632, 918, 950
Chesterfield & Lancaster, 428
Chicago & Alton, 129, 290, 820, 918
Chicago & Eastern Illinois, 950
Chicago & Milwaukee Electric, 322
Chicago & North-Western, 62, 95
Chicago & Western Indiana, 129
Chicago, Cincinnati & Louisville, 290
Chicago City Railway, 500, 880, 918
Chicago Great Western, 428, 728, 760
Chicago, Indiana & Eastern, 696
Chicago, Indiana & Southern, 950
Chicago, Indianapolis & Evansville, 950
Chicago Junction Railway, 820, 950
Chicago, Kalamazoo & Saginaw, 30
Chicago, Lake Shore & Eastern, 664
Chicago, Milwaukee & St. Paul, 62, 163, 664, 728
Chicago, Rock Island & Pacific, 30, 163, 196, 290, 378, 428, 760, 918
Chicago, South Bend & Northern Indiana (Electric), 163, 196
Chicago Southern, 600
Chicago Subway, 918
Chicago Terminal Transfer, 290, 428, 500, 566, 664
Chicago Union Traction, 500
Cincinnati, Hamilton & Dayton, 95, 290, 918, 950
Cincinnati, New Orleans & Texas Pacific, 196
Cleveland, Cincinnati, Chicago & St. Louis, 129, 224, 728
Cleveland, Southwestern & Columbus (Electric), 378, 566
Colorado & Northwestern, 918
Colorado & Southern, 196, 260, 290
Colorado Southern, New Orleans & Pacific, 322
Coney Island & Brooklyn (Electric), 664
Connecticut Railway & Lighting Co., 820
Consolidated Railway, 129, 632, 820
Cornwall & Lebanon, 163
Corvallis & Eastern, 322, 918

Dayton, Lebanon & Cincinnati (Electric), 600, 918
Deepwater Railway, 468
Delaware & Eastern, 566, 600
Delaware & Hudson, 30, 62, 95, 224, 428, 696, 728, 760
Delaware, Lackawanna & Western, 260
Denver & Rio Grande, 632
Detroit, Jackson & Chicago (Electric), 260
Detroit United (Electric), 196, 260, 880
Dutchess County Railway, 950

Erie, 62, 129, 196, 468, 500, 532, 728, 820, 880, 918, 950
Erie & Jersey, 820
Eureka & Klamath River, 95
Evansville & Southern Indiana Traction, 129, 224

Fitchburg, 918
Fitzgerald, Ocilla & Broxton, 918
Flint River & Gulf, 760
Fort Dodge, Des Moines & Southern (Electric), 130

Gainesville & Gulf, 532
Galveston, Harrisburg & San Antonio, 500
Genesee River Railroad, 880, 918
George's Creek & Cumberland, 130
Georgia Railway & Electric, 500
Grand Rapids & Indiana, 600
Grand Trunk, 532, 566, 728
Great Northern, 62, 130, 163, 224, 378, 500, 880
Green Bay & Western, 164
Greenwich & Johnsonville, 428
Gulf & Ship Island, 196
Gulf, Beaumont & Kansas City, 566
Gulf, Beaumont & Great Northern, 566
Gulf, Colorado & Santa Fe, 566
Gulf Line Railway, 760

Havana Central (Electric), 664
Havana Electric Railway, 378
Hawkinsville & Florida Southern, 760
Henderson City Railway, 322
Henderson Traction, 322
Hocking Valley, 62, 163, 290, 322, 728
Houston & Brazos Valley, 532
Houston & Texas Central, 532
Hudson & Manhattan, 164
Hudson Valley (Electric), 62

Illinois Central, 62, 95, 260, 290, 820
Indiana Harbor (Belt) 820, 950
Interborough-Metropolitan, 728
Interborough Rapid Transit, 260
Interstate Railways Co., 164

Jackson Consolidated Traction, 728
Jamestown, Chautauqua & Lake Erie, 322
Joliet & Northern Indiana, 880

Kalamazoo, Lake Shore & Chicago, 566
Kanawha & Michigan, 62, 290, 322, 728, 880
Kansas City, Mexico & Orient, 468
Kansas City Southern, 164, 290, 468, 500, 728, 950

Lake Shore & Michigan Southern, 164, 950
Lake Shore Electric, 880
Lehigh Valley, 95, 164, 880, 918
Lehigh Valley of New York, 880
Lewiston, Augusta & Waterville Street Railway, 728
Lewiston, Brunswick & Bath Street Railway, 728
Little Miami, 96
Long Island, 600, 950
Louisville & Nashville, 196, 322, 632, 820
Louisville Railway Co., 820

Mt. Mansfield (Electric), 500
Macon, Dublin & Savannah, 62, 130
Maine Central, 532, 664
Maine Steamship Co., 164
Manila Electric Railroad & Lighting, 260
Manila Suburban Railways Co., 260
Maritime Coal, Railway & Power Co., 918
Maryland Electric, 918
Merchants' & Miners' Transportation Co., 378, 468, 664
Metropolitan West Side Elevated (Chicago), 164
Mexican Central, 696
Mexican Railway, 30, 760
Mexican Southern, 760
Michigan Central, 164, 880
Michigan United (Electric), 728
Milwaukee Electric Railway & Light Co., 322
Minneapolis, St. Paul and Sault Ste. Marie, 130, 196, 224
Missouri & Kansas Interurban, 260
Missouri, Kansas & Texas, 428, 760, 950
Missouri, Oklahoma & Gulf, 880
Missouri Pacific, 566
Missouri River & Northwestern, 260
Mobile & Ohio, 30, 196, 632, 820
Mobile, Jackson & Kansas City, 30, 96, 196
Mohawk Valley, 950

Nantucket Central, 950
Napiersville Junction, 428
Nashville, Chattanooga & Louisville, 62, 196
National of Mexico, 196, 696
Natural Bridge Railway, 322
Newburg, Dutchess & Connecticut, 950
New England Investment & Security, 632, 918
New England Navigation Co., 820
New England Railroad, 428
New England Steamship Co., 820
New Orleans Terminal, 566
Newton & Northwestern, 130
New York & Portchester, 62, 95
New York Central & Hudson River, 96, 164, 532, 880
New York Central Lines, 30, 130, 164, 224, 378, 532, 600, 664, 880, 950
New York, Chicago & St. Louis, 96
New York Connecting, 880
New York, New Haven & Hartford, 62, 96, 130, 164, 224, 260, 322, 378, 428, 468, 532, 632, 664, 696, 760, 820, 880, 950
New York, Ontario & Western, 196, 820, 880, 918
New York, Westchester & Boston, 62
Norfolk & Ocean View (Electric), 224
Norfolk & Portsmouth Traction, 228
Norfolk & Western, 196
North Shore, 96
Northern Central, 196, 228
Northern Indiana (Electric), 164
Northern Maine Seaport Railroad & Terminal, 950
Northern Pacific, 130, 260, 918
Northwestern Pacific, 96, 164

Ocilla & Valdosta, 566, 918
Old Colony Railroad, 950
Oregon Railroad & Navigation, 500
Oregon Short Line, 62, 566

Panama Railroad, 164
Pennsylvania, 96, 130 (2), 196, 228, 260, 322, 378, 500, 532, 566, 880
Pennsylvania Co., 322, 566, 696
Pennsylvania, New Jersey & New York, 918
Pennsylvania, New York & Long Island, 918
Peoria & Pekin Terminal, 130, 290
Peoria Terminal Railway, 290
Pere Marquette, 96, 290, 566, 918, 950
Philadelphia & Erie, 130, 260
Philadelphia & Reading, 260, 566, 820
Philadelphia & Western, 62
Philadelphia, Baltimore & Washington, 196, 918, 950
Philadelphia, Bristol & Trenton, 164
Philippine Railroad, 468
Phoenix & Eastern, 600
Pittsburg & Lake Erie, 130, 378
Pittsburg, Cincinnati, Chicago & St. Louis, 130, 228, 696
Pittsburg, Fort Wayne & Chicago, 164
Pontiac, Oxford & Northern, 260
Portland & Rumford Falls, 664
Poughkeepsie & Eastern, 468, 950
Prospect Park & Coney Island, 322
Providence Securities Co., 696

Quebec & Lake St. John, 728
Quebec, Montreal & Southern, 228, 428

Richmond-Washington Co., 600
Rochester, Syracuse & Eastern, 164
Rock Island Company, 378, 760
Rockland, South Thomaston & Owl's Head (Electric), 428

St. Joseph & Grand Island, 62
St. Louis & San Francisco, 164, 260, 378, 428, 566, 950
St. Louis, Brownsville & Mexico, 760, 880
St. Louis, Iron Mountain & Southern, 664
St. Paul, Minneapolis & Manitoba, 164
San Francisco & Northern Pacific, 96
San Francisco & Northwestern, 96
Santa Fe, Liberal & Englewood, 96, 164
Santa Fe, Raton & Des Moines, 96
Santa Fe, Raton & Eastern, 96
Schenectady & Margaretsville, 566
Schoodic Stream Railroad, 950
Sea Beach Railway, 322
Seaboard Air Line, 62, 130, 164, 196, 260, 696
Somerset Railway, 532, 664
South Brooklyn Railway, 322
South Dakota Central, 566
Southern, 130, 196, 260, 566, 820, 950
Southern Indiana, 600
Southern Pacific, 96, 196, 322, 378, 500, 600, 696, 760, 880, 918
Syracuse & South Bay (Electric), 322

Tampa & Jacksonville, 532
Tennessee & Carolina Southern, 880
Terre Haute, Indianapolis & Eastern Traction, 468
Texas & Gulf, 566
Texas & Pacific, 950
Texas Central, 950
Tidewater, 260, 468
Toledo & Western (Electric), 130, 500
Toledo Railway & Light, 500, 918
Toledo Railway & Terminal, 532, 600, 820, 880
Toledo, St. Louis & Western, 428
Transit Development Co., 322
Traverse City, Leeland & Manistique, 600
Trenton, Lakewood & Atlantic, 880

Union Pacific, 62, 196, 378, 696, 820, 918
United of Havana, 664
United Railroads of San Francisco, 664
United Railways Investment Co., 664, 918
United Railways of Mexico, 696
United Traction Co. of Albany (Electric), 62, 96
Utica & Mohawk Valley (Electric), 950
Uxbridge & Blackstone Street Railway, 918

Vandalia, 30
Velasco, Brazos & Northern, 532
Virginia Railway, 468, 880

Wabash, 96, 532, 728
Wasatch & Jordan Valley, 632
Washington & Columbia River, 918
Washington, Alexandria & Mt. Vernon (Electric), 62
Washington Terminal, 532
West Jersey & Seashore, 196
Western Maryland, 130
Western Massachusetts (Electric), 130
Wheeling & Lake Erie, 378
Williams Valley, 566
Wiscasset, Waterville & Farmington, 130
Wisconsin Central, 664, 918

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CONTENTS

EDITORIAL:
- Disastrous Collision in the District of Columbia. 1
- Receivership and Foreclosure Sales 1906 1
- A Short Review of 1906 1
- Trainmen's Hours of Labor 3
- Summary of Annual Reports 4
- Dividend Changes and New Railroad Capital in 1906. 6

ILLUSTRATED:
- Mogul Locomotive for the Vandalia 10
- New Bay Shore Yards of the Southern Pacific at San Francisco 12
- Steel Passenger Car for the L. I. R.R. 17
- Alexander Johnston Cassatt 20
- James McCrea 21
- Rapid Transit Lines in New York City .. 22

CONTRIBUTIONS:
- Policy versus Production. 8
- The Obliteration of State Lines. 8

MISCELLANEOUS:
- Proposed 16-Hour Law 9
- Disastrous Collision in the District of Columbia 12
- Railroad Officers on the 1907 Outlook ... 13
- Pensions to be Paid on the Atchison 19
- Engineering Periodicals and the Card Index 21
- Foreign Railroad Notes 12, 19

GENERAL NEWS SECTION:
- Notes 25
- Trade Catalogues 27
- Obituary 27
- Elections and Appointments 27
- Locomotive Building 28
- Car Building 29
- Railroad Structures 30
- Railroad Construction 29
- Railroad Corporation News 30

VOL. XLII., No. 1. FRIDAY, JANUARY 4, 1907.

The collision on the Baltimore & Ohio last Sunday evening was one of the most disastrous and spectacular on record, although, sad to say, it is in most of its features not unlike many others that have occurred on American railroads. But in one feature it is unlike all the other prominent cases: it occurred in the District of Columbia, almost in sight of the capitol. Congressmen who have neglected the recommendations of the press and of the Interstate Commerce Commission to have train accidents regularly investigated will probably now have the subject forced upon them. On railroads in the District of Columbia Congress and the Interstate Commerce Commission have exclusive jurisdiction, of course, whatever may be the right or wrong of Federal action on a subject of this kind in New Jersey or Nevada. This will give point to whatever the Commission may have to say in its report on the special investigation of block signaling that it is now making, under the resolution passed by Congress last June. As to the essential questions of this particular collision, they seem from press reports to be these four: (1) Whether there was a distant signal; if there was, the runner's fault is more glaring than if there was not; if there was none, how much time do enginemen feel free to lose, in times of fog, to insure that no home signal (showing stop) shall be passed without being seen? (Going one foot beyond such a signal is a grave fault. Strict disciplinarians say that it should lose the runner his job.) (2) Assuming that the engineman was at fault what is his past record; and what has the superintendent done to assure himself that this engineman's habitual conduct, as regards signals, is correct? (3) As the only useful result of an inquiry concerning this case will be to afford security against similar collisions in the future, these questions, of course, must be broadened to take in the whole road; and (4) to embrace a review of the same features of practice on railroads everywhere. In a bill recently introduced in Congress to regulate the employment of telegraph operators and block signalmen it is proposed that candidates shall be required to pass an examination and be marked "at least 75 per cent." This collision shows in a striking manner that nothing less than 100 per cent. is a satisfactory mark for men who hold in their hands the lives of trainloads of passengers. It was a train of empty cars that worked the destruction in this case. An engine with no cars at all might have done the same. It is not alone the men in charge of fast trains whose duties involve possibilities of dire destruction. In the line of securing efficient enginemen, the only rational standard for the superintendent to set up is perfection. If he consciously stops (or relaxes his efforts) at any point short of perfection, he may safely conclude that he has fallen short of his full duty.

An addition must be made to the list of foreclosures published in the *Railroad Gazette* last week. This foreclosure sale is another of the class referred to as typical of the 1906 record, where the proceeding was merely the necessary formality of the taking over of a small by a larger road. The Carrabelle, Tallahassee & Georgia, a 50-mile road from Carrabelle, Fla., on the Gulf, north to Tallahassee, controlled since 1904 by the Georgia, Florida & Alabama, whose own line runs over 100 miles further north to Cuthbert, Ga., was on January 3, 1906, sold at foreclosure sale and bid in for $425,000. The road is now operated as part of the Georgia, Florida & Alabama. There has also been added to the list of receiverships published last week by the *Railroad Gazette*, the receivership of the Mobile, Jackson & Kansas City, news of which came too late last week to be included in the list. This is a road with 403 miles of line running from Mobile, Ala., northeast and north to Middleton, Tenn., near the southern boundary of the state, with a 27-mile branch to Hattiesburg, Miss., and two other short branches. It is made up of two parts, the Mobile, Jackson & Kansas City, which, controlling directly 200 miles of line, extends as far north as Decatur, Miss., and the Gulf & Chicago, a leased road running from Decatur, Miss., north to Middleton, 203 miles. The Mobile, Jackson & Kansas City has outstanding $4,000,000 first consolidated mortgage 5 per cent. bonds of 1953 and $4,000,000 common stock, as well as $210,000 4½ per cent. equipment bonds running to 1910. The Gulf & Chicago has $5,000,000 first mortgage guaranteed 5 per cent. bonds of 1953 and $5,000,000 common stock outstanding. The date of receivership, which was made at Mobile on application of a committee representing holders of about $1,000,000 bonds and $500,000 stock of the Gulf & Chicago was December 26. Application was made on the ground of insolvency in *ex-parte* proceedings without notice to the company. From the widely conflicting statements made by the different parties in interest it is difficult to draw an accurate conclusion of the justification of the appointment of a receiver for the parent property. The president of the company, on the day after receivers were appointed, made a statement to the effect that the company is not in default in the payment of any interest due bondholders, or in the payment to any creditor of any kind or description, also that all preparations had been made to pay the interest due on the bonds of the two roads on January 1, and that the company is taking immediate steps toward the removal of the receivers and the restoration of its property, as the earnings are more than sufficient to meet all operating expenses and are rapidly increasing. On the other hand the published annual report of the Mobile, Jackson & Kansas City for the year ended June 30, 1906, showed a very large increase in floating debt and omitted the rental which was paid for the Gulf & Chicago, thus showing a small surplus instead of a considerable deficit. F. E. Dewey, one of the receivers, and formerly general manager of the road, also alleges mismanagement on the part of the present officers. The true status of the company will, no doubt, shortly be made clear in the courts.

A SHORT REVIEW OF 1906.

There are two reasons why a set of facts and conditions should be reviewed at the end of a year, even though they are tolerably fresh in the minds of everybody. First, because the presence of such reviews constitutes a known historical record, easy of access; second, because in this era of Rooseveltian rapidity we forget easily, having so much to remember. Let it be said at once, therefore,

that the event in 1906 which stands out above all other events in the recognition it deserves, as well as in the recognition it has received, is the attitude of hostility and suspicion which has grown up, east and west, but especially west, against the railroads. This hostility and suspicion bore fruit in the Rate Bill; a weapon good rather than bad in its potentialities, always provided it be not wielded with a socialistic hand. Like much of our legislation, state and national, the Rate Bill leaves far too much to the Supreme Court in the construction of doubtful passages. But it remains most noteworthy that discriminatory practice of every sort, great and small, has this year been driven out of sight, and most of it destroyed entirely.

Great traffic, with a multitude of attendant circumstances, takes the next place in the year's record. The attendant circumstances include tremendous gains in gross earnings, increased dividends on stocks yielding a high return, so that the bond market has been much depressed; also severe congestion and car shortage, in spite of the largest additions to equipment that have ever been made in a single year. It is worthy of record that in the face of such prosperity no such indiscriminate railroad building is under way as characterized certain previous years of great earnings. The development of the northwest and the extensions to the northern Pacific coast are a separate phenomenon, having no connection with the great earnings of 1906. This is a very healthy condition of affairs and there is no indication that a year or two of hard times, even of severe commercial depression, would affect railroad values as it did in 1888 and the years following.

The movement to the northwest really belongs in the 1905 rather than the 1906 record, although it has attracted much attention this year. The Chicago & North-Western has large free funds which it seems probable will be used in branch line work rather than in the opening of much new northwestern territory. The St. Paul has given an idea of the location of its entire extension to Spokane, and has financed its needs in this line for some years to come. The Grand Trunk Pacific, building under the curious division between governmental and private responsibility, is making rapid progress, and the Canadian Pacific is retaliating by entering Grand Trunk territory in the east. The Western Pacific is being pushed as rapidly as the extraordinary adverse labor condition will permit, and the same is true of the Denver, Northwestern & Pacific. Meanwhile, the Canadian Northern, cheaply built and cheaply operated, is gradually pushing westward and watching its chance for a strike into new fields.

In the southwest there was less rapid extension of the Rock Island network than in some previous years, but the Rock Island has made arrangements for a Galveston connection through a joint enterprise with the Colorado & Southern. Most interesting of all is the present uncertain position of the north and south lines reaching the Gulf. No one knows for sure, as yet, whether the Illinois Central can fairly be counted in the Harriman group or not. We are inclined to think it may still be classed as an independent, with the greatest power, both actual and potential, of all independent lines in that territory. The Missouri, Kansas & Texas and the Kansas City Southern are very obviously in the market. Both are being rehabilitated, especially the Kansas City Southern, which is being turned into a first class railroad and is apparently amply supplied with capital for its needs, chiefly, we believe, from foreign sources. Since Mr. Hill made his often quoted remark that if you kicked a barrel of flour at Minneapolis it would roll to the Gulf, many people have questioned whether these convenient routes would one or both become part of the Hill system, or become affiliated with the Chicago, Milwaukee & St. Paul, or would form a base to the Harriman triangle. It is probable that the next year or two will determine their status.

By the order for 6,000 refrigerator cars, an amount equal to something like half of the entire Armour equipment, the Harriman lines have introduced a new element into the private car situation, so widely exploited at the time of the Government investigation. The change seems to be entirely a healthy one, and this purchase, in connection with new legislation on the subject, seems likely to do away with many of the vexatious evils that have grown up around the private car business. The obvious difficulty of each road owning its own refrigerator equipment has always been that this equipment had maximum use each year during a short season, and would have to lie idle most of the rest of the year. Whether or not the Harriman cars will find their way to Michigan and to Georgia in the respective seasons, remains to be seen. It is at least obvious that there will be more refrigerator cars in service during 1907 than there were in 1906, and that the use of these cars will be much better regulated.

Only the briefest review can be given of the new construction work during the year. Besides the lines in the Northwest, it is noteworthy that the Pennsylvania tunnels have been extended across the North river and are well in progress beneath the East river. The Western Maryland and the West Virginia Central & Pittsburg have been joined, and the Florida East Coast has laid 37 miles of track on its extension to Key West.

At the time of writing, the New York Central and New Haven are almost ready to begin the operation by electricity of the New York suburban territory. The Long Island's suburban lines, so far as they have been electrified, are already in operation, and the West Jersey & Seashore electrification was completed last summer. It cannot now be said where the next important electrification will be done, but it seems sure that electricity will be the motive power for all dense suburban work before many years.

The size and power of locomotives has been increasing steadily for the last few years, but all records for heavy engines were supplanted during 1906 by the order of the Erie of four Mallet compounds to weigh 410,000 lbs., all on drivers. These locomotives when put into service next year will haul trains of 2,000 tons unassisted over the hilly Susquehanna division. The Baltimore & Ohio Mallet compound is still in hard pusher service, and the Great Northern has four of this type slightly heavier than the pioneer, at work in the Cascade mountains. Twenty-five more have been ordered for the same road for 1907. For heavy freight road service the consolidation type, heavier and more powerful, remains the almost universal type. On the western roads the Prairie type is coming into general use for fast freight service. Compounding for freight service is not so much in evidence now as a few years ago, but the four-cylinder balanced compound arrangement for fast passenger locomotives is coming to the front rapidly. Superheating and the mechanical stoker are still in the experimental stage. The Walschaert valve gear was applied to a large number of locomotives during the year, and its advantages in the matter of simplicity and ease of access have been generally acknowledged.

The car building industry has had a phenomenal year. The demand for cars far exceeded the capacity of the plants and nearly all the builders made extensive additions to their works. Unable to obtain cars from the builders, many of the railroads ordered cars built in their own shops. This practice is becoming more and more general. Most of the freight cars built during the year were of high capacity, 80,000 lbs. and 100,000 lbs., and more than 65 per cent. of the builders' output were of steel or with steel underframes. Comparatively few of the cars built in the railroad shops were of steel, for they have not as yet the facilities for putting up such cars in numbers. A few experimental steel passenger cars have been built, but they are not yet a standard on any road for through trains. The designs so far tried are promising and next year will undoubtedly see a more general movement in this direction. They can be built as light and quite as luxurious and comfortable as the wooden car, and their strength in collisions is many times greater. Steady improvement in the design and material of draft gears and couplers and the greater strength of the cars have done much to reduce the failures which proved so serious with the first high capacity cars introduced. Cast-iron wheels are still a source of expense and trouble, but the action of the Master Car Builders' Association in providing for an increase of ⅛ in. in the thickness of the flange promises to ameliorate some of the difficulties.

A general survey of the physical and financial condition of the important roads of the country shows practically all in better condition than at any other time in their history. It is unfortunate that certain exceptions must be made. As a whole, the management of the Gould lines is certainly very unsatisfactory. The Wabash, Wheeling & Lake Erie and Denver & Rio Grande are in strong hands, but the Missouri Pacific, constituting the base of the system is in need of radical change and is calling aloud for the expenditure of much more money than can be made available. The Rock Island management, by passing the first preferred dividend on the Rock Island stock and the second preferred on the St. Louis & San Francisco, last February, gave signs of awakening to its large responsibilities. The Seaboard Air Line is undoubtedly in bad shape and the recent campaign inaugurated against the management by John Skelton Williams has brought out many discouraging facts. Keeping in mind, however, the conditions of these three systems, not much else can be found, among the railroads of the

country, that does not show promise of great strength and health. Higher operating costs have surely to be faced in 1907, and it is not clear that these can be reduced until retrenchment becomes necessary. If the great earnings continue as they now promise to do, these costs, while serious, will not be a matter of the first importance. If the great earnings do not continue, it may be assumed that the costs will adjust themselves, in whole or in part.

TRAINMEN'S HOURS OF LABOR.

According to press despatches from Washington the railroads have concluded that there is no use in opposing Senator La Follette's 16-hour bill. This bill forbids the working of men on railroad trains more than 16 hours continuously, and imposes a heavy penalty on the railroad officer who violates the law. The bill is "sure to pass" —to use a phrase familiar in New York state. Senator La Follette evidently had strong backing in the last session or he would not have secured the definite promise that the bill should be taken up on a specified day of this session (January 10); and this strength must be in evidence at Washington now, for the reporters seem confident in their assertion that the railroads have given up the contest. And yet, like the rate bill passed last summer, this bill, if it becomes a law, will doubtless be carried by the votes of men who have given very little study to the right and wrong of the matter they are deciding.

The question of the number of hours that trainmen shall be kept on duty is a difficult one, and not the least of the difficulties is that to settle it rightly there must be hearty and friendly co-operation between the superintendent and the employee. It is futile for the superintendent to prescribe proper hours for a trainman if the trainman himself, lacking moral principle and devotion to duty, chooses to work or play when he ought to be asleep, and thus impairs his bodily or mental strength, so that he comes on duty tired or otherwise unfit. Moreover, to change for the better the present customs, a superintendent must get the co-operation of the president of his company, for the change will mean a large increase in expenses.

The chief advocate of this bill before the Congressional Committee last spring was Mr. Fuller, spokesman for the four principal brotherhoods, those of the enginemen, firemen, conductors and brakemen; and it is to be assumed that all of these brotherhoods are formally in favor of it (although there are plenty of individual employees who are opposed); but to simplify the discussion, we may, for our present purpose, consider enginemen only. If any one of these classes is more important than the others it is the enginemen. Moreover, the enginemen's brotherhood is the strongest, and may well be looked upon as the leader. If the enginemen's hours are made right it will be comparatively easy to make those of the conductors and brakemen right. For our present purpose we may also leave entirely out of account the passenger train service.

What has come to be regarded as the economical railroad division for freight train runs is from 125 to 150 miles long. For reasons of economy, runs should be made as long as is practicable. Changing engines and remaking trains takes up time and costs money. It is generally agreed that the trips of the enginemen shall be the same as those of the engines. To stop in the middle of his run and give up the engine to another man and wait to take an engine in the opposite direction is inconvenient to the runner, and impairs the efficiency of the management and discipline. This means that the length of a run settles the length of time that the man must be on duty. Engines must be required to haul as heavy trains as they can, and make uniform speed, or the cost of transportation will be largely increased. The suggestion made before the Congressional Committee that the hours of trainmen be made more uniform by lightening the loads, so that trains can more surely reach their destination on time, will be looked upon as absurd by all practical men. It is true that some railroads have gone to extremes in loading freight engines to their utmost capacity, and have thereby disturbed their general train service with abnormal delays, but the opposite mistake of sacrificing economy to speed would be about equally unwise. This has to be done in the passenger service, but in freight service it soon degenerates into extravagance, as has been seen where sharp competition has led to running very light freight trains to carry live stock at express speed.

The hours of service on freight trains are not only in many cases too long, but they are, beyond all reason, irregular. To prevent strife among the men, the "chain gang" has had to be made practically universal. The normal way to arrange the runs of 25, 50 or 100 crews would be to have, say, 40 per cent. of them day runs, 40 per cent. night and 20 per cent. irregular. Everybody admits that regular hours are desirable, if not necessary, in a business requiring clear heads and fresh bodies; and in the days of small things, 40 years ago, this theory was carried out; but as traffic has grown and the spirit of independence has led men to more and more strenuously insist on their "rights," the worried superintendent has found no way to satisfy the whole of his men, except to put them all in one list, and run them "first in, first out." This perpetuates a system wholly bad. It may perhaps in some cases be a necessary evil, but it is none the less an evil. If, where there are 25 crews, there are on Monday 30 trains, five of the men who have done a normal day's work by, say 7 p.m., are called upon to begin another day's work as soon as they have had the minimum of rest; and, as everybody knows, this minimum is often made too small. Thus the man who begins on Monday, expecting to work days, at once finds that he is required to work nights; and if, by Wednesday or Thursday, the number of trains drops off to 20, he will find himself on day runs again. Unless the number of crews remains constant, and the number of runs constant also, he never knows beforehand what time he can have to himself, or what part of the day or night will be given to him for rest. If business is not rushing the unpleasant results of this irregularity are ameliorated by giving the men 36 hours or more to rest at one time. By raising the pay, while they do work, to what is really an abnormally high figure, the men are enabled to thus lie off a day and a half and still earn a fair month's pay. On the other hand, when business is rushing and every man is needed, the rest periods, week in and week out, are made just as short as they can be made.

Many times on freight trains the men on duty excessively long hours can get a half hour to sleep in their seats, as, for example, when waiting on a side track. Of a crew of five men, one can remain awake as watchman, and all the rest can sleep. This has made tolerable what otherwise would be absolutely intolerable conditions. We need not remind railroad men that now and then the whole crew go to sleep and, on awaking, resume their trip on the strength of guess work, and kill some of their fellow workmen in a collision.

The engineman has delicate and responsible duties. In the case of the fast express, everybody agrees with this. It is also true, however, in the case of the slow freight, as a freight wreck frequently causes a passenger wreck. Moreover, the life of the poor brakeman deserves consideration, the same as that of the passenger. The importance of being in the best mental and physical health is frequently emphasized by the enginemen themselves, as, for example, when one makes a blunder and his brotherhood committee apologizes for him by expatiating on the necessity of being in perfect condition, and on the obstacles that are put in the way of the man who strives to be always at his best. These facts seem almost too obvious to need restating, and yet there are enginemen who will object to any law calculated to interfere with the liberty, which they now enjoy, of overworking themselves. The fact that, in spite of adverse conditions, enginemen, as a body, do make excellent records, does not change the truth of which we are speaking, and still less does it diminish the duty of the employer to forbid excessive hours. How absurd it is, when one comes to think of it, that the conductors and porters who attend to the wants of passengers in the sleeping cars, and the waiters who serve them in dining cars, are held to a higher degree of perfection in their duties than are the men at the head of the train who hold in their hands the lives of the passengers!

One of the most indefensible features of the freight train service is the custom of making rest periods as short as possible, in order to enable the men to rest at home instead of away from home. A decent trainman does not like to lie over for a period of 15 hours away from home, at the farther end of his run, especially if he has to spend his time in the woods or in a rum shop, and to relieve him as much as possible these absurd round-trip runs have been provided. A train is scheduled outward in 10 hours; rest for, say, four hours, and then return in 10 hours. Then there is a "lay-off" in which the men are supposed to get fully rested. If the 10-hour schedule by unexpected delays is made 12 hours, or 15 hours, the conditions are by that much aggravated. It is true that this kind of work does not kill the men; nor does it often result in a collision. The brakeman and the conductor can stand it quite well by "pounding their ear" on the cushions in the caboose. The engineman cannot so easily get relief, but he can get some, especially if he has a fireman competent to run, and a head brakeman willing to fire a little now and then. Nevertheless, as the government records have shown, this 24-hour tour of duty now and then gets lengthened to

26, 28 or 30 hours, and sometimes the enginemen fall asleep in their cabs on the road.

The advocates of the bill before the Congressional Committee wasted their energies in citing certain cases from the accident records where overwork may have caused the collision, but did not certainly cause it. This was really unnecessary, for surely no Congressman or railroad officer or anyone else wants men to sleep on moving engines, whether the possible collision does or does not result. Whether the number of collisions caused by sleeping enginemen during the last five years has been one, or a dozen, or a hundred, is immaterial; the thing to do is to provide in the most effective manner possible against the chance of collision. Everybody knows that long hours are common, and the least that can be done is to take all possible means to put a stop to the practice. A superintendent is, indeed, unable to compel men to rest; but for that very reason he must clear his own skirts by allowing ample and regular time for rest.

Such a widespread and generally admitted faulty condition certainly demands action; and yet the railroads strenuously object to the passage of any bill by Congress. Why is this?

1. The proposed law is harsh and probably unjust. It proposes to punish the officer or the company, but not the trainman. The officer may do his best, but the careless or unprincipled trainman will foil him. The promises of a benevolent government not to prosecute where it would be unfair to do so are the only assurances that the railroad can have of freedom from the most absurd, excessive and unjust penalties.

2. Rigid prohibition of runs longer than 16 hours would, on some roads, necessitate expensive changes. Division terminals would have to be relocated. (The manager who has, at great inconvenience to his men, lengthened the runs of trains in order to save a little expense for the company, may not deserve much sympathy, if he now gets caught in the flow of the flood the other way; but that is another story.) With or without changes in terminals, it would be necessary to have larger forces; and this the trainmaster dreads. Extra men demoralize the force. The trainmaster is backed up by the trainmen, for they like to keep the force small enough to insure good wages. In this they may easily go to excess and violate the public interest, for keeping the number of crews at the minimum affords too good opportunity for overwork; yet this is what has been many times done. The brotherhoods have claimed it is a right and superintendents have acquiesced.

3. Besides the points mentioned, the proposed change would multiply the superintendent's troubles with the labor unions, and many of the members of the unions prefer the present arrangement, and are opposed to the proposed law. Moreover, these opponents believe that their motives are right and laudable. In some respects they are; and it is questionable whether a majority of all the members of all the unions would be found to be intelligently in favor of the proposed law. With this division of opinion the situation is seriously confused. But the advocates of the law have sentiment on their side, and the public, so far as it is able to judge for itself, will be with them; for the bald proposition that overwork should be forbidden admits of no dispute. On the other hand the avaricious trainman, opposing the law, cannot even state his case without practically giving himself away.

What can best be done to promote safety and justice is difficult to say. No one questions that trainmen work too long hours. The trainman disposed to go beyond his strength often finds it easy to do so. A road, which, like the Chicago & North-Western, sets out to establish rigid rest hours usually finds it difficult to carry out its ideals. The railroads certainly should welcome anything which would inspire their men with the purpose to give good service. The fact that a man at the far end of his run has to go to a saloon for company, or to a board cot for rest, does not justify him in trying to run an engine when he is asleep or even drowsy. This runner's problem is a hard one, but he should not meet it by endangering train loads of passengers. If superintendents have to put on large extra forces, we may expect, in many cases, to see all of the demoralizing influences that have been known to accompany this condition in the past. Especially is this true at a time like this, when good men are scarce. The real need is a high grade of enginemen who will voluntarily refrain from working excessive hours, and from coming on duty when not fresh and rested. Most roads give their men opportunity to rest at reasonable hours if the man, on each occasion, demands it. The trouble is largely with those who, from avarice or fear of displeasing an unreasonable boss, do not make the demand. The ideal engineman is intelligent, and knows that regular and reasonable hours are necessary to uniform safety and to the security of his own reputation; and he is morally educated to the point of doing right in this matter, even at the loss of possible extra pay. On the other hand, no law can make men conscientious, and men lacking conscience can nullify the law with impunity. Moreover, one of the worst dangers, the danger from men sleeping on duty when kept out by a wreck, is not touched by the proposed law at all. Whatever Congress may do, we are still dependent for safety, ultimately, on the vigilant, wise and conscientious superintendent.

Summary of Annual Reports.

In order to present in graphic form the results of the year's operation as reported in the annual statements of the companies, some 60 of which are reviewed in the *Railroad Gazette* as they appear, we have, for several years, made it a practice to publish diagrams, by means of which the movements of earnings and of the principal details in the expense account will appear at a glance. It seems clear that by taking the composite returns of a number of companies the effect of special circumstances will be modified, and the result will be more accurate, as a statement of the year's tendencies, than would the results of any single company.

The first diagram shown takes as a base the composite earnings, gross and net, and the operating expenses, of 17 railroads for the year 1899.* The diagram then shows the increases per cent. of each of these three aggregates for the fiscal years from 1900 to 1906. Thus, in 1900 the gross earnings of these roads had increased 14.4 per cent. over the total for 1899, while in 1906 gross earnings had increased 87 per cent. over the total for 1899.

The curve, as developed in this manner, is of considerable interest. It will be seen that the increase has proceeded considerably more rapidly during the past fiscal year than in any other year on the list. It is interesting to observe how net earnings actually decreased between 1903 and 1904, while during the 1906 fiscal year their increase in relation to the 1899 base fell 1 per cent. short of equaling the increase in 1900, and was equaled by 1903, but by no other year. The curve for operating expenses is more even, but it is noteworthy that while it inclined upward more rapidly than that for gross earnings in 1904 and 1905, gross earnings crossed it again in 1906.

It must be pointed out by way of correction that the Vanderbilt roads have changed their fiscal year from June 30 to December 31 since this diagram was first constructed. It seems best to retain these roads in the list, and to accept as their fiscal year the one just reported, consequently the Vanderbilt totals are for a period which begins and ends six months earlier than that of the other roads.

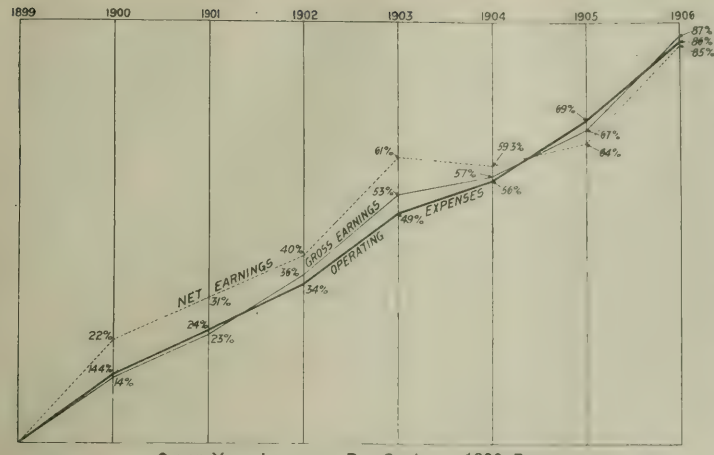
If a prediction may be ventured, based on the returns for the last few months, it is that when this diagram is compiled for the 1907 fiscal year, the curves for gross and net may be further apart than they are now, and the operating expense curve will cross that representing the increases in gross earnings. Under normal conditions, operating expenses ought to increase by a smaller proportionate amount than gross earnings do, but the present outlook is for an increase in larger proportion.

The diagram showing the percentages of increase in the three principal component charges contained under the general head of operating expenses is, this year, of quite unusual interest.† Under ordinary management, which exercises care, but is not disposed to retrenchment, it is natural to expect that the item of conducting transportation shall increase somewhat in proportion to the traffic moved. This item for the 1906 year, however, had increased only 3 per cent. over the figure for 1905, as compared with the 1903 base. The only conclusions which can be drawn from this showing are that, in the first place, the cost of conducting transportation was abnormally high in 1905, and in the second place, wage and fuel costs were not abnormally high in 1906. There is no apparent reason why the charge for maintaining way and structures should progress as rapidly in the face of increasing traffic as the charge for conducting transportation, yet this year it increased almost three times as rapidly, while the charge for maintenance of equipment of the roads, included in the list, increased from $112,621,353 in 1905 to $125,162,190 in 1906, an increase of 40 per cent., and in three years increased 40 per cent.

The extraordinary charges which have been made during the past few years, and especially during the past year for maintaining equipment are worthy of special comment. It may fairly be as-

*These railroads are as follows: Atchison, Topeka & Santa Fe, Baltimore & Ohio, Chesapeake & Ohio, Chicago, Burlington & Quincy, Chicago & North-Western, Chicago, Minneapolis & St. Paul, Cleveland, Cincinnati, Chicago & St. Louis, Erie, Great Northern, Illinois Central, Louisville & Nashville, New York, New Haven & Hartford, Norfolk & Western, Northern Pacific, Philadelphia & Reading, Southern, Wabash.

†The roads included are as follows: Atchison, Topeka & Santa Fe, Buffalo, Rochester & Pittsburg, Baltimore & Ohio, Chesapeake & Ohio, Chicago & North Western, Chicago & Alton, Cleveland, Cincinnati, Chicago & St. Louis, Chicago, Minneapolis & St. Paul, Chicago, Burlington & Quincy, Denver & Rio Grande, Great Northern, Illinois Central, Missouri, Kansas & Texas, New York, New Haven & Hartford, New York Central, Norfolk & Western, Chicago, Rock Island & Pacific, Southern Pacific, Wabash.



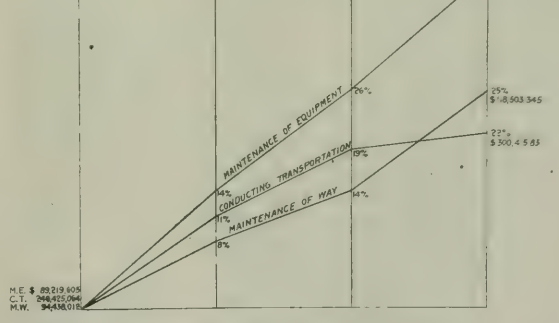
Seven-Year Increases Per Cent. on 1899 Base.

sumed that the actual cost of keeping a large modern locomotive in first class repair will not materially exceed $1,800 a year per locomotive. The Granger roads have often done it for less, and kept their equipment in first class condition. It is little short of astonishing, therefore, to find a group of prosperous roads such as the Union Pacific, Southern Pacific, Pennsylvania and Louisville & Nashville charging well over $3,000 a year per locomotive. The discrepancy in the charge for maintaining freight and passenger cars, as compared with what it is fair to assume is its actual needs, is equally striking. Several explanations of this may be given. It is doubtless true that the tremendous rush of traffic throughout the past few years has given the equipment harder service than normal, and has delayed small repairs until much larger ones have become necessary. We think it is also fair to assume that the great increase in the cost of maintaining equipment has been, in no small degree, occasioned by the desire of railroad managers to make replacements as liberally as possible out of the repair account. If this is true, it seems evident that this special charge offers a fruitful field for retrenchment when retrenchment next becomes necessary. The most striking showing made by any single road in the group in this regard was that of the Southern Pacific, which, along with enormous increases in the charges for maintenance, actually handled its vast traffic in 1906 for a less gross cost of conducting transportation than it did in 1905.

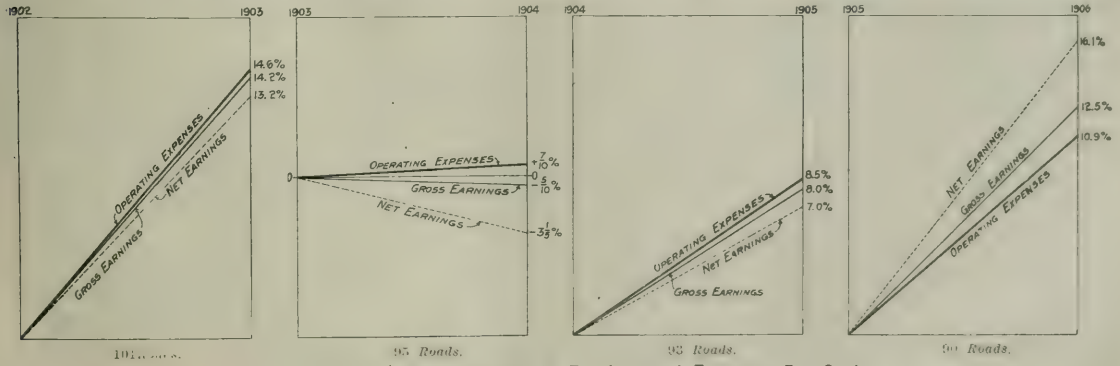
It may be said in passing that the present period of great earnings and great hostility towards corporations on the part of the government, national and state, is an exceptionally good one in which to put money back into the property. It may be expected, therefore, that the maintenance curves will continue upwards for the 1907 fiscal year if present conditions obtain. The curve for the cost of conducting transportation, in view of the recent large increases in wages, should make quite a sharp upward bend next year.

Figure 3 shows the percentages of increase for large groups of roads year by year. These cannot be shown in the form of a continuous curve for the reason that the groups are compared in series of two; thus, 101 roads are shown in the comparison of 1902 and 1903, 95 roads in the comparison of 1903 and 1904, 93 roads in the comparison of 1904 and 1905, and 90 roads in the last comparison shown. For the figures on which these diagrams are constructed we are indebted to the compilations made by the *Commercial and Financial Chronicle*, which presents this matter in tabular form.

The concluding table shows the increases in revenue train loads on a group of 17 characteristic roads since 1901. It will be seen that the average is almost at 400 tons this year, an increase of 74 tons in five years. This is a very striking showing, testifying not only to the physical betterment of the properties, in the shape of reduced grades and curves, but also to the great increases in engine capacity. It is probable that the increased train load is as much attributable to these facts as to better average loading, for the extremely dense traffic of the past year has made it impossible to give the care and attention to the question of average loading that can be given when traffic is less. On the other hand, there was certainly plenty of freight to move in 1906, and no running light on that account. It will be recalled that in 1905 the Baltimore & Ohio came to the conclusion that it was hauling too heavy trains for the maximum of economy, and the year's average at that time showed a decrease of two tons from the average of 1904. This year, however, the B. & O. train load has again risen, due probably to the conditions named above, rather than to any change in policy. Among other noteworthy items on the list is the small average loading of the St. Louis & San Francisco and the Cotton Belt, indicating no deficiencies of management, but rather the possibilities of great gains in economy of working when the thin branch line territory traversed attains a higher state of development than at present. The phenomenal train loading of the Great Northern has often been pointed out. This year it reaches 530 tons. While the preponderance of grain movement has much to do with this, we believe that the Granger roads in general, and the Great Northern in particular, might get along better with their neighbors and customers, if, during the ensuing year, they should devote more attention to quick movement of freight and less attention to full loading of trains. From the average load of some 70 tons on the charac-



Expense Account Increases, Per Cent.



101 Roads. 95 Roads. 93 Roads. 90 Roads.

Years Ending Oct. 31, Changes in Earnings and Expenses, Per Cent.

teristic British fast goods train to the average of 530 tons on the Great Northern there is an intervening vastness which measures not only the difference in traffic, but also the difference in the way the traffic is handled. In the face of the present hostility in the Granger states, we believe that a smaller train load and a faster freight movement might be a very profitable investment for the northwestern roads.

Revenue Train-Loads; Tons.

	1906.	1905.	1904.	1903.	1902.	1901.
Atchison, Topeka & Santa Fe	307	282	269	279	247	242
Baltimore & Ohio	420	399	401	416	406	381
Buffalo, Rochester & Pittsburg	525	507	439	441	424	406
Chesapeake & Ohio	586	547	508	493	508	511
Chicago & Alton	381	341	336	356	316	288
Chicago, Burlington & Quincy	365	327	278	266	218	201
Chicago, Milwaukee & St. Paul	282	265	245	244	254	236
Erie	459	412	400	406	376	375
Great Northern	530	523	447	446	417	381
Illinois Central	353	319	278	288	275	235
Lehigh Valley	504	501	486	485	467	467
Minn., St. Paul & S. Ste. Marie	329	309	301	305	315	314
Northern Pacific	400	367	339	344	346	324
St. Louis & San Francisco	214	200	193	195	187	209
St. Louis Southwestern	280	267	288	284	344	318
Union Pacific	510	507	451	403	418	365
Wabash	348	293	280	302	285	283
Average for 17 roads	399	376	356	356	341	325

Dividend Changes and New Railroad Capital in 1906.

The first of the following tables sums up the principal increases and decreases in the annual rate of railroad dividend payments during the calendar year 1906. Wherever possible the companies have been grouped by ownership, or, in the case of the New Orleans & North-eastern and the Vicksburg, Shreveport & Pacific, which are not known to be actually controlled by the Southern Railway, by traffic relationship, since these companies form part of the Queen & Crescent Route, of which the Southern controls the two northern members, the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern. The month given opposite each new dividend is usually that in which the dividend was announced or declared. The record, on the whole, is a striking one of increased returns to railroad stockholders, particularly of the common shares. The grouping together of allied roads shows strikingly one important factor which made possible the raising of their dividend rates by the two great trunk line railroads, the Pennsylvania and the New York Central. In the case of the New York Central particularly, the additional income required comes almost entirely from the increased dividend returns received on stocks of controlled companies like the Lake Shore and the Michigan Central, and through the Lake Shore, the Pittsburg & Lake Erie. The increase in the dividend rate will, of course, make it easier to issue the $70,000,000 or more new stock authorized and unissued during the year, as shown in the second table. This is of great importance to the company, as its practice is to finance new requirements with stock. A similar purpose also probably had more or less to do with other increases in dividend rates, notably in the case of the Baltimore & Ohio, the Pennsylvania and the Norfolk & Western.

The beginning of dividends on its preferred stock by the Missouri, Kansas & Texas, and on its common stock by the Southern Pacific, neither of which securities had ever before received dividends, is of special interest. The increase of 4 per cent. annually in the Union Pacific's return was officially announced to be from income from investments—a new distinction in dividend returns. The Nevada mining boon is reflected in the 17 per cent. paid on both classes of stock of the Tonopah & Goldfield, a remarkably high rate for a new road in its first year of operation. The only decreases of importance during the year were in the stocks of the companies in the Rock Island group made in accordance with the policy adopted at the end of 1905 of improving the properties instead of distributing surplus dividends.

The second table includes the more important new railroad capital authorized during the year, an arbitrary minimum of $1,000,000 having been used in making up the list, and also the large new issues announced during the year of stock or convertible bonds previously authorized. It does not include new issues of other securities previously authorized, nor in general, bond issues of roads under construction like the Kansas City, Mexico & Orient or the Trinity & Brazos Valley, where bonds are issued covering the new road as built at a certain rate per mile. Bond issues of roads under construction are included only where a road which has a certain amount of track built makes an issue definite in amount or where the construction bonds are guaranteed by an existing company. The amount and kind of new security authorized, the amount sold or issued, the amount of the new issue, the amount of old securities to be refunded by the new issue, and the date of authorization, or in the case of securities not yet authorized or those issued from a previous authorization, the date of announcement of the new issue or sale—these facts it is the attempt to include in the tables. Owing to the fact that information as to to the amount of securiies issued or sold, and the amount which is to be used to cover refunding is not always made public by the companies, it has not been possible in every case to secure the facts under these two heads. This is particularly true in the case of security issues by a controlled or leased corporation held by the parent company. The striking features of the year's financing include the large amounts of equipment issues, which were to be expected to take care of the tremendous purchases of new rolling stock by railroads, the large increases in capital stock by the northwestern and other railroads, and the considerable financing which a road like the New York, New Haven & Hartford has had to do for internal improvements to its system and the financing of its electric properties; as well as the authorization of a $200,000,000 bond issue, in each case providing for ample development, by each of two companies which have been handicapped by insufficient funds provided at the time of reorganization. There have also been included on account of their size the new security issues of two electric railway corporations in New York City, the Interborough-Metropolitan Company, in which are merged all the local transportation lines in Manhattan and the Bronx, and the Hudson & Manhattan Railroad, which is building several tunnels under the Hudson River to Manhattan Island.

Dividend Increases and Decreases in 1906.

Name of company.	New annual rate.	Declared.	Former annual rate.	Paid in
Atchison, Topeka & Santa Fe common	5	October.	4	1905.
Canadian Pacific	7[1]	October.	6	1906.
Chicago Great-Western pf. A	5	January.	5	1904.
Colorado & Southern Group:				
Colorado & Southern pf.	4	March.	2	1904.
Fort Worth & Denver City pf.	4	March.	4	1904.
Cripple Creek Central com.	5½	January.	3	1905.
Huntington & Broad Top Mt. pf.	5	January.	5½	1905.
Harriman Group:				
Union Pacific com.	6	February.	5½	1905.
Union Pacific com	10	August.	6	1906.
Southern Pacific com.	5	August.	0	.....
Illinois Central	7[2]	July.	7	1905.
Lehigh Valley com.	5[3]	December.	4	1906.
Louisiana & Arkansas	1½	March.	0	.....
Mexican Roads:				
Interoceanic of Mexico, B. deb.	7	December.	4½	1905.
Interoceanic of Mexico pf.	2	December.	0	.....
Mexican Railway 2d pf.	3¾	November.	1	1897.
National of Mexico	1	July.	0	.....
Missouri, Kansas & Texas pf.	4	May.	0	.....
New York Central Group:				
New York Cent. & Hudson River	6	December.	5	1905.
Lake Shore & Michigan Southern.	12	"	8	1905.
Michigan Central	6	"	4	1905.
Pittsburg & Lake Erie.	12	"	10	1905.
St. Law. & Adirondack (N. Y. C.)	5	"	1½	1905.
Mahoning Coal R.R. (L.S.& M.S)	12	"	10	1905.
Pennsylvania Group:				
Pennsylvania Railroad	7	October.	6	1905.
Pennsylvania Company	6	June.	5	1905.
Pitts., Cin., Chic. & St. L. pf.	5	June.	4	1905.
Pitts., Cin., Chic. & St. L. com.	4	December.	3	1905.
Pitts., Y'gstown & Ashtabula com	7	September.	5	1906.[4]
Cleveland, Akron & Columbus	3	September.	2	1905.
Vandalia	5	December.	4	1905.
Northern Central	20½[5]	December.	8	1905.
N. Y., Phila. & Norfolk	31[6]	June.	12	1905.
Delaware Railroad (P., B. & W.)	8	December.	6	1905.
Del. Riv. R.R. & Bdg. Co.(P.R.R.)	6	"	4	1905.
Richmond, Fredrksbg. & Potomac	34[7]	"	9	1905.
Norfolk & Western com.	5	"	4	1905.
Baltimore & Ohio com.	6	June.	5	1905.
Washington Branch (B. & O.)	6	February.	10	1896.
Rock Island Group:				
Rock Island Company pf.	0	January.	4	1905.
Chicago, Rock Island & Pacific Ry	6	Jan., Apr., Jul., and Oct.	6½	1905.
St. Louis & San Francisco 2d pf.	0	February.	4	1905.
Evansville & Terre Haute com.	4	September.	1½	1901.
Seaboard Company 1st pf.	5	July.	0	.....
Southern Railway Group:				
Ga. Southern & Fla. 2d pf.	5	November.	4	1905.
Cin., New Orleans & Texas Pac.	5½	"	5	1905.
Mobile & Ohio	5½	December.	4	1905.
New Orleans & North-Eastern	5	November.	3½	1905.
Vicksburg, Shreveport & Pac. com	0	"	2	1905.
Tonopah & Goldfield, com & pf.	17[8]	May, Aug., Nov.	0	.....
Tonopah & Goldfield, com & pf.	20[9]	December.	17	1906.

[1] 1 per cent. extra from receipts from land sales to be paid in 1907 and thereafter.
[2] Made regular rate.
[3] 1 per cent. extra, to be paid in January, 1907.
[4] First semi-annual payment of 2½ per cent. made Sept. 25.
[5] 12½ per cent. stock dividend.
[6] 25 per cent. stock dividend.
[7] 25 per cent. stock dividend.
[9] First dividend of 10 per cent. on second year of operation, declared in December.

Judged by the precedents of earlier years, the great output of new capital is remarkable for the small proportion of mortgage bonds which it includes. Aside from the two large issues of the Wabash and the Southern and certain first mortgage bonds on new lines under construction, the typical financing of the year has been in stock, or, if in bonds, in those of the convertible sort. This is only an expression in facts of the general tendency only too familiar to every bond salesman that for the present at least, mortgage bonds with a fixed return are not favored by investors. The typical investor of to-day demands a security which shall, whether with or without certain bond features, give him an opportunity to share in the probable increases in value of the railroad property which it covers. The total authorization of new securities included in the list, which will be found on the next two pages, is something over $2,500,000,000—to be exact, $2,697,402,205.

NEW RAILROAD CAPITAL AUTHORIZED AND ANNOUNCED, AND LARGE ISSUES OF STOCK AND CONVERTIBLE BONDS IN 1906.

Name of road.	Amount authorized.	Kind of security.	Amount issued, listed or sold	Amount of refunding covered	Date.
Alabama Great Southern	$1,479,000	4½ per cent. equipment notes.	$1,479,000	.....	May 1
Atchison, Topeka & Santa Fe	98,000,000*	Convertible bonds	.....	.....	July 30, 1907
Atchison, Topeka & Santa Fe	.....	50-year convertible 4 per cent. bonds	17,296,000	.....	April 12
Atlanta, Birmingham & Atlantic	30,000,000	1st mortgage, 30-year, 5 per cent. bonds.	6,000,000	6,059,900	Jan. 1
Atlanta, Birmingham & Atlantic	9,000,000†	5 per cent. preferred stock	4,822,000	.....	June
Atlanta, Birmingham & Atlantic	18,000,000†	Common stock	9,743,800	.....	June
Atlanta, Birmingham & Atlantic	8,000,000	4-year collateral trust 5 per cent. notes of the Atlantic & Birmingham Construction Co.	8,000,000	.....	June
Atlantic Coast Line	1,880,000	1st mortgage bonds of the Macon, Dublin & Savannah	.....	.....	Dec. 22
Atlantic Coast Line Railroad	10,000,000	Common stock	4,557,600	.....	March 3
Baltimore & Ohio	.....	Common stock	27,750,000	.....	April 27
Boston & Maine	10,000,000	20-year refunding 4 per cent. deb. bonds.	10,000,000	10,319,300	Sept. 1
Boston & Maine	2,000,000	Fitchburg R. R. bonds	2,000,000	1,500,000	Sept. 26
Boston & Maine	4,203,700	Common stock	4,203,700	.....	June
Buffalo, Rochester & Pittsburg	4,200,000	Stock of Mahoning Investment Co.	4,125,000	.....	December
Buffalo, Rochester & Pittsburg	1,500,000	Construction and improvement; 3-yr. 4½ per cent. notes.	1,500,000	.....	Aug. 1
Canadian Northern	2,200,000	Equipment bonds of the Imperial Rolling Stock Co.	2,200,000	.....	June 1
Canadian Pacific	40,000,000	Stock	20,280,000	.....	March 19
Central of Georgia	3,320,000	10-yr. 4½ per cent. equip. tr. certificates	3,320,000	.....	Feb. 1 and July 1
Chesapeake & Ohio	6,100,000	4 per cent. equipment trust certificates.	6,100,000	.....	Ap. 2, Je. 1, Aug. 1, Oct. 15
Chicago & Alton	2,260,000	4 per cent. guar. equip. certif. C. & A. Equip Ass'n.	2,260,000	.....	June 1
Chicago & Eastern Illinois	4,400,000	4½ per cent. equipment notes	4,400,000	.....	Aug. 16
Chicago & Illinois Midland	5,000,000	1st mortgage, 5 per cent. bonds	780,000	350,000	Feb. 1
Chicago & North-Western	.....	Common stock	16,267,400	.....	April 2
Chicago & North-Western	100,003,835	Common stock	.....	.....	August
Chicago, Indiana & Southern (N. Y. C.)	20,000,000	Capital stock	.....	5,626,250	March
Chicago, Indianapolis & Louisville	1,500,000	1st mortgage, 50-year 4 per cent. bonds of the Indianapolis & Louisville	1,500,000	.....	Jan. 1
Chicago, Milwaukee & St. Paul	75,000,000	Preferred stock	66,328,500	.....	Sept. 29
Chicago, Milwaukee & St. Paul	75,000,000	Common stock	33,164,300	.....	Sept. 29
Chicago, Milwaukee & St. Paul	.....	Common stock	24,802,809	.....	Aug. 29
Chicago, Rock Island & Pacific	5,600,000	4½ per cent. equipment tr. certificates of the R. I. Imp. Co.	5,600,000	.....	Nov. 1
Chicago, Rock Island & Pacific	6,000,000	2-year 4½ per cent. notes	6,000,000	.....	April 7
Chicago Terminal Transfer	3,500,000	5 per cent. receiver's certificates	3,500,000	.....	May 14
Cincinnati, Hamilton & Dayton	1,023,660	Receiver's certificates	1,023,660	.....	Jan. 1, July 2
Cincinnati, New Orleans & Texas Pacific	1,938,000	4½ per cent. equipment notes	1,938,000	.....	May 1
Cleveland, Cincinnati, Chicago & St. Louis	10,000,000	Stock	10,000,000	.....	Oct. 31
Colorado & Southern	5,000,000	1st mortgage bonds Houston Belt Line & Terminal Railway	5,000,000	.....	Sept. 20
C. S., N. O. & Pac. (St. L. & S. F.)	12,000,000	1st mortgage 4½ per cent. bonds	8,500,000	.....	March
Delaware & Eastern	1,000,000	1st mortgage, 50-year, 5 per cent. bonds.	800,000	.....	Feb. 1
Delaware & Hudson	14,000,000§	4 per cent. 10-year convertible deb.	14,000,000	.....	Feb. 19
Delaware & Hudson	10,000,000	40-year 3½ per cent. bonds of the Albany & Susquehanna	10,000,000	10,000,000‖	April 1
Denver, Yellowstone & Pacific	8,750,000	1st mortgage 30-year 5 per cent. bonds.	1,650,000	.....	Jan. 1
Duluth, Missabe & Northern	1,600,000	5 per cent. bonds	.....	.....	May
Duluth, Rainy Lake & Winnipeg	2,000,000	1st mortgage bonds	1,000,000†	.....	Jan. 1
Evansville & Terre Haute	1,200,000	4½ per cent. equipment bonds	1,200,000	.....	Feb. 1
Georgia Coast & Piedmont	1,000,000	1st mortgage 50-year 5 per cent. bonds.	406,000	.....	March 1
Great Northern	150,000,000¹	Certificates of beneficial interest in ore land trust	150,000,000	.....	December
Great Northern	60,000,000	Stock	60,000,000	.....	Dec. 11
Grand Trunk	1,000,000	Guar. 30-yr. 4 per cent. bonds of Montreal Warehousing Co.	.....	.....	April 1
Grand Trunk Pacific	25,000,000	Debenture stock	15,000,000	20,000,000²	June 1
Hocking Valley	13,750,000	Stock of new company	13,750,000	13,750,000	August
Hocking Valley	30,000,000	General lien 30-yr. 4 per cent. bonds	17,000,000	17,000,000	July 1
Hudson & Manhattan	100,000,000‡	1st mortgage 50-year convertible 4½ per cent. bonds	50,000,000	5,000,000	Dec. 5
Hudson & Manhattan	40,000,000	Common stock	40,000,000	.....	Dec. 5.
Hudson & Manhattan	10,000,000	5 per cent. preferred stock	5,250,000	.....	Dec. 5
Interborough-Metropolitan Company	70,000,000	4½ per cent. collateral trust bonds.	70,000,000	35,000,000⁴	Jan. 26
Interborough-Metropolitan Company	55,000,000	5 per cent. cumulative preferred stock.	55,000,000	52,000,000⁵	Jan. 26
Interborough-Metropolitan Company	100,000,000	Common stock	100,000,000	91,300,000⁵	Jan. 26
Kansas City Southern	10,000,000⁷	20-year 4½ per cent. imp. mort. bonds.	6,000,000	5,100,000	March 19
La Dicha & Pacific	1,500,000	1st mortgage 6 per cent. 30-year bonds.	1,000,000	.....	Jan. 17
Lake Shore & Michigan Southern	50,000,000	25-year 4 per cent. bonds; no mortgage or collateral lien	35,000,000	.....	Sept. 13
Long Island	10,000,000	40-yr. coll. tr. 4½ per cent. bonds L. I. Consolidated Electrical Cos.	.....	.....	March 14
Louisiana & North West	10,000,000	5 per cent. mortgage bonds	1,725,000	150,000	March
Louisville & Nashville	.....	Atlanta, Knoxville & Cincinnati Div., 4 per cent. bonds	10,000,000	.....	February
Mexican Central	35,000,000	4-year 5 per cent. collateral notes	33,000,000	29,000,000	July 2
Michigan Central	4,500,000	50-year 1st mort. 4 per cent. bonds of Toledo, Canada Southern & Detroit.	1,600,000	1,500,000	Jan. 1
Michigan Central	15,000,000	Guaranteed 5 per cent. bonds of the Detroit River Tunnel Co.	.....	.....	May
Minneapolis & St. Louis	5,000,000	5-year 5 per cent. notes	5,000,000	.....	Feb. 1
Minneapolis & St. Louis	50,000,000	1st mortgage 4 per cent. bonds of the Minnesota, Dakota & Pacific	6,250,000	.....	May
Minneapolis & St. Louis	1,000,000	2d mortgage 5 per cent. bonds of the Des Moines & Fort Dodge	600,000	.....	April 1
Missouri, Kansas & Texas	20,000,000	General mortgage 30-year 4½ per cent. bonds	10,000,000	3,678,568	March 3
Missouri Pacific	6,000,000	2-year 5 per cent. collateral tr. notes	6,000,000	6,000,000	Feb. 10
Missouri Pacific	3,828,000	3d mortgage 32-year 4 per cent. bonds	3,828,000	3,828,000⁸	Nov. 1
Missouri Pacific	1,425,000	5 per cent. certificates of the Missouri Pacific Equipment Association	1,425,000	.....	March 1, June 1
Mohawk Valley Co. (N. Y. C. & H. R.)	10,000,000	Additional capital stock	10,000,000	.....	July.
New York Central & Hudson River	100,000,000	Capital stock	29,839,000	.....	April 18.
New York, Chicago & St. Louis	10,000,000	25-year 4 per cent. debenture bonds	10,000,000	.....	March
New York, New Haven & Hartford	15,592,700	Capital stock	3,362,800	8,018,200⁹	April 14
New York, New Haven & Hartford	15,000,000	Non-convertible 50-year 4 per cent. deb.	15,000,000	.....	May 1
New York, New Haven & Hartford	13,000,000	2-, 3- and 5-year 5 per cent. notes	13,000,000	.....	Nov. and Dec.
New York, New Haven & Hartford	10,000,000	4 per cent. bonds of the New Haven & Northampton	10,000,000	3,900,000	June 1
New York, New Haven & Hartford	7,750,000	50-year guaranteed 4 per cent. bonds of the Providence Terminal Co.	1,000,000	.....	March 1
New York, New Haven & Hartford	10,000,000	50-year guaranteed debentures of the Consolidated Railway	2,500,000	.....	Jan. 1

*$98,000,000 common stock for conversion also to be authorized.

†Approximately.

‡Secured by $7,500,000 4 per cent. first mortgage bonds of the Rock Island, Arkansas & Louisiana.

§$7,000,000 stock also authorized for conversion of these bonds at 200.

‖6 per cent. and 7 per cent. bonds.

¹ Assumed $100 par value; no actual par value.

² Preferred stock, previously authorized.

³ Also an extra $100,000,000 common stock for conversion authorized.

⁴ Interborough Rapid Transit stock which also received $34,650,000 in common stock of the new company.

⁵ Metropolitan Street Railway stock, exchangeable at par.

⁶ This amount of common stock of the new company exchangeable for $30,000,000 stock of the Metropolitan Securities Company, and also for the Interborough and Metropolitan Street Railway stock.

⁷ $5,100,000 5 per cent. 6-year notes were authorized for which $6,000,000 of these bonds are collateral.

⁸ Old 7 per cent. bonds extended.

⁹ Representing $16,038,400 50-year 4 per cent. outstanding debentures of the Consolidated Railway exchangeable, $200 for $100, in stock of the N. Y., N. H. & Hartford.

Name of road.	Amount authorized.	Kind of security.	Amount issued, listed or sold.	Amount of refunding covered.	Date.
New York, New Haven & Hartford	10,000,000	Preferred stock New England Investment & Security Co.	10,000,000	.....	September
New York, New Haven & Hartford	10,000,000	Common stock New England Investment & Security Co.	10,000,000	.....	September
Norfolk & Southern Railway	25,000,000	1st mortgage and refunding 50-year 5 per cent. bonds	14,000,000	3,500,000	Nov. 28
Norfolk & Southern Railway	5,000,000	5 per cent. convertible preferred stock	4,800,000	.....	Nov. 28
Norfolk & Southern Railway	20,000,000	Common stock	12,700,000	.....	Nov. 28
Norfolk & Western	4,000,000	4 per cent. equipment bonds	4,000,000	.....	May 3, June 5, July 5 and Aug. 3
Norfolk & Western	34,000,000[10]	Convertible bonds	14,576,000	.....	Oct. 11
Northern Pacific	95,000,000	Stock	93,000,000	.....	Jan. 7, 1907
Pennsylvania	10,000,000	Pennsylvania Steel Equipment Improvement Trust	.....	.....	January
Pennsylvania Company	20,000,000	Guaranteed 15-25 4 per cent. bonds	20,000,000	.....	February
Pennsylvania Company	50,000,000	1½-year collateral 4½ per cent. notes	50,000,000	.....	May 1
Pennsylvania Company	48,250,000	12-15-year guaranteed 3¾ per cent. French franc loan	48,250,000	.....	June 15.
Pere Marquette	2,038,360	Receiver's certificates	2,038,360	.....	Jan. 1, May 5, July 2
Pittsburg & Lake Erie	20,000,000	Stock	.....	.....	Feb. 28, 1907
Pittsburg, Binghamton & Eastern	20,000,000	50-year 5 per cent. bonds	15,000,000	.....	Oct. 16
Pittsburg, Binghamton & Eastern	20,000,000	Stock	.....	.....	Nov. 14
Pittsb., Youngstown & Ashtabula (Pa. Co.)	9,100,000	Preferred stock	9,100,000	.....	Jan. 1
Pittsb., Youngstown & Ashtabula (Pa. Co.)	5,900,000	Common stock	.....	.....	Jan. 1
Pittsb., Youngstown & Ashtabula (Pa. Co.)	15,000,000	Bonds	.....	3,062,000	Jan. 1
Rock Island, Ark. & La. (C., R. I. & P.)	15,000,000	1st mortgage 4 per cent. bonds	7,500,000	1,262,000	Jan. 1
Rutland (N. Y. C. & H. R.)	1,000,000	1st mortgage 20-year 4 per cent. bonds of the Rutland Transit Co.	400,000	.....	March
St. Louis & San Francisco	3,080,000	10-year 4½ per cent. equipment notes	3,080,000	.....	April 1
St. Louis & San Francisco	7,500,000	5-year, 5 per cent. notes.[11]	7,500,000	.....	April
St. Louis Southwestern	4,000,000	1st refund'g and extension mortgage 50-yr. 5 per cent. bonds of Grays Point Terminal Railway	.....	500,000	Oct. 2
Seaboard Air Line	18,000,000	30-year 5 per cent. bonds	7,300,000	.....	Jan. 10, 1907
Seaboard Air Line	1,750,000	5 per cent. equipment bonds	1,750,000	.....	June 1
Southern	200,000,000	Development and general mortgage 50-year 4 per cent. bonds	15,000,000	65,166,000	April 18
Southern	9,000,000	4½ per cent. equipment tr. certificates	9,000,000	.....	Aug. 1
Southern Indiana	6,000,000	General mortgage 5 per cent. bonds	2,000,000	.....	July
Southern Indiana	5,500,000	Guaranteed 30-yr. 5 per cent. bonds of the Chicago Southern	.....	4,400,000	Oct. 1
Texas & Pacific	5,000,000	Guaranteed bonds of the Opelousas, Gulf & North Eastern	.....[12]	.....	March 1
Toledo, St. Louis & Western	1,000,000	10-year 4½ per cent. bonds certificates	1,000,000	.....	Sept. 1
Tonopah & Goldfield	1,500,000	1st mortgage 15-year 6 per cent. bonds	1,500,000	.....	Jan. 1
Wabash	200,000,000	50-year refunding 4 per cent. bonds	21,862,500[13]	30,000,000[14]	Oct. 22
Wabash	16,500,000	Preferred stock	15,810,000[15]	30,000,000[14]	Oct. 22
Wabash	81,500,000	Common stock	15,810,000[15]	30,000,000[14]	Oct. 22
Wabash	6,180,000	4½ per cent equipment notes	6,180,000	.....	July 1
Wabash	1,100,000	1st mortgage 1-year 6 per cent. notes of the Buffalo Terminal Association	835,000	.....	July
Wadley Southern	1,000,000	1st mortgage 20-year 5 per cent. bonds	800,000	315,000	August
West Jersey & Sea Shore (P. R. R.)	1,999,950	Capital stock	1,999,950	.....	March 6
Wheeling & Lake Erie	2,000,000	1st mort. 50-yr. 4 per cent. guar. bonds of the Lorain & West Virginia	.....	.....	June 1
Wisconsin Central	8,500,000	Superior & Duluth division and terminal mortgage 50 yr. 4 per cent. bonds	7,000,000	.....	March 8

[10] Same amount of common stock for conversion authorized.
[11] Secured by $8,500,000 first mortgage bonds of the Colorado Southern, New Orleans & Pacific.
[12] To be issued at rate of $20,000 a mile of road built.
[13] For refunding.
[14] "A" and "B" debentures.
[15] For exchange.

CONTRIBUTIONS

Policy Versus Production.

Worcester, Mass., Dec. 13, 1906.

To the Editor of the Railroad Gazette:

Regarding your editorial of Dec. 7th on the collision at Lawyer, Va., and especially the italicized portion of the quotation from the *Evening Post*. The wide diversity, not to say confusion, of public opinion concerning the present economic problem is due to the failure to grasp the wide distinction between faults of system and faults of individuals—for, of course, the only way for the faults of the system to manifest themselves is through the faulty acts of individuals.

In your italicized quotation you put your finger on the trouble. The striking characteristic of the present time is the abnormal proportion of the available energy which is devoted to policy and finance, in comparison to the remainder left over for production (using the word production to include transportation). In 1850 70 per cent. of the energy exerted went to productive ends and 30 per cent. to questions of "policy and finance"; that is to say, to questions of the ownership of existing business and values and to the search for new markets or profits (here excluding invention and design, and referring solely to commercial manipulations). In 1900 these figures had been reversed! Seventy per cent. of the energy actually exerted is devoted to "policy and finance" and only the remaining 30—for it *is* a remainder, possible of exertion only after the policy and finance have been attended to—actually accomplishes the entire production of wealth which we enjoy!

These statements are based upon an analysis of the six United States censuses from 1850 to 1900 inclusive. They reveal a change from a primitive community concerned chiefly in production to a complex one concerned chiefly in "policy and finance." All available evidence outside of the census goes to show that since 1900 this half-century's steady alteration in the purpose underlying our national industrial organization has undergone a marked acceleration. Since the change has been one identified with the growth of commercial development, and since that development has been more phenomenal since 1900 than ever before in human records, it is safe to assume, even lacking a United States census, that our plunge into policy and finance has actually been accelerated from the 70 per cent. point of 1900 to an even more remarkable figure.

These curves are set forth in my "Cost of Competition." Without wishing to insinuate that commercial prosperity is an unmitigated evil, it is proper to point out, in the present connection, that some of its inevitable concomitants, which have grown and must grow as it grows and which may decrease only when it has ripened out of itself into its natural fruit, are the prevalence of unemployment, overwork, crime, suicide, heart disease, haste, waste and railroad accidents.

To return now to the mental confusion existing between the people and the railroads. The people have a real and a tremendous grievance, rapidly growing toward the point where it must lead to revolutionary change of laws and customs. It is based, in reality, upon this 70 per cent. waste of the economic energy available for the creation of life-support, by its diversion into "policy and finance." But they express it against individuals who are themselves blameless. Mr. Spencer I did not know personally, but I know two vice-presidents of big roads (one of whom I have heard condemn, at the dinner table, the whole competitive, profit-seeking, dividend-paying, private-responsibility system in sweeping terms) and a number of minor officials. I am ready to believe that they are making every possible personal effort to furnish ample, safe and prompt service, and that the entire railroad personnel is like them. But under the conditions, under the rapidly increasing burden of policy and finance which *must* be carried though the road may stop, they are becoming daily more and more helpless to prevent late trains, overcrowded cars and fatal accidents.

SIDNEY A. REEVE.

The Obliteration of State Lines.

Washington, D.C., Dec. 20, 1906.

To the Editor of the Railroad Gazette:

It was certainly not without deliberation that Secretary Root, at the Pennsylvania Society dinner in New York City, made his significant declaration concerning the future relations between the states and the Federal government. Coming, as it did, from the first cabinet minister of the President who, of all Presidents since Andrew Jackson, most thoroughly dominates and controls the public conduct and expressions of all his subordinates, and coming in

so formal a manner on an occasion chosen with such evident care, this declaration can be regarded as nothing less than an official statement of the President's views and purposes. It is more than this, for it is not only a declaration as to the future but an apology as to the past. The President has done much to centralize power at Washington, and by consequence to subtract from the power exercised at the several state capitols. He now explains that this centralization was necessary because the power which he took from the states was not positively exercised as it should have been, or, as in his view, it should have been. And for the future, he announces, through his Secretary of State, that if the states wish to retain the several powers still left to them, powers be it understood which the fathers refused to delegate to the Federal government, they must exercise them as they ought to be exercised, or rather, as in his view or in the view of the dominant faction of the political party, at any particular time in power, they ought to be exercised. Secretary Root, emissary of the President, being a lawyer, does not fail to note that the written constitution of the United States is a somewhat formidable obstacle in the way of this programme. But being a well-read lawyer and of some ingenuity withal he reminds him that in the early history of the Common Law, in England, whenever the judges did not like the law they changed it by construction. This simple plan of judicial-legislation law-making by those to whom the people had entrusted merely the function of interpreting and enforcing laws made by others, was never very popular and the framers of the American Constitution undoubtedly supposed they had provided against it. Certainly this country has been substantially free from the vice of judge-made law. But the process of centralization has gone about as far as it can go under current interpretations of the constitution and the states are known to be so opposed to the surrender of their reserved powers that it is realized that the ordinary and orderly method of amending the constitution is unavailable. Therefore it is proposed to resort to the extraordinary and illegal means of obtaining new powers by means of new interpretations by the Supreme Court.

No one will realize the nature of the proposal thus formally advanced by the Administration, if he fails to understand that the primary purpose involved is that "increasing control" of the business of railroad transportation and of property productively employed within the several states, but the products of which are destined to become objects of interstate commerce, to which President Roosevelt is committed. That the President would also like to secure Federal control of marriage and divorce, if not of child labor, and that the same character of judicial legislation might eventually strengthen efforts to regulate what he is pleased to call "swollen fortunes" does not detract from the fact that it is with the railroads and the large manufacturing corporations that he is first concerned. Nor is it that the states have failed to satisfy their own citizens by their exercise of the powers reserved to them by the Constitution, as that instrument is now understood. They have satisfied their own citizens, within measurable degrees, but they have not satisfied the President. They have not gone as far in the directions of restriction and supervision as he thinks they ought to have gone. He fears that, hereafter, they will not, to use his own words, "go my pace." For this failure and on account of this fear the rights of the states must be invaded and those of the Federal government increased at the cost of home rule among the sovereignties which make up the Union.

The most immediate question presented by the foregoing is whether the Supreme Court of the United States is likely to lend itself to the proposed programme. If it declines to do so progress toward centralization, along the lines suggested by Secretary Root, will be impossible. Hitherto that august tribunal has maintained an attitude of impartiality as between contending political parties and principles not expressly declared in the Constitution and has yielded nothing to partisan demands. This attitude is the most creditable fact in its honorable history and the element in its position as a co-ordinate branch of the Federal government which judges equal in judicial stature to the demands of that history and controlled by its honorable traditions would last voluntarily surrender. Is it possible that, in spite of this fact, the transformation in the membership of the Supreme Court may, in the early future, change its attitude concerning the proper interpretation of those particular portions of the Constitution which are now supposed to stand in the way of further centralization of power at Washington? This is largely a question of the personnel of future changes for it may be conceded that, like the President, some men eligible to appointment as justices of the Supreme Court, honestly believe that the recognized interpretations are an impediment to national progress and are unwarranted. If there are such, there need be no doubt that, so far as he is able, the President will select future members of the Court from among them. Probably former Attorney-General Moody is of their number, for it is known that no other lawyer in the cabinet has been willing to go as far as he has in supporting the railroad regulation and "trust"-control plans of the President. On the other hand, the only other selection so far made by President Roosevelt, that of Mr. Justice Holmes, antedates the emergence of the plans now predominant, and it is not unlikely that the first of Mr. Roosevelt's appointees will, in this particular, offset the second. As to the future, there are not likely to be more than three vacancies, at the most, before March 4, 1909, and of the three justices, any or all of whom may retire before that date, it is pretty certain that none will give the present President a chance to name his successor if it is physically possible to do otherwise. Yet Chief Justice Fuller, Justice Harlan and Justice Brewer, or any of them, may give place to their successors within two years. If all of them should do so it would not be very surprising to find the four justices, most recently appointed, in sympathy with the policy of centralization. The question then would be, whether even one of the justices of longer service would unite with them or, if not, whether other changes would soon turn the minority into a majority.

HOME RULE.

Proposed 16-Hour Law.

F. C. Rice, General Inspector of Train Service, of the Chicago, Burlington & Quincy, has gathered a number of criticisms on the bill before Congress to limit the working hours of trainmen, from some of which we quote the following paragraphs. (The law is discussed on the editorial page.)

G. W. CREIGHTON, PENNSYLVANIA.

"It is a well-recognized fact by all railroad managements, that to secure the best results along the lines of safety, we must not only provide for proper rest of trainmen, but that rest or lay-over must be so arranged that it will occur at the end of the division where the men live or have their homes.

"Nothing is more demoralizing than to have a long lay-over away from home, where the men are without home comforts and hence are more likely to misuse the time allowed for rest, and consequently would return for duty less prepared for their work than if they returned immediately to their homes, where proper and comfortable rest could be taken.

"The fact that the men would be taken from their runs at the expiration of the time limit of 16 hours would in practice also operate against additional safety in railroading, because the men themselves would object to being relieved from duty out along the line at any point where the 16 hour limit might find them, for the reason that they could not reach a point where they could take rest any sooner than if they continued on to the completion of their run or trip; besides, if relieved on the road their earnings would be cut off, and in most instances they would be compelled to continue on to destination on same train from which they had just been taken off. This fact would at once offer a premium for reckless or fast running in order to reach destination within the time limit of 16 hours and therefore add to the liability of accidents.

"On the Pennsylvania Railroad division where we have, say at Mifflin, a freight train passing every 12 minutes, it will be readily seen that any law that provides for the stopping of trains en route, to change crews, at once introduces an element of the greatest danger."

J. KRUTTSCHNITT, SOUTHERN PACIFIC.

"The passage of this law will not afford any additional protection or safeguard against railroad accidents, for the reason that it is not now the practice to keep men on duty in excess of 16 hours, except in cases of accidents, storm or other emergency. Accidents due to this cause have been of rare occurrence.

"If this law is passed, it will be necessary to abandon a number of terminals, in order to shorten the distance between same to from 100 to 120 miles each, many of the present terminals being in excess of these limits. This will force our present employees to sacrifice the savings they have invested in homes, and also compel the railroads to give up valuable facilities and provide new ones; and it will also seriously interfere with commercial interests at such terminals as will be abandoned. Freight terminals must necessarily be located at points where living accommodations can be obtained for employees, and where suitable school facilities can be had, and only at such points where an ample supply of good water is available, and where it is possible to obtain suitable space for yard tracks and other facilities.

"Its enforcement will necessitate delaying trains between terminals until employees have had the required number of hours' rest, or until relief employees can be sent from the nearest terminal. The tying up of trains in traffic, perhaps within a short distance of terminal, will prove a great hardship to employees, as the delay will invariably occur at a point where there are no facilities for rest and meals, or necessary force to care for train and engine, and where, perhaps, neither fuel nor water is available."

H. J. HORN, NORTHERN PACIFIC.

"Whatever plan is adopted, the cost of freight transportation will be largely increased; and, at the same time, shippers will suffer loss and inconvenience from delay in making deliveries. In many instances, it will be necessary to tie up trains at points where

neither fuel nor water for engines nor food for the men can be obtained. The number of hours that a man is in this class of service depends on the condition of the man. By this, I mean that one man can stand, under certain conditions, 24 hours' service; and another man, in another class of service, is only able to stand eight hours. There is nobody except the man in the service who knows whether he is fit for duty or not. Our train records show that train and engine men have had ample opportunity for rest, and yet may have been up all night, from various causes; they may have had sickness at home, or some slight ailment themselves. I have never known of a case where a superintendent tried to push a man out on the road who said he was unfit for service; and the law should compel the employee to say when he is unfit. The responsibility for saying whether a man is fitted or not for a certain class of work should rest with the man himself. I have worked, during the past few years, for practically 48 hours at a stretch, with enginemen, trainmen, bridgemen and trackmen during troubles, and know that all the men in that service were safe for the positions they were filling."

W. H. GEMMELL, MINNESOTA & INTERNATIONAL.

"A large percentage of the men are not in favor of this law because it decreases their earnings, and takes out of their hands the decision of the question whether or not they are physically fit for duty, when no one is better qualified to decide that than themselves."

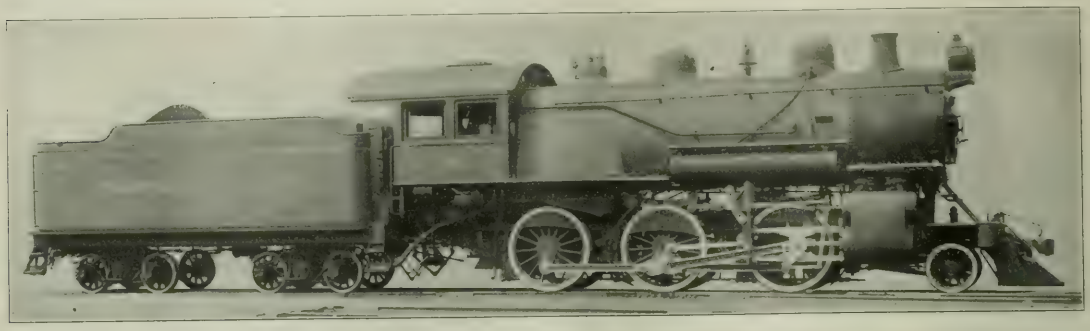
W. W. ATTERBURY, PENNSYLVANIA.

"I believe with the arrangements now in force between the various railroad companies and employees, in the matter of working hours and rest periods, that the lives and property of the traveling public are as well safeguarded as they could be by the enactment of the proposed legislation. In fact, I believe they are even more protected for the reason that if we are obliged to carry a large list of extra men, who, in the natural course of events, would not have the same experience as our old and tried employees, the liability of accident occurring from inexperienced men is as great, if not greater, than with experienced men who might occasionally exceed 16 hours on duty."

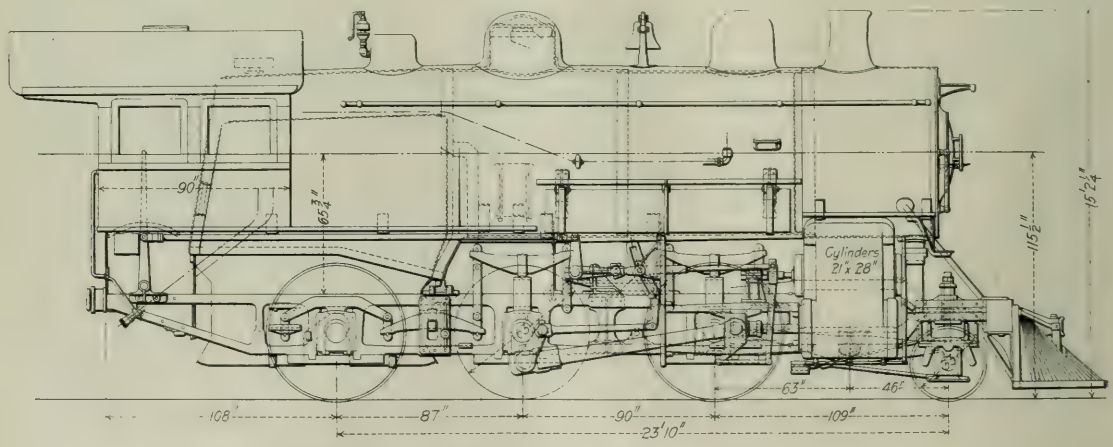
Mogul Locomotive for the Vandalia.

The American Locomotive Company recently built for the Vandalia three heavy mogul (2-6-0) locomotives at the Schenectady Works. Not only is the total weight great but that carried on each of the driving wheels averages 27,700 lbs. at the front. The only case of a greater weight on a single wheel of a six-coupled engine built by this company is that of the Pittsburg & Lake Erie switchers illustrated in the *Railroad Gazette* of August 3.

In general design these engines do not differ from the standard arrangements of the mogul type, except in the use of the Walschaert valve gear and the utilization of the space thus gained between the frames for braces for the latter. This marked advantage of the new type of gear has been quickly seized on by designers and will probably materially decrease the number of frame breakages that have caused so much trouble where large cylinders are used. In this case the cylinders are of 21-in. diameter and 28-in. stroke, giving a tractive power of 33,300 lbs., or as much as that of a 4-6-0 or 2-6-2 engine weighing 200,000 lbs. The boiler is proportionately large for an engine of this size; it is 75 in. in diameter inside the smallest ring, and the plates of the shell are $^{13}/_{16}$ in. thick. The boiler is, however, shorter than many, as the tubes are but 13 ft. 7 in. long. At the dome the shell is cut away for the full diameter of the open-



Mogul (2-6-0) Locomotive Built for the Vandalia at the Schenectady Works of the American Locomotive Company.

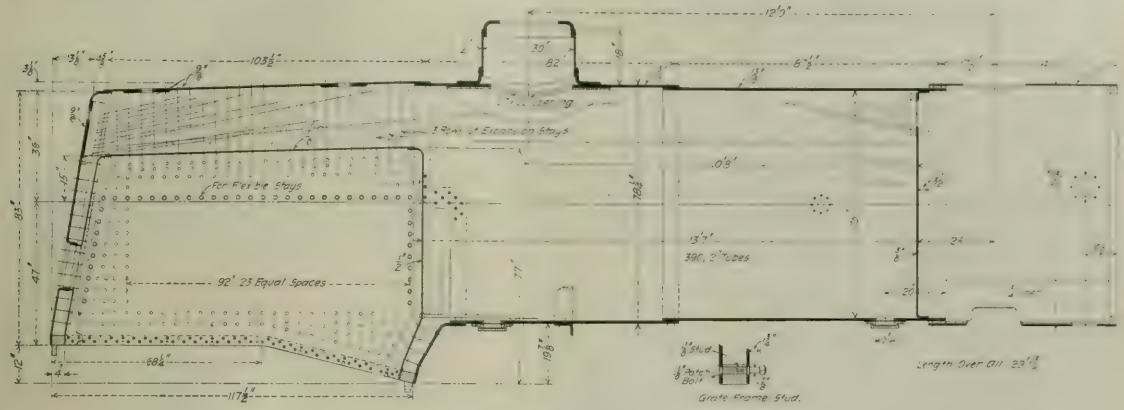


Side Elevation of Mogul (2-6-0) Locomotive; Vandalia Line.

ing, which is strengthened by a broad and heavy stiffening ring. Liners $^{5}/_{8}$ in. thick are also put in beneath the steam openings in the roof sheet.

The firebox is wide and the number and location of the flexible staybolts are interesting. It has been said that the modern locomotive with wide firebox is not troubled with broken staybolts as much as the older type with a narrow firebox dropping down between the frames. In this boiler there is a single row of flexible bolts starting at the front, at about the level of the bottom row of tubes and extending up to the fifth row below the crownsheet, which row is composed entirely of flexible bolts, together with the back vertical row down to the third from the foundation ring. Expansion stays in the crownsheet are also used at the front ends of the rows X and Z, while the ordinary radial stay only is used in the

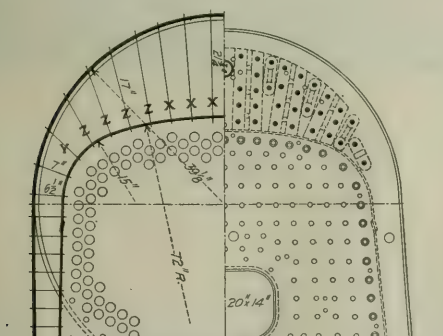
row Y; that is, well over on the side of the curve. It will be noticed, too, that there is a single row of flexible staybolts all around the back head just inside the side and below the crownsheet, reaching from one side up and over to the other side of the foundation ring. At the tubesheet there is a similar row extending up the sides and crossing on a curve just beneath the throat. It will be seen that, with this arrangement, the firebox is held by flexible stays on either side of every corner, so that there can be a yield at that point without putting any bending stress on the stays themselves, as well as allowing a slight buckling at the bends.



Longitudinal Section Through Boiler of Mogul (2-6-0) Locomotive; Vandalia Line.

The small sketch of the grate frame stud shows how that stud is put into the foundation ring and how the opposite sheet is held with a patch bolt, so that both sheets are held at intervals in this way. Back of the saddle the boiler is carried by buckle plates in the usual manner except at the front end of the foundation ring, where it is supported on a special bracket, as shown in the side elevation.

The general design of the engine presents no marked features other than its size and the fine proportions of the whole. The total weight of the engine in working order is given as 187,000 lbs., of which 159,300 lbs. are on the drivers and 27,700 lbs. on the truck. An examination of the equalizing system and spring suspension shows that the weight assigned to the drivers is not equally distributed over all three pair. The equalization is of the usual type, and in the connection between the forward pair of wheels and the truck the leverages are equal, so that 55,400 lbs. is on the front drivers, leaving 51,950 lbs. for each of the two rear pair. This distribution of weight is made for by placing an extra leaf in the springs over the forward driving boxes.



Cross-Section Through Firebox.

Attention is called to the length of the radius arm of the pony truck. We are not aware of the existence of any established formula for calculating this dimension, but, in a report to the Master Mechanics' Association in 1891, it was incidentally mentioned that the length is sometimes determined as follows:

$$X = \frac{D R + D^2}{R + 2 D}$$

In which

R = rigid wheel base.

D = distance from the front flanged driver to the center of the truck.

X = length of the radius bar.

This formula gives a rather long bar and no engines of recent date, that have been examined, seem to have been designed in accordance with it. Checking off a number of locomotives built by the American Locomotive Company, it is found that a modification can be made that fits them so closely that it almost seems that the designers used it, barring slight variations due to the elimination of fractions of an inch and the adjustments due to the necessities of construction. This modified formula is:

$$X = .85 \left(\frac{D R + D^2}{R + 2 D} \right)$$

The formula actually used is

$$X = \frac{T \times D}{T + D} \times .85$$

in which T = the total wheel base for mogul and consolidation locomotives; the other symbols remain as before.

The following are some of the principal dimensions of the locomotive:

Cylinders, diameter	21 in.
Piston, stroke	28 "
Wheel base, driving	14 ft. 9 "
" total	23 " 10 "
" " engine and tender	56 " 10¼ "
Weight in working order	187,000 lbs.
" on front drivers	55,400 "
" on rear drivers	51,950 "
" on all drivers	159,300 "
" on truck	27,700 "
" of tender	146,000 "
Heating surface, tubes	2,754.6 sq. ft.
" " firebox	180.4 "
" " total	2,935.0 "
Grate area	52.0 "
Axles, diameter of driving journals	9½ in.
" length of driving journals	12 "
" diameter of truck journals	6½ "
" length of truck journals	12 "
Boiler, type	Straight top, radial stay
Boiler, pressure	200 lbs.
Firebox, length	9 ft. 0⅛ in.
" width	5 " 9¼ "
" thickness crown sheet	7/16 in.
" " side and back sheet	5/16 in.
" " tube sheet	½ in.
" water space, front	4½ in.
" water space, sides and back	4 "
Tubes, number	390
" diameter	2 in.
" length	13 ft. 7 in.
Exhaust nozzle	Single
Exhaust nozzle, diameter	5¼ in. and 5½ in.
Height of stack above rails	15 ft. 3 in.
Tank, water capacity	7,500 gals.
Tank, coal capacity	13 tons
Valves, type	Piston
Valves, lead	1/16 in.
Valves, travel	6 in.
Diameter of driving wheels	63 in.
Tractive power	33,300 lbs.

$$\frac{\text{Weight on drivers}}{\text{Tractive power}} = 4.78$$

$$\frac{\text{Total weight}}{\text{Tractive power}} = 5.61$$

$$\frac{\text{Tractive power x diameter drivers}}{\text{Heating surface}} = 714.78$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 56.44$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 0.062$$

$$\frac{\text{Weight on drivers}}{\text{Heating surface}} = 56.0$$

$$\frac{\text{Total weight}}{\text{Firebox heating surface}} = 63.71$$

Volume of 2 cylinders = 11.22 cu. ft.

$$\frac{\text{Total heating surface}}{\text{Volume of 2 cylinders}} = 261.58$$

$$\frac{\text{Grate area}}{\text{Volume of 2 cylinders}} = 4.63$$

Disastrous Collision in the District of Columbia.

In a rear collision on the Baltimore & Ohio, at Terra Cotta, D. C., on Sunday evening, December 30, about 6.20 o'clock, a passenger train of three cars was completely wrecked and 53 or more persons were killed, about 60 at the same time being injured. Some of the killed and injured were persons on the station platform about to board the train which was run into, which had just stopped at the station. This was eastbound local passenger train No. 66, bound to Washington, the terminus of that division of the road. Following it was a train consisting of an engine and eight empty passenger cars, and this struck the standing train at full speed, making a terrible wreck. The colliding engine was, however, not very badly damaged, and the engineman and fireman escaped with little or no injury. The wreck did not take fire. The train of empty cars had passed the last block station, Takoma Park, at full speed, and, according to all accounts thus far published, in violation of the block signal, which indicated stop. There was a dense fog at the time. The engineman, an experienced runner, has as yet made no coherent statement. He and all the rest of the men in charge of the train were arrested by the police of the District of Columbia, and are held in jail.

Foreign Railroad Notes.

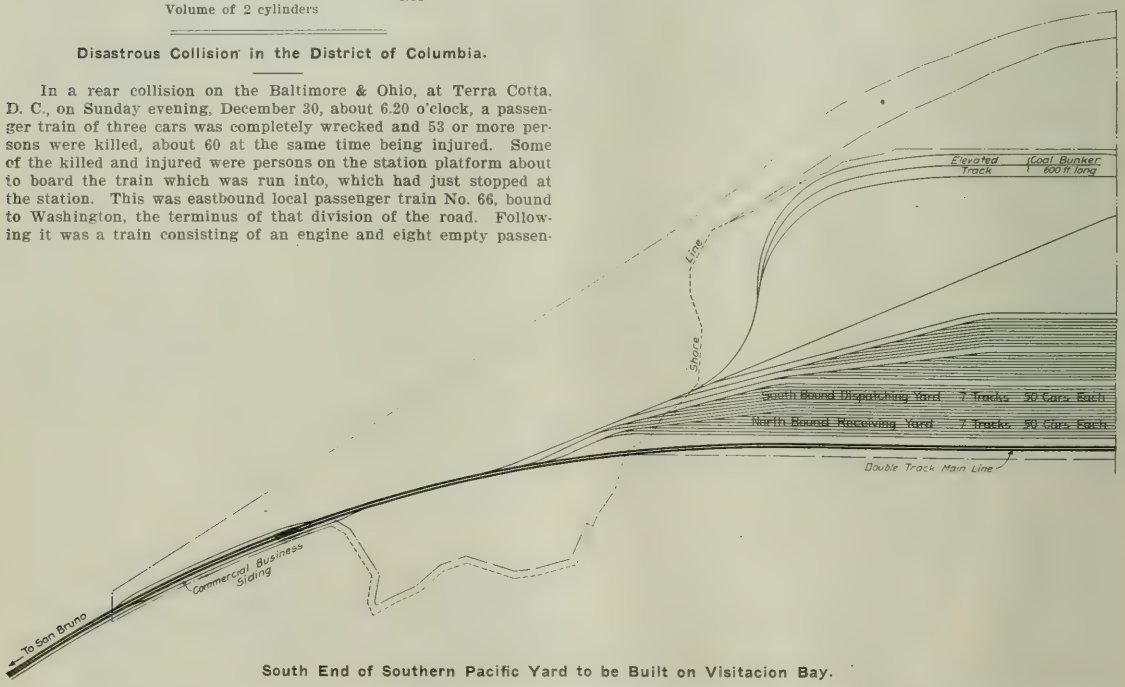
A press despatch from London, December 31, says that the railroads of the United Kingdom, members of the Railway Clearing House Association, have joined in an agreement to abolish private rebates to shippers; and that the agreement contains a provision for the payment of heavy fines for violation.

According to consular reports, the idea of building automobile highways in South Africa to compete with railroads is extensively favored. It is estimated that such roads could be built for $2,500 a mile, while a railroad costs $20,000; also that passenger and mail traffic could be handled more quickly and cheaply with automobile coaches. During the first nine months of the present year, the value of automobiles exported from Great Britain to South Africa was considerably more than in any previous year.

A London cab company has ordered from France 500 motor cabs, of which 100 are to be delivered this month. The fares for these cabs will be lower than the present rate inside the four mile radius, Charing Cross being the center of the circle. The fare will be 16 cents for the first half mile, whether one or five passengers are carried. For the first mile, the rate is 24 cents and for two miles 32 cents; outside the four-mile radius the charge will be 24 cents for every mile. When hired by the hour the fare is 87 cents per hour. All the cabs are to be fitted with taxameters, which register the distance traveled.

New Bay Shore Yards of the Southern Pacific at San Francisco.

This is a transition period for the terminal arrangements of the railroads entering San Francisco and Oakland. As a result of changes made necessary by the earthquake and the opportunity to extend at the same time terminal facilities which are inadequate for present traffic large changes are being made by the different roads.



South End of Southern Pacific Yard to be Built on Visitacion Bay.

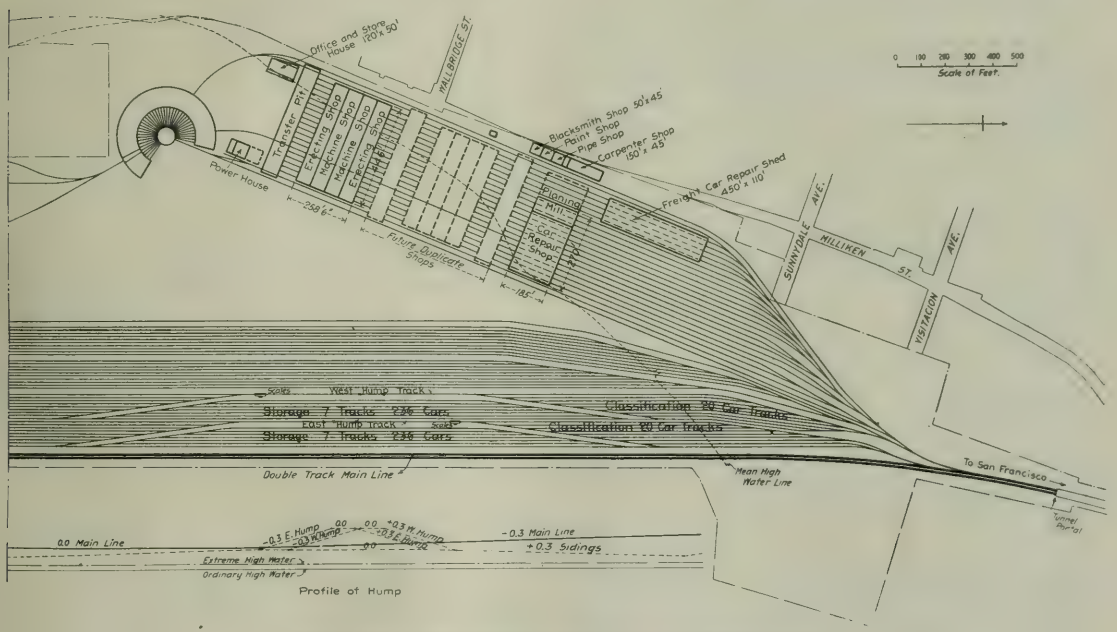
The Southern Pacific is to have one of its most important terminals at Visitacion bay, six miles south of San Francisco, on the line of the Bay Shore cut-off, a new line which is almost ready for operation. Here over 200 acres in a semicircular area, with a deep water frontage of one mile, are being reclaimed by electric dredges. This water front includes a large part of the cove known as Visitacion bay, which connects with San Francisco bay. As soon as the new cut-off is placed in operation the yards, roundhouses and repair shops at this point will relieve the pressure on the present terminals in San Francisco and Oakland. The present machine shops on Sixteenth street and car-repair shops on Kentucky street will be abandoned, only the Kentucky street roundhouse remaining in the city. Some of the coach cleaning will be done at San Francisco, but freight trains will be made up at Visitacion bay.

Under this arrangement the trains leaving San Francisco for Los Angeles and the southern route over the Coast division will follow the bay shore close to the sea level as nearly as possible by the new cut-off instead of winding out through the Mission hills over heavy grades and curves for the first five miles. The cut-off route, after leaving the station at Third and Townsend streets, passes through five long double-track tunnels 24 ft. wide, and across

a number of long fills, crossing shallow arms of the bay, and finally rejoins the original main line at San Bruno, about 11 miles out. Some four miles of distance is thus saved. Also the new route has low grades. When a proposed bridge across San Francisco bay at Dumbarton point is built the new yard will be even more important. Trains whose runs formerly ended at Oakland, will then cross the bay over the cut-off instead of by car ferry.

The Visitacion bay yard is to be about 8,400 ft. long, from the yard limits on the south to the portal of the large tunnel on the north. It is 1,800 ft. wide from the sea wall at the main tracks of the Bay Shore cut-off to the company's property line on the west. The main tracks are about 8½ ft. above ordinary high tide. There are two main tracks now built, with space reserved for two more. The accompanying drawing shows the layout of the yard. The main freight yard is laid out for 38 tracks. At the south end, just west of the main tracks, are seven tracks with a capacity of 50 cars each for the southbound despatching yard, and the same number of tracks for the northbound despatching yard. Further north are 14 storage tracks with a total capacity of 472 cars. At the north end of the yard are 18 classification tracks with a capacity of 20 cars each.

Work is already in progress on the pile foundations of most



North End of New Southern Pacific Yard on Visitacion Bay.

of the shops and other buildings at the yard. Most of the shop buildings are to have concrete foundations on piles, with brick and steel superstructures. In the layout of the yards ample ground space is allowed for building duplicates of all of the shops at some future time. In the drawing future proposed extensions of these buildings are indicated by dotted lines. There will be a power house from which steam pipes are to run for use on the locomotives, but there is to be no steam heat in the buildings, as this is not necessary in the California climate. Near the south end of the yard is a coal bunker 600 ft. long. Five hundred feet north of this and extending northward are the following buildings: A 40-stall roundhouse, the center of which is 1,350 ft. west of the main track of the Bay Shore cut-off; the power house, 31¼ ft. by 87¼ ft.; office and storehouse, 50 ft. by 120 ft.; machine shop and erecting shop, 258 ft. by 437½ ft., one-half to be built at once and the remainder later. Eighty feet south of the machine shop is a transfer pit 70 ft. by 481 ft. Space is also reserved north of the machine shop and erecting shop for another transfer table. Other structures are a carpenter shop, 45 ft. by 150 ft., and a car repair shop 185 ft. by 270 ft., with an adjoining planing mill, a part of which, 62½ ft. by 185 ft., will be built now and a large extension later. A freight car shed 110 ft. x 450 ft., equipped with a 20-ton traveling crane, is the last building at the north end of the yard. In connection with this, there is provision for 24 freight car repair tracks.

For this information we are indebted to William Hood, Chief Engineer of the Southern Pacific.

Railroad Officers on the 1907 Outlook.

Following our usual custom, we have asked officers of the principal railroad systems to express an opinion on the outlook for 1907. We agreed in each case not to quote the writer or his road by name; therefore we have tabulated the replies received under the questions asked, as follows:

(1.) How does the general railroad outlook for 1907 appear to you, compared with the outlook a year ago at this time?

CENTRAL WEST.

The outlook for 1907 as compared with that of a year ago is better in that many wage questions are settled, and, in consequence, fear of labor troubles lessened. Improved facilities should permit of larger railroad earnings at a smaller proportionate cost, and I do not see reason to expect any impairment of the country's prosperity within the next 12 months; therefore the volume of net earnings should be maintained notwithstanding higher costs of labor and certain classes of material. —*Vice-President.*

Business is very good and is going to continue very good, and the only difficulty is that railroads are between two fires. There is a constant demand of communities competing with each other for reduced rates. It seems impossible to advance rates, and yet we are compelled to increase wages and compelled to pay more for materials. At the same time, the public, and even the technical newspapers, are demanding of the railroads many improvements. Officers directly concerned in the operation and management of railroads are anxious to make many of the improvements quite as much as the public wish them; but the question is where to get the money. Mr. Hill pointed out in a recent speech at Chicago that the railroad facilities had not kept pace with the growth of the country's business. This is absolutely so, but how can we cure it? Complaining about it will not cure it. The difficulty is a fundamental one concerned with the economics of the question. The trouble is that capital will naturally seek investment where the rates of interest, considering the certainty of return, are the best, and capital is finding, and has found for a number of years, more remunerative investment, all things considered, in other lines than in the development of railroads.

We want the newspapers, and especially the railroad and engineering newspapers, to analyze these questions, and point out the facts, and not *hammer* railroad officials constantly for improved facilities, safety appliances and all sorts of things, which the railroad officers would be glad to have if they possibly could get them. There are many railroad companies which would be glad to spend millions of dollars on improvements of all kinds just as rapidly as the work could be done; but the question is, how to persuade the people and institutions who have the money to invest it with

us. Reducing passenger fares and freight rates won't help to accomplish it.

The statistics in regard to railroad accidents published by one of the bureaus at Washington are misleading in the extreme, and, like the evidence which was recently prepared for Congress in the discussion of the proposed Sixteen Hour Law, it is a special pleading for a particular thing which it is sought to accomplish. An important function for a technical or scientific newspaper would be the advocacy of accurate and therefore impartial statistics. The Interstate Commerce Commission and the statistical bureaus in Washington exist for the whole people; not for the shipping interests against the railroad interests, not for the interests of the employee against the interest of the employer. The railroads of the country pay about one-tenth of the total taxes of the country and are entitled to fair treatment. We ask nothing more, and we should receive nothing less. —*President.*

The general outlook for 1907 has prominently in the foreground the shortage of all kinds of railroad labor, the excessive wage demands of organized labor, the continuing growth of tonnage in much greater proportion than new cars are built to provide for it, the greater output of each individual factory, without a comparative increase in the facilities at the factory for taking care of fuel and other raw materials in-bound, and the lack of adequate additions to the terminals of many of the railroads.

—*President.*

The general railroad outlook does not appear to me as favorable as it was a year ago, on account of the enormous increase in cost of labor and material, and the constant tendency to reduce rates all over the country. —*President.*

The general railroad outlook for 1907 appears fully as good now as it did at this time a year ago. —*Vice-President.*

Fully as encouraging. —*Vice-President.*

TRUNK LINES.

The prospects for 1907 are very encouraging and there is good reason for the belief that the business of the country will continue to increase. The healthy growth in the various industrial and commercial lines means more tonnage for the railroads. Manufacturing business of every description is flourishing to a point never before experienced. The coal mines are all doing a large and increasing business. —*President.*

The general railroad outlook for the year 1907 is as good as it was for the year 1906 at this time last year. —*President.*

NORTHWEST.

The general outlook for 1907 appears to be fully as good as the outlook a year ago for 1906. —*President.*

WEST.

The general railroad outlook for 1907 appears to be quite as good as that of a year ago; there is no apparent diminution in the volume of business and it is impossible to say how much might be done if the facilities to do it with were present.

—*President.*

On the surface the outlook is equally good, but we have reached a point where over-speculation, political agitation and labor demands are going to impair the net results. —*Vice-President.*

SOUTHWEST.

Do not see anything to prevent the continuance of the general prosperity. In my opinion, business will rather increase than decrease. —*Vice-President.*

I think the general railroad outlook for 1907 is quite as good as that for 1906 seemed to be a year ago.

—*Chm. Exec. Comm.*

The general outlook for railroads for the year 1907 appears to me to be fully as favorable as at this time last year, if not more so.

—*Vice-President.*

SOUTH.

I think gross earnings will be less and expenses more.

—*President.*

The outlook for the coming year, to my mind, throughout the south, is just as favorable as it was a year ago at this time.

—*Vice-President.*

The general railroad outlook with us for 1907 is very unsatisfactory, by reason of increased cost of material of all kinds, and especially coal, and the decline in the quality of the coal we are using. Also from an increase in wages and the employment of a larger number of men than has heretofore been necessary in handling our business. —*President.*

EAST.

The continued prosperity of the country promises, in my opinion, an exceedingly busy year for its railroads. —*President.*

The general railroad outlook for earnings for the year 1907 seem to be good on account of the crops, demand for merchandise and the general prosperity of the country. —*President.*

(2.) Extraordinary expenditures and betterment work. How will your expenditures in 1907 compare with those in 1906? How much do you expect to spend?

CENTRAL WEST.

Expenditures will be somewhat larger.

—*Vice-President.*

Practically nothing. —*President.*

We do not expect to spend over half a million dollars during the calendar year on improvements and betterments, and the completion of work now under way. —*President.*

We spent about $2,500,000 during last year. Our expenditures during next year will depend entirely on the financial market.

—*Vice-President.*

TRUNK LINES.

We are carrying on a large extension and betterment work that was authorized during the year 1906. We have not at present decided what additional work will be undertaken during the year 1907. —*President.*

NORTHWEST.

We expect to spend on extensions and betterment work about the same amount of money as spent in 1906. —*President.*

WEST.

We expect to spend in extraordinary betterment work as much money as it is physically possible to spend; we did this in 1906 and in 1905. Just what it will amount to in dollars and cents it is very hard to state, but it will possibly be seven or eight millions. As to extensions almost the same thing may be said. We shall build as much track as we can get men and materials for. We have also more than $11,000,000 worth of equipment on order, to be delivered during 1907, which is probably all that we can get under any circumstances. —*President.*

This work has not yet been outlined. It is contingent upon several matters: scarcity of material and scarcity of labor makes difficult undertakings which are necessary if the present volume of business is to be maintained. —*Vice-President.*

SOUTHWEST.

We expect to spend about the same amount for extraordinary betterments during 1907 as we have during 1906, or approximately $1,250,000. This will all be expended on improvement of existing lines. —*Vice-President.*

We hope to spend in 1907 the same amount on extensions and extraordinary betterment work as was spent in 1906.

—*Chm. Exec. Comm.*

We have as yet made no estimate of expenditures to be made for extensions and extraordinary betterment work, but expect them to exceed somewhat the expenditures for these purposes in the year 1906. —*Vice-President.*

SOUTH.

Cannot say at this time. —*President.*

I am unable to state how much we will spend in extraordinary betterment work as compared with 1906. We do not contemplate any extensions during this year. —*President.*

EAST.

Our present plans, as outlined, contemplate expenditures for permanent improvements during the coming year, for motive power shops, installation of block signals, and the construction of several pieces of second track, aggregating some four or five millions of dollars. —*President.*

We do not expect to spend any considerable amount of money on extensions during the year 1907. —*President.*

(3.) Are you making any special efforts to check the prevalent increases in operating expenses?

CENTRAL WEST.

Nothing unusual, except in the way of prompter movement of cars. —*Vice-President.*

No. —*President.*

We are making every effort possible to check increases in operating expenses, but conditions are such that our best efforts avail but little. —*President.*

We are always endeavoring to check increases in operating expenses. —*Vice-President.*

We have been diligently scanning every item of operating expense since my advent on this road, and we are now operating a line of varied gradients at a cost of approximately 3 mills per ton-mile, and we hope to get somewhat below this figure, although you will probably agree that this is a pretty low cost.

—*Vice-President.*

TRUNK LINES.

Special effort will be made to check the increase in operating expenses, but it looks as if it will be of little avail, as all employees expect increases in wages. —*President.*

NORTHWEST.

We are always making efforts to check the prevalent increases

in operating expenses, but with the increased prices of labor and material are meeting with very limited success.

—*President.*

WEST.

Of course we are making all possible efforts to "check the prevalent increase in operating expenses," but with the best of efforts there will be a large increase both in wages and cost of material. Moreover, business done under such terrific pressure as now exists cannot be done economically. —*President.*

There is no possible way to check this with the increased demands of labor, the increased cost of material, the increase of taxes, and stricter regulations by municipalities, state and congressional, and this, to my mind, is laying the foundation for panic conditions.

—*Vice-President.*

SOUTHWEST.

Yes, but the increase occurs almost wholly in labor and material charges, so there is little possibility of our making any great reduction. —*Vice-President.*

We are doing everything possible to keep down cost of operation.

—*Chm. Exec. Comm.*

We are making special efforts to reduce operating expenses.

—*Vice-President.*

SOUTH.

We are trying to keep our expenses down to the lowest figure possible consistent with economical operation.

—*President.*

We are making every possible effort to check the increase in operating expenses. —*President.*

EAST.

We are doing what probably every other railroad management in the country is attempting—to check inordinate increases in operating expenses—but experience has shown that but little can be done in this direction so long as there is a rapid expansion in business and in gross earnings. —*President.*

We are unable to check the prevalent increases in the operating expenses, except that materials and labor have advanced to a considerable extent. —*President.*

(4.) Are you apprehensive about the attitude of the present government towards corporate interests?

CENTRAL WEST.

I am; but rather in connection with state than federal governments. However, it seems to me that a change in the tide is at hand and that frankness in dealing with the people, coupled with earnest efforts along educational lines, will be productive of excellent results. —*Vice-President.*

We can only hope that the rumored intentions are without foundation. —*President.*

I am apprehensive as to the attitude of the government towards corporate interests. —*President.*

Do not feel particularly apprehensive as to attitude of the national government toward corporate interests, but very much so as to that of the states. —*Vice-President.*

Not at all, as the government officials, having these matters in charge will have an opportunity to become familiar with all the phases of railroad operation, which in many cases justify rules of practice which, to the layman, look irregular and unreasonable, and this will be better for the public generally.

—*Vice-President.*

TRUNK LINES.

We do not feel extremely apprehensive as to the attitude of the government towards corporate interests. —*President.*

NORTHWEST.

We are not at all apprehensive of the present government towards corporate interests. This refers to the general government. We are much more interested in the attitude of the state governments. At the present time they are soaking the railroads outrageously on taxes, and this attitude is preventing eastern people from putting money into new railroad work. —*President.*

WEST.

There is undoubtedly apprehension among the owners of railroads as well as other corporations as to the attitude of the present government. While those in authority probably do not mean to be unjust they are tampering with matters of which they have very imperfect knowledge and are liable to do a great deal of injury.

—*President.*

It appears to us that the attitude of the government towards corporate interest will prevent to a great extent the enlargement of the present ones, except where compulsion requires, and it will prevent the establishment of new ones, as capital will not feel safe in the hands of both labor and politicians.

—*Vice-President.*

SOUTHWEST.

Yes. —*Vice-President.*

I am very apprehensive of the effect of the attitude of the present government towards corporate interests. They seem to [illegible] void of wisdom (not of honesty), and people so constituted are probably capable of working the greater destruction.

—*Chm. Exec. Comm.*

We are apprehensive of results detrimental to the railroads growing out of the attitude of the government towards corporate interests. —*Vice-President.*

SOUTH.

I do not think the attitude of the present national or state government towards corporate interests could be much more harmful; it probably will remain, however, until the government learns that the general public is interested in corporations.

—*President.*

We are apprehensive about the attitude of the government towards corporate interests. Railroads have been assailed by federal and state officials and by the press to a large extent, resulting in an abnormal and very unjust public sentiment with respect to the rights of the owners of railroad properties—the idea prevailing that anything that can be gotten from the railroads in any way is legitimate gain to whoever may lay hands on it.

—*President.*

EAST.

The attitude of the government toward corporate interests in the present state of the public mind is pregnant with possible evils, but unless the Interstate Commerce Commission makes arbitrary and unfortunate use of its rate-making power I do not believe that such railroad managements as are endeavoring to conduct their public business in a proper way have very much to fear.

—*President.*

I am not apprehensive about the attitude of the present government toward corporate interests. —*President.*

(5.) How do your labor costs compare with those of a year ago?

CENTRAL WEST.

About 10 per cent. higher. —*Vice-President.*

Any statement of labor cost at this time will be misleading Readjustments are now being made pretty much all over the country. Data obtained 30 days from now will be valuable.

—*President.*

Labor costs will show increases after January 1st, between 5 and 10 per cent. over a year ago. —*President.*

Labor costs increased 10 per cent. compared with those of a year ago. —*Vice-President.*

We have, as yet, made only slight increases.

—*Vice-President.*

TRUNK LINES.

On account of increases in wages, our labor costs compared with that of a year ago will show an increase of about 8 per cent

—*President.*

NORTHWEST.

Labor is from 10 to 20 per cent. higher than a year ago and men very scarce at any price. —*President.*

WEST.

It is not possible at this moment to state in percentages what our labor is costing us compared with a year ago. The advances which will undoubtedly have to be made to train and enginemen have not as yet become operative, and the wages in those lines are nominally the same as a year ago. But there have been considerable increases in less important lines, and, of course, the cost of everything we buy has been enhanced by general labor conditions I regret to say also that labor is as a rule less efficient in proportion as it is better paid. —*President.*

The labor cost is very materially higher, averaging all the way from 10 to 30 per cent., according to the character of the people employed. —*Vice-President.*

SOUTHWEST.

Our labor costs are easily 10 per cent. higher than a year ago and will undoubtedly increase from 10 to 12 per cent. for year 1907

—*Vice-President.*

I think our labor costs are likely to be increased by the present disposition to increase the rate of wage. —*Chm. Exec. Comm.*

Our labor costs, as compared with those of a year ago, show considerable increase. —*Vice-President.*

SOUTH.

Nearly 10 per cent. higher. —*President.*

Our labor costs from advances in wages and the employment of extra labor for the first four months of the fiscal year will amount to nearly 25 per cent. over the same cost of a year ago.

—*President.*

EAST.

As the whole matter of wages paid to all classes of employees is undergoing the process of readjustment, it is impossible to make any comparisons at the present time, upon this subject, with conditions existing a year ago. —*President.*

We are now negotiating with our employees as to settlement of the wage question. —*President.*

(6.) Car detention and diversion: Are you seriously troubled? What do you consider the proper remedy?

CENTRAL WEST.

Yes. Remedy: Increase in per diem rate for car hire.
—*Vice-President.*

We are seriously troubled by car diversion. The remedy would be a proper use by all lines of foreign cars. This can be stimulated by a diversion rule with a penalty of five to ten dollars for each diversion. —*President.*

We are seriously troubled with car detention and diversion. A remedy is now being considered by a special committee appointed for the purpose. It will probably come through an increase in per diem and penalties, more prompt unloading, and the discontinuance of their use as storehouses. —*President.*

We are experiencing much inconvenience by delays and diversions of our cars on other roads—not on our own lines. Remedies: Higher per diem, and, by roads which are short of equipment, making up their deficiencies. —*Vice-President.*

Being an originating road for tonnage to connecting lines, most of our cars are returned to us empty and we naturally have considerable trouble from car detention, but we have confidence in the recent action of the American Railway Association, together with the rulings of the Car Hire Committee, and feel that much good will be accomplished in the way of bringing about better results within the year. —*Vice-President.*

TRUNK LINES.

We are seriously troubled with car detentions and diversions. The remedy, we think, has been found in raising the per diem rate to 50 cents and the application of five dollars penalty for each case of diversion. —*President.*

To meet the requirements of the abnormal increase of freight traffic the railroads need more cars and enlarged terminal facilities. The difficulty in many cases is that the freight houses and yard tracks are not large enough to accept the cars and promptly unload, re-load and get them out on the road again. There are a number of factors that tend to delay the movement of cars, such as slow unloading, often because facilities of consignees are not ample; and while the railroad may collect car service, it does not promptly give the road the use of the equipment.
—*President.*

NORTHWEST.

We are seriously troubled with car detentions and diversions. What cars we have, and we have a pretty good supply, are not returned to us, but are used by other roads without paying any attention to getting them back home. We have seen only a small percentage of our equipment on our own road for the last six months. The proper remedy is for your New York roads and other eastern roads to quit spending money for improving passenger terminals, and for the taking care of the 15, 20 and 25 cent business coming to them on suburban trains. You should spend money on freight terminals. There are plenty of cars in the country to do the business in the country if they can be kept moving. When the West Shore road opened from Buffalo to Weehawken in 1884, there were some terminals added to those in existence. Since that time the country has grown immensely and the business of the country has increased faster than the population, but New York, Philadelphia and Boston have practically the same old freight terminals they had 22 years ago. It is all right to spend money on passenger business, which is a luxury anyway, but when it is spent to the detriment of the freight terminals, it is as good as thrown away. You have plenty of places up the Hudson river 10, 20 or 30 miles from New York that could be utilized for elevators, warehouses and shipping points for vast quantities of material that could be handled promptly and economically and kept out of New York.
—*President.*

WEST.

We are no more troubled with car detention and diversions than heretofore; it has always been bad in rush times and I do not see that it is any worse. One of the remedies for existing conditions is the obtaining of proper equipment by the smaller roads who have heretofore depended on the trunk lines to supply cars and have paid a very inadequate compensation for their use. Another remedy is the strict enforcement of rules and rate of demurrage more commensurate with the value of the property that is used.

In general it may be said that the entire country seems to have all at once outgrown its transportation facilities in spite of the best efforts on the part of the carriers to increase them. I do not know that any one is to blame for it or that any one could have foreseen it. One of the great troubles is, of course, that crops mature in the west, northwest and southwest at substantially the same time, so that cotton, wheat and corn are all pressing for shipment at the same time. In addition to this the domestic needs for coal are also most acute at the same time, so that an equipment and facilities that are ample for the average business of the entire year are inadequate between September 1st and January 1st. This has always been the case more or less but, of course, the condition has been more acute during the last few years. —*President.*

We are, like all other companies, seriously troubled. The volume of business is unquestionable. The shippers have as great desire to store freight as in the past, if not more so, because the volume of their business has increased while their storage facilities have not increased, and therefore they expect the railroads to carry the burden. The remedy is increase in equipment, increase in terminal facilities, and more prompt loading and unloading of cars by the shippers and receivers. —*Vice-President.*

SOUTHWEST.

We are very seriously troubled by shortage of cars, but own ample equipment to handle our business if other lines would return our cars promptly to us, or give us car for car in exchange for business delivered to them at junction points and terminals. We originate from 65 to 70 per cent. of our traffic, so that failure to return our equipment very quickly strips our line of cars. I am in doubt as to the proper remedy for this situation, but considerable relief can be found in the avoidance of detention of cars at tidewater and eastern mills. This is especially true at tidewater where free time approximating 60 days is allowed. The business of the country has seemingly outgrown the facilities, not so much those of the railroad companies as those of elevators, warehouses, docks, etc., and consignees as a rule insisting on the full limit of free time allowed in unloading; in fact, so many concessions in the matter of free time have been made in years past that it seems almost impossible to overcome it now. —*Vice-President.*

We are very seriously troubled by detentions and diversion of our cars by our connections. I have no remedy to suggest, except that I think the railroad organization in this country is very weak in not having an official, subordinate to the superintendent, in such charge of station work as the trainmaster has of train movement. Further, all cars are probably subjected to repairs four or five times a year, and this work is in the main in the hands of the dollar and half a day car inspector, and is done with the exercise of the minimum amount of judgment. I think we might quicken the movement by strengthening the organization and release a brake upon it by regulating the activities of the inspectors. We have exhausted our resources so far as they can be exerted through the transportation department; possibly a remedy might be found through the traffic department, but at best this is only a local view.
—*Chm. Exec. Comm.*

We have been troubled to some extent with car detention and diversion, and favor an increase in per diem rates and penalties as a remedy. —*Vice-President.*

SOUTH.

Generally speaking, a certain class of cars are detained by shippers and consignees longer than they should be owing generally to their not having provided necessary facilities for loading and unloading and caring for the freight which they receive. The diversion of cars has become so universal that it does not make so much difference. If shippers will handle their freight promptly, furnish storage room for coal and other carload freight, the trouble will be reduced 50 per cent. If grain and other similar products were shipped directly through to the ultimate destination much time would be saved and fewer cars would move the products. Intermediate commission men and elevator interests would naturally make less money. Terminal facilities at intermediate points would also be greatly relieved. —*President.*

The car situation is one of serious import, although the railroads are making every effort to accord the necessary relief, both as to new equipment as well as furnishing facilities for prompt handling of the business. —*Vice-President.*

There is much complaint of car detention and diversion. We have been seriously troubled on this account. It is difficult to suggest a remedy susceptible of successful application, and for this reason I would prefer not to hazard an opinion upon this very important and equally compplicated question. It is undergoing discussion, and the opinion of many of our ablest railroad officials is that an increase in the per diem for the use of the cars will tend to correct the trouble. —*President.*

EAST.

Every railroad is hampered and troubled by the shortage of freight car equipment due, in most cases, to the extraordinary increases in traffic and the inability of builders to supply the new equipment ordered. This inability is, however, apparently due to no fault on their part but to the scarcity of skilled help, and to the slowness with which they are able to get the materials used in car construction. I think, however, that this difficulty is being gradually overcome and that cars are now being delivered everywhere in such quantities as will ultimately tend to a removal of the present serious freight congestions. —*President.*

We are very seriously disturbed and troubled on account of the detention to our cars and diversion by foreign roads. This has cut down our earnings at least 33⅓ per cent. —*President.*

Steel Passenger Car for the Long Island Railroad.

The American Car & Foundry Co. has recently designed and built at its works at Berwick, Pa., an experimental all-steel passenger coach for the Long Island Railroad, which is shown in the accompanying illustrations. It corresponds in general appearance and finish to the standard wooden coach of the Pennsylvania Railroad but is 5 ft. 3¼ in. longer and seats 72 passengers as against 68. The following are the general dimensions:

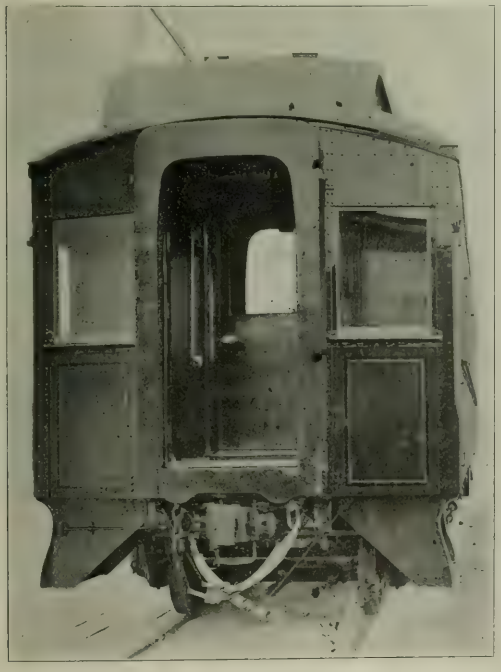
Length over buffers	67 ft. 4½ in.
Length over body	58 " 5¾ "
Width over all	10 " 2⅞ "
Height, rail to top of roof	14 " ¼ "
Truck centers	45 " 5 "
Clear width of aisle	25⅝ "
Weight of body	66,800 lbs.
Weight of trucks	22,000 "
Weight of storage battery and attachments	5,700 "
Total weight	94,500 "

The principle on which the car is designed is to have the plate girders forming the sides of the body below the windows carry the entire load, including the weight of the underframe, and to utilize the 10-in. I-beam center sills only for transmitting the buffing and pulling stresses. These side girders are 3 ft. 1⅜ in. deep and consist of a ⅜ in. web plate with a bottom flange angle 6 in. x 6 in. for a tension member and a special bulb angle along the top which forms the outside window sill. The bulb angle is further reinforced by a flat bar placed back of it and running continuously from end to end of the car, being offset at the posts. This construction has been adopted in all steel passenger cars built by the American Car & Foundry Co. and all the details are patented.



Steel Passenger Coach Built for the Long Island Railroad by the American Car & Foundry Co.

The three cross-bearers between the bolsters consist of flanged plates placed between the center sills and the side bottom angle with a special trough-shaped bottom member in one piece, which extends from side to side and passes under the center sills, having its upper edge riveted to the spacing plates between the center sills. The top cover plate of the cross-bearers passes through the center sill webs and is riveted to the projecting flanges of the sill fillers. The double bolsters are formed of pressed web plates and top and bottom cover plates. The top cover plates are made in three sections with lapped joints, the center section passing through the center sills. Should it be necessary to remove one of the bolsters for repairs it can be done without disturbing the side sheathing. The side posts in the narrow piers are light tees and in the wide piers a pair of angles are used. The posts are offset slightly at the bottom to allow fastening them to the inside of the heavy side sill angle. At the top the posts are secured to a continuous side plate angle 4½ in. x 3 in. The roof carlines are light angles bent to the outline of the upper deck and fastened to the side plate angles with pressed connection plates.

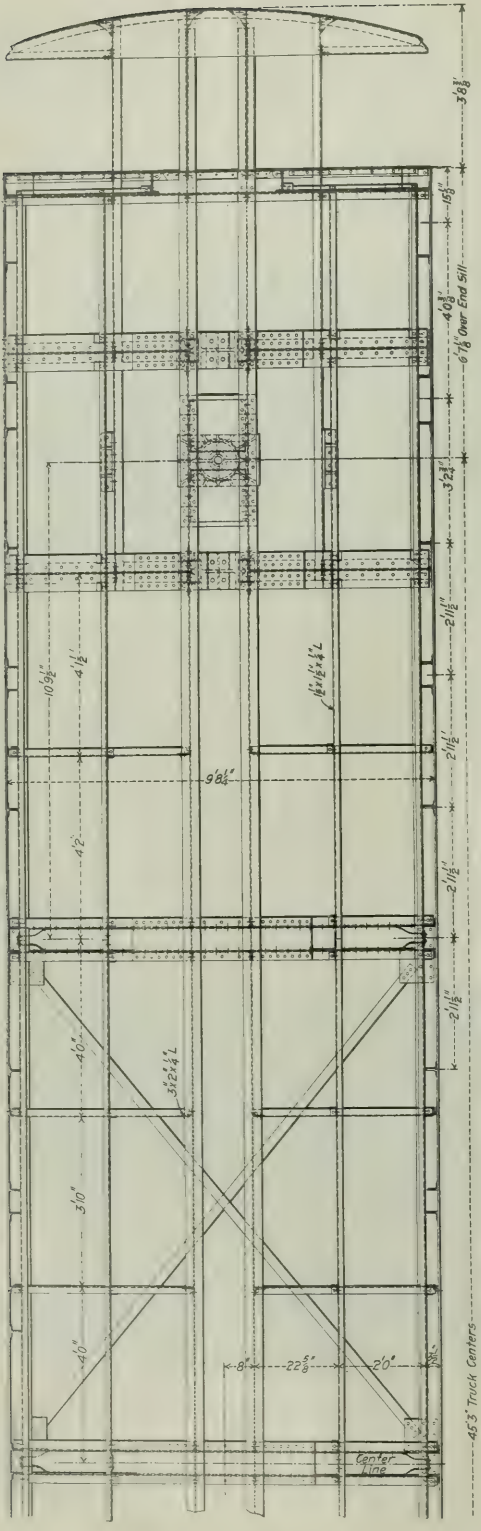


End View of Long Island Car.

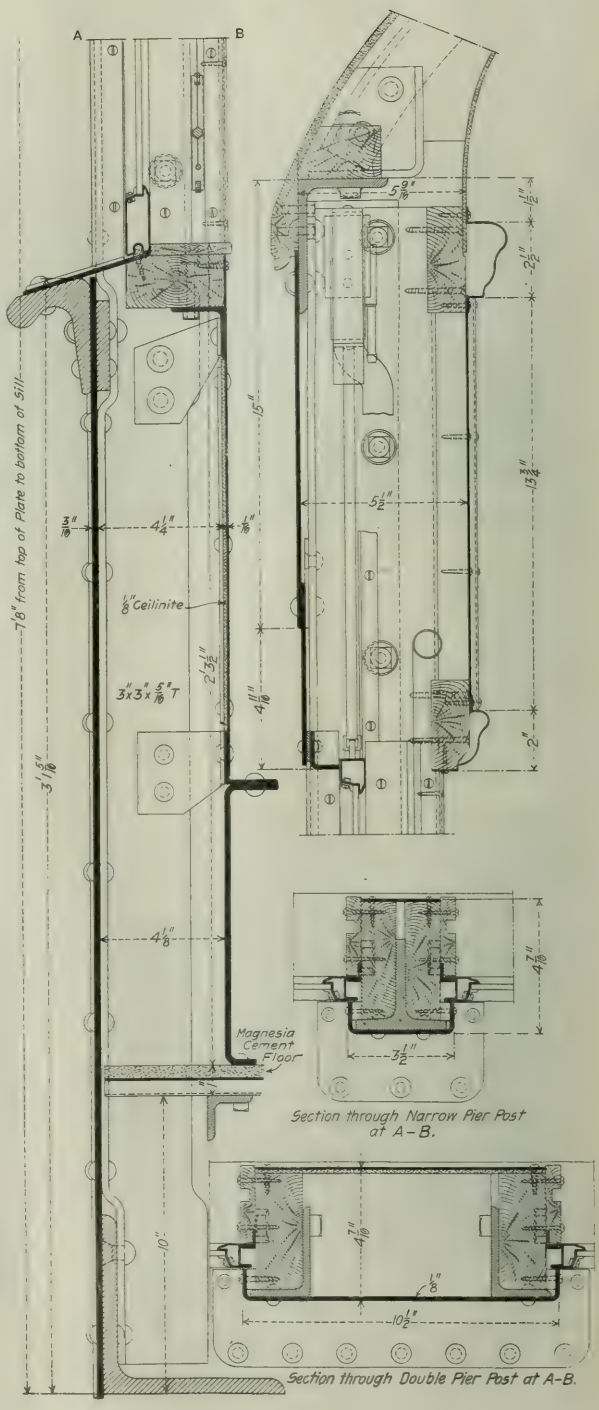


Interior of Long Island Railroad Steel Passenger Car.

The floor consists of corrugated sheets of galvanized iron laid on the center sills and longitudinal floor angles, over which is



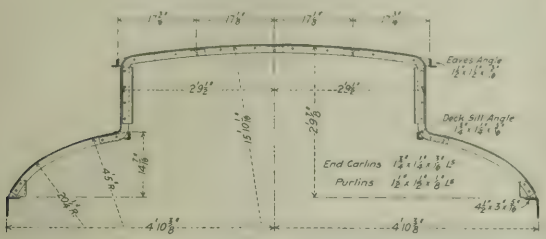
Half Plan of Underframe; Long Island Steel Car.



Details of Side Posts; Long Island Steel Car.

spread a layer of "acandlith" cement. The interior finish, including the moldings, battens, etc., with the exception of the headlining, is sheet steel. The headlining is a non-combustible material known as "Durite"; this material is also used for the outside roofing, where it is covered with canvas and copper flashing following standard construction in wooden passenger cars. The interior is stained and grained in imitation of mahogany.

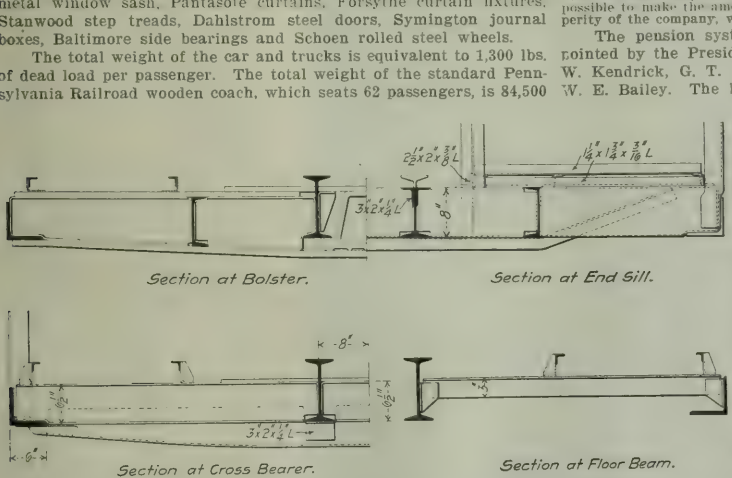
The car is lighted with electricity from storage batteries furnished by the Universal Electric Storage Battery Co. There are 32



Detail of Steel Carlines.

cells having a capacity of 600 ampere hours, which, it is claimed, will furnish current for the thirty-two 16-c.p. lamps for a continuous period of 30 hours without recharging. Other special equipment includes Westinghouse air-brakes and friction draft gear, Gould friction buffers and vestibule, Gold heating system, Hale & Kilburn steel frame seats, Adams and Westlake fittings, Railway Utilities Co. metal window sash, Pantasote curtains, Forsythe curtain fixtures, Stanwood step treads, Dahlstrom steel doors, Symington journal boxes, Baltimore side bearings and Schoen rolled steel wheels.

The total weight of the car and trucks is equivalent to 1,300 lbs. of dead load per passenger. The total weight of the standard Pennsylvania Railroad wooden coach, which seats 62 passengers, is 84,500



Cross-Sections Through Underframe of Long Island Steel Passenger Car.

lbs. without the additional weight of storage batteries, or 1,360 lbs. per passenger. An experimental steel coach recently built at Altoona from the railroad company's designs and having the same seating capacity, 72 persons, as the car here illustrated, weighs 103,550 lbs., or 1,438 lbs. per passenger.

Foreign Railroad Notes.

The Swedish State Railroads, which heretofore have imported their rails from England, Germany or Belgium, have been authorized to contract with a Swedish works for 8,000 tons at a price not to exceed 120 crowns ($32.13) per ton. Heretofore no works in Sweden has been equipped for rolling rails.

The Hungarian zone tariff as introduced in 1889 had three zones for short distance travel and 14 for longer journeys, but the 14th included all journeys for distances greater than 225 kilometers (14.0 miles), so that the rates for very long journeys were extraordinarily low. In 1903 this 14th zone was limited to journeys from 225 to 300 kilometers, and two new zones were added, the 15th from 300 to 400 kilometers and the 16th for all greater distances, and 20, 40 and 60 cents for the three classes respectively were added to the old 14th zone fare for each of these new zones. The results of this change are now reported. In the 14th zone, which then included the present 15th and 16th zones, the number of passengers was 1,501,773 in 1901 and 1,523,763 in 1902. After the change the number in the three zones was 1,503,930 in 1903 and 1,487,052 in 1904, showing a slight decrease in the travel, where without change of fares an increase was to be expected. But the receipts from the travel were 11.2 per cent. greater in 1903 and 11 per cent. greater in 1904 than in 1902; and thus the purpose of the changes was effected.

The St. Gotthard Railroad has acquired of the Canton Ticino, south of the Alps, a large part of the water-power of the various streams descending the Alps, to utilize for motive power when electrical traction is introduced.

The *Journal* of the German Railroad Union has published an article nearly eight pages long on the Empire State Express of the New York Central.

Dr. Krauss, the founder and long the manager of the well known Krauss Locomotive Works in Munich, died there November 5 at the age of 80.

Pensions to Be Paid on the Atchison.

President E. P. Ripley, of the Atchison, Topeka & Santa Fe, announced that on December 12 the directors of that company adopted a pension system, which went into effect January 1, 1907. Mr. Ripley, in his circular to the employees, says that he believes this plan to be more liberal in its terms than any other now in force. He accompanies his announcement with the hope

"that all will show appreciation of it by increased zeal and loyalty. Nearly every employee has it in his power to benefit the company by his work and influence, or to injure it by carelessness or indifference. The system will be carried out wholly at the expense of the company and it is only fair that those whose future is thus made safer should in return render the best service of which they are capable. I hope that it will some day be found possible to make the amount of pension larger—that will depend on the prosperity of the company, which every employee should strive to promote."

The pension system is to be managed by a Board to be appointed by the President, and the first board consists of Messrs. J. W. Kendrick, G. T. Nicholson, W. B. Jansen, Robert Dunlap and W. E. Bailey. The board will have power to pension any retired officer or employee who has been continuously in the service 15 years, and who has reached the age of 65; or may do so before that age if the officer or employee has become permanently incapacitated, and cannot be employed in any other branch of the service. Pensions are not to be paid if during the last 15 years the employee has been in any other business, though this does not exclude men who have served the Atchison and another railroad jointly. Among other things the circular says:

No pension shall be allowed or paid to any officer or employee who shall make or enforce any claim against the company for damages by reason of any injury or accident occurring within three years prior to the date when such employee shall be retired or leave the service.

If any person after leaving the service shall be re-employed, he shall be considered for the purpose of the pension system as a new employee. Any person whose name does not appear on the pay rolls for any two consecutive months shall be considered as having left the service, except that absence from the service pursuant to leave of absence duly granted or by reason of suspension or dismissal followed by reinstatement within one year shall not be considered a break in the continuity of service.

No person who hereafter shall be taken into the service at the age of fifty years or more shall be eligible to the payment of a pension.

The board may deny, revoke or withhold a pension in the case of an undeserving or immoral employee.

The basis of the pensions will be:

(a) For each year of service an allowance of one and one-quarter per cent. of the first fifty dollars of the highest average monthly pay of the officer or employee during any consecutive ten years of service, and, in addition, three-quarters of one per cent. of any excess of such highest average monthly pay over fifty dollars: *provided, however*, that in no case shall the allowance made be less than twenty dollars nor more than seventy-five dollars per month.

(b) In exceptional cases of long and unbroken service with first-class record, the Board of Pensions may, with the approval of the President, increase by not exceeding twenty-five per cent. the amount of any pension allowance hereinbefore authorized.

It will be seen that the pensionable age limit is lower than on the other roads paying pensions, except the Lackawanna; and for men whose pay has been $600 a year or less the rate is decidedly higher. Most or all the other important roads paying pensions give 1 per cent. per year of service to all alike.

Alexander Johnston Cassatt.

Alexander Johnston Cassatt, President of the Pennsylvania Railroad, died of heart disease at his town house in Philadelphia on December 28. Mr. Cassatt's health had been failing since last spring, and in June he went abroad to take a short vacation. His pleasure trip was cut short, however, by the investigation of the Interstate Commerce Commission into the relations between the officers of the Pennsylvania Railroad and the large mining and industrial companies along the company's lines. When the damaging testimony was made public Mr. Cassatt returned to his office at once, and with his accustomed vigor began a housecleaning investigation of his own. Later in the summer he went to Bar Harbor, Me., and while there he contracted whooping cough from his grandchildren. His recovery left him weakened and unable to take up the work of his office, but on his return to Philadelphia he still kept in touch with the workings of the great railroad system of which he was the head through daily conferences with his subordinates at his house. He came to his office in Broad Street Station occasionally, the last time on December 8, and frequently drove out in his carriage. His death came suddenly and without pain while he was sleeping. He leaves a widow, two sons and a married daughter.

Mr. Cassatt was born in Pittsburg, December 8, 1839, his father, Robert S. Cassatt, having been the first Mayor of that city. His early youth was spent abroad, where he received his elementary education, and later attended the University of Darmstadt. The family returned to the United States and he entered Rensselaer Polytechnic Institute, graduating from there in 1859 as a civil engineer. He began his railroad career as an assistant engineer on the construction of a road in Georgia, but on the outbreak of the Civil War he went to the Pennsylvania as rodman. His ability brought him rapid promotion and he was made successively assistant engineer of construction on the Connecting Railroad; in 1866, resident engineer on the Philadelphia & Erie; in 1867, superintendent of motive power of the same road, and in 1868, superintendent of motive power of the Pennsylvania Railroad. In 1874 he was made general manager of the lines east of Pittsburg and third vice-president of the Pennsylvania Railroad Co., and in 1880 was elected first vice-president. George B. Roberts was then president, and Mr. Cassatt was in line to succeed him. But when Mr. Roberts died in 1882, Frank Thomson was given the coveted office, and shortly after Mr. Cassatt resigned and severed his active official connection with the Pennsylvania. He still retained his place as director and served as chairman of the Committee on Roads. He was elected president of the New York, Philadelphia & Norfolk, one of the subsidiary companies of the Pennsylvania, in 1885, and held that office until his death. After he dropped active railroad work Mr. Cassatt devoted himself to outside interests and amusements, principally horses, and for 17 years he remained in retirement from business. When Mr. Thomson died in 1899 the board of directors unanimously elected Mr. Cassatt as president of the lines east and west of Pittsburg. At 60 years of age his career was just beginning, but during the last seven years of his life he accomplished more, perhaps, than any other man of his time. Another three years would have seen the completion of the stupendous improvements in and around New York which he inaugurated. These will stand as a monument to his aggressive genius in the years to come.



Alexander Johnston Cassatt.

In these days of "railroad kings," of Goulds, Harrimans, Vanderbilts and Rockefellers, most railroad officers are mere puppets. Mr. Cassatt did not own the Pennsylvania Railroad or even a large part of it, but he owned the confidence of the stockholders, and it can be said that he never abused it. His word was final and his direction of the affairs of the company, financial, political and operative, was intimate and absolute. The expansion of the Pennsylvania during the last seven years was his work, his was the master mind directing, devising and always looking ahead with unlimited faith in the possibilities of the great transportation machine which he was creating and perfecting. He stands without a peer as a railroad man, not as a financier manipulating stocks and ownership, but as a navigator at the helm, running the railroad.

One of the first aggressive acts of Mr. Cassatt after being elected president was to begin a bitter fight between the Rockefeller, Carnegie and Gould interests over rates. He enlisted the New York Central, and together they established more profitable rates to the seaboard. In retaliation, Gould forced an entrance into Pittsburg, but paid for it by the ousting of the Western Union Telegraph Company from the Pennsylvania Lines. There was no parleying over the ejectment. Mr. Cassatt ordered the poles cut down over night and the next day, before his opponents had a chance to resort to the courts and get out injunctions, the roadbed was strewn with tangled wires and broken poles.

Mr. Cassatt began his administration with the idea of making impregnable the position of the Pennsylvania Railroad. To do this required two things, expansion and improvement of the existing lines. The Pennsylvania acquired a controlling interest in the Baltimore & Ohio, its nearest competitor, and then successively a large interest in the Norfolk & Western and the Chesapeake & Ohio. The coal traffic was thus virtually controlled. The Long Island Railroad promised to prove useful in creating better terminals at New York; he bought that quietly before any definite plans had been made for its utilization. Meanwhile the vast scheme of improvements to existing lines was being worked out and begun. Philadelphia and Pittsburg, the two terminals of the main line across Pennsylvania, were attacked first. The network of tunnels, yards and overhead lines in Philadelphia was reconstructed and the hills of Pittsburg cut away to make room for yards and a new passenger terminal. At Altoona and Harrisburg the yards were doubled and trebled to make room for the cars that were to come. Hardly a mile of the main line was untouched in the betterment work, reducing grades, straightening out curves and putting in additional tracks. A new low grade freight line from Pittsburg to tidewater was built at enormous cost. It was Mr. Cassatt's ambition to see six tracks across the state, and for most of the distance now there are that number, all carrying traffic and all crowded. The financing of these improvements fell to him. That he managed always to get the money needed and never undermined the credit of the road is proof enough of his ability as a financier. In six years the Pennsylvania has floated nearly $400,000,000 in new securities to pay for this programme of improvement.

The terminal improvements in New York, however, surpass any of the others. Mr. Cassatt began on the scheme in 1902. The North river bridge project, to which he was at one time attracted, having fallen through, he and his associates planned anew, with the result that in 1903 it was announced that the Pennsylvania would build tunnels under the two rivers and the island of Manhattan, and have a passenger terminal in the heart of the city. It was a daring undertaking, for its cost was estimated at over $75,000,000, and the return on the investment was to come solely from an undeveloped passenger traffic. A great freight yard was to be built in the upper bay, and the New York Connecting through Brooklyn and Queens and over a bridge across the East river at Ward's Island was to connect Long Island by rail with New England. It took all of Mr. Cassatt's persuasive powers to commit his directors to the scheme and to persuade bankers and financiers to advance the money for it. His death has come before he could see the realization of his plans, but he at least had the satisfaction of knowing that the necessary money was provided and that the work was well under way, and would go forward to the end as he had planned it.

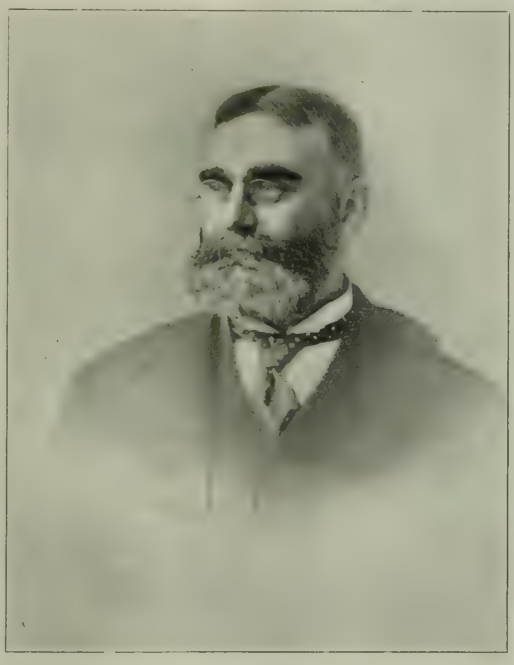
Mr. Cassatt was a diffident man, painfully shy before an audience of any size, but at a directors' meeting or in conferences with his officers, speaking quickly to the point and as incisively as he thought. In his offices at Philadelphia he was impregnable,

and it was easier to get an audience with a king than with him. His time was taken up with thinking and acting, and he made the rule to see no one that he did not call in during business hours. He was fond of the good things of life and lived and worked among luxurious surroundings, which his large private fortune permitted him to enjoy. Horses were his recreation, and his racing stable was at one time well known. In later years he took up the breeding of fancy coach horses and spent much of his time at his large stock farm near Berwyn.

The death of such a man—he can truthfully be called great—is a great loss to the Pennsylvania Railroad and to the railroad interests, no matter who his successor may be. He was an inspiring figure to his associates, a man with a moral calibre beyond criticism, who commanded the respect and esteem of all who knew him.

James McCrea.

James McCrea was, on January 2, elected President of the Pennsylvania Railroad, succeeding Mr. Cassatt. Mr. McCrea is 58 years old, and all his railroad service has been on the lines of the Pennsylvania System. Although he has been on the Lines West for the last 25 years, he has spent much of this time in the east, so that he is also familiar with many of the details of the operation of the eastern lines. He takes up his new work with an intimate knowledge of Mr. Cassatt's plans for the future and a grasp of the entire situation. Like Mr. Cassatt, Mr. McCrea began in the engineering department. He started in 1865 as a rodman on the Connellsville & Southern Pennsylvania. Three years later he was made Assistant Engineer on construction of the Bennett's Branch extension of the Allegheny Valley. In 1871 he was appointed Principal Assistant Engineer in the construction department of the Pennsylvania Railroad, and in 1874 was made Assistant Engineer of Maintenance of Way of the Philadelphia division. The next year he was appointed Superintendent of the Middle division, and from 1878 to 1882 was Superintendent of the New York division; he then went west as Manager of the Chicago, St. Louis & Pittsburg, now part of the Pittsburg, Cincinnati, Chicago & St. Louis. In 1885 he was made General Manager of the Pennsylvania Lines West of Pittsburg, and two years later was elected also Fourth Vice-President. He was elected Second Vice-President in 1890, and in 1891 First Vice-President. Mr. McCrea has been also a Director of the Pennsylvania Railroad, and President of the Cincinnati & Muskingum Valley, the Vandalia, the Grand Rapids & Indiana, and the Cleveland, Akron & Columbus.



James McCrea.

Engineering Periodicals and the Card Index.*

BY H. WADE HIBBARD.
Member Am. Ry. Master Mechanics Association, Am. Soc. M. E.

Among the most valuable members of the engineering profession to-day are the moving spirits of the engineering press. Much matter of great value is regularly to be found in the current periodicals of a profession growing so rapidly and in so many directions as is mechanical engineering. Books, monographs upon particular subjects, necessary as they are by their gathering within one cover all the required material of years and many places, and by their orderly classification, logical discussion, and evolving of principles; are, by very necessity of their production, always and inevitably behind the times. The reason for existence of the engineering press is to collect all recent valuable information—news, if you please—and present it weekly or monthly, less or more digested, to as large a circle of readers as possible. Unthinkingly or deliberately to neglect forming acquaintance with so great a source of engineering knowledge is not fitting for the student who has his own future to make in a country where ruts and old fashions are only for the failures.

Habits are excellent balance wheels, generally. Brilliancy being given to but few men, the great majority must hammer out lesson or problem or engineering feat. Genius has been defined as an infinite capacity to take trouble. Regularity of mind, a habit of undivided intensest application, may place the worker far beyond the one who thinks to accomplish by fits and starts. It is well to form the habit of regular perusal of the weekly engineering papers. Student life is called full by those in it; but it is leisure personified compared to the high-pressure life of the successful engineer in the harness. Let then the student distrust his ability to commence reading the technical papers after graduation, unless he has learned to read them before.

Independent investigation is promoted by reading the papers. A printed controversy stimulates anyone who loves a fight. Blessed be the man whose engineering eye is fired and mettle aroused by the prospect of a battle royal between men of fame. Perhaps he too can put in a lance, if extra spare hours or thesis subject will permit.

After the different papers become known, then the heart of the very human editor should be gladdened by a little note of appreciation; with some of that necessity for which he works, though not chiefly. A good engineering paper should be one of the life partners, ready at hand when moments of leisure permit its instruction and enjoyment, better understood and liked as the years roll on, acquaintance or perhaps friendship formed with editor, contributions made, suggestions given and taken, some share had in its mighty influence in the engineering world. Years afterwards, when official responsibilities come, this earlier training will bear good fruit. A superintendent's office will take regularly several papers or several copies of one most useful paper. He marks in these papers articles appropriate for the instruction or spurring of particular subordinates; and sends them out. Later he will call for meetings of these heads of divisions or departments in his office; and the resulting interchange of opinions on the papers, tempered with experience, will prove of decided advantage to the business, promoting unanimity of feeling between the departments and the introduction of the best methods suited for each or perhaps all. The speaker recalls with much pleasure such meetings on the Lehigh Valley, and has been told only recently by President Vreeland, of the Metropolitan Street Railway of New York City, of the success attending his marking of such articles and sending them out, not merely to subordinates, but to some thousands of motormen and gripmen.

But what of that dimly remembered life-preserver which could not be found when there was dire need? Editors of papers, engineering and otherwise, are frequently in receipt of letters like the following: "A number of months ago I read an article in your paper, or one like it, bearing upon such a subject. At the time of reading I recognized its value. Not only did I think that I had its essential items impressed upon my memory, but I recall making some record in my note-book. I find now a problem has come up in my practice for which I greatly need, and at once, the information contained in that article, but I can find neither it nor my note, the latter being evidently hidden in the midst of other material. If it appeared in your paper, will you give me the date and if possible send me the copy? I am willing to pay a good price for it."

Even when one has the annual indexes of his engineering papers bound up with the volumes, it may be a search of hours to unearth an article whose general subject or whose most valuable details are more strongly impressed upon the memory than its title as appearing in the index. The average subscriber does not get the full value out of his paper, because of this very inability to find again what he has read.

The Card Index will obviate the difficulty, giving ready access to what has been read by its maker, recording information in the

*An address before the students of the Society of Mechanical Engineers, Sibley College of Mechanical Engineering, Cornell University.

form best adapted to his professional needs and to his own peculiar habits of mind and memory, and following his own pet system. The speaker gave up note-books 10 years ago and commenced a card index, making it really a written memory of everything which "might come in handy some time"; of reading, of experience, of oral information; engineering, household, athletic, religious; references to catalogues, drawings, clippings; lists, future plans, addresses—everything.

The making of a card-index is a growth. The easiest way to get started is to read the papers with slips in hand and fountain pen or indelible pencil (ordinary purple copying) ready for use. Read an important article. At the top of a card place the subject of the article, very likely not the author's title of the article, but the *subject that appeals to your type of mind* after the reading. Right here is the most difficult part of a card index. You are in danger of indexing an article on Compressed Air under C the adjective, when it should be under the noun A; or Blowers under B, when it should be under A as Air Blowers. Perhaps the most accessible guide for the inexperienced indexer is the table of contents of Kent's Mechanical Engineers Pocket Book, which every Sibley man must, of course, own. On page 447 of the American Society of Mechanical Engineers' Proceedings for 1896, a discussion on card indexes, Mr. Kent explains his method of general heads—*e.g.*, to put everything relating to steam under Steam, as steam boilers, steam engines, steam pipes. The Railway Mechanical Engineer should follow the Car Builders' Dictionary, and the Index of the Master Mechanics Association on page 67 of the Proceedings for 1900, to be revised by a special committee for the Proceedings of 1901.

Sometimes one is uncertain how to index some piece of information. Remember then that almost everything will have two parts —the thing and its function—and if the thing is the more prominent, catalogue it under the thing; or if the function, then under the function; but, and the following is called "cross-indexing" be sure and make out a card for the other and write on it: See the main card (giving its subject). A liberal use of cross indexing is no fault: one's mind does not always work on the same lines, and data *might* be buried even in a card index. Five years later one may not be able to recall just the one heading under which he indexed an article, but is sure to remember one out of the several headings of the cross indexing. After the subject is written on the card, add the name of the *paper, with year and page.* The card is as yet practically worthless. Add a *short description* of the article with your opinion of its value or applications. Perhaps you can place upon the card all of the article that is of value. At least enough must show on the card to give the future searcher after information some discriminating idea of the article and whether it will pay to read it again to aid him in his engineering problem.

Briefly, the card index then has the following advantages:

Accessibility—always get-at-able—nothing is buried and lost.

Time-saving—for the searchers after information.

Expansibility—only one end, the beginning. Can enlarge forever and still be as good.

Order—new material inserted into the exactly proper place.

Adaptability—suits every frame of mind, and every sort of business; varied classification.

System—encourages system in vast accumulating data and brings it under general heads of classification.

Divisibility—some cards can be removed for temporary use elsewhere, or for permanent transfer.

Labor-saving—nothing has to be rewritten, saves clerical labor.

Simplicity—can be operated by the inexperienced.

Contractability—no need of retaining useless, outgrown matter.

No wasting of spaces—it is impossible to apportion blank spaces in books so that they will fill evenly.

Always being up to date.

Re-arrangement made easy.

Substitute for memory—supplementing it and becoming independent of existing hired memories.

Classifications within the index—by using tab cards.

In conclusion be it said that engineering periodicals and the card index are not the fabled philosopher's stone, turning all metals into gold, but an unfading love for our profession can use them, among the other reagents, to bring out the measure of true worth within the capacity of each man.

Pretty nearly the whole world seems to be short of cars. Italy has been the first and the worst instance. At Genoa vessels couldn't unload because the wharves were blocked, and the wharves were blocked because cars couldn't be had to take the freight away. Naturally this has driven trade to Marseilles, which had been losing it for years. But now Marseilles complains as Genoa had done. The railroad says it is because low water had greatly reduced shipments up the Rhine; but the truth is that production almost everywhere has increased beyond expectation.

Rapid Transit Lines in New York City.

The accompanying map of Manhattan Island and the Bronx shows all of the existing Rapid Transit lines, both subway and elevated, and also all of the proposed additional lines which have been approved by the Board of Rapid Transit Railroad Commissioners up to June 7 1906. In all there are eight proposed routes in Manhattan and the Bronx, and two proposed routes between the Borough of Manhattan and Brooklyn. These routes and branches as well as existing lines are designated on the map by numbers. The following description gives the routes in detail:

1—East Side Route. On First avenue, from the Borough of the Bronx south to the Battery, in the Borough of Manhattan. Beginning at East 138th street and Alexander avenue, in the Borough of the Bronx; running thence southerly a four-track subway under Alexander avenue and private property to and under the Harlem river and private property to First avenue; thence continuing under First avenue to Second street; through private property to First street and private property to East Houston street, crossing East Houston street and through private property to Essex street; through Essex street widened to Hester street (where a two-track loop will begin —passing through private property, Seward Park, East Broadway, Canal and Essex streets); thence from Hester street continuing two tracks through Essex street and Rutgers street and private property to Madison street; through Madison street to Roosevelt street and New Bowery; through New Bowery to Pearl street, between Dover and Ferry streets; through private property to Water street, through Water street and private property to Pine street, through private property to Wall street, from Wall street through private property, Beaver street and Bowling Green to Battery Park.

1A.—Beginning at the intersection of Alexander avenue and 138th street, a four-track subway through Alexander avenue, Third avenue, Melrose avenue and Webster avenue to a point near the intersection of Webster avenue and 171st street; thence a two-track loop through Webster avenue and Claremont Park, returning to Webster avenue at 171st street.

2.—West Side Route. Via Ninth avenue and Columbus avenue, from Battery Park to West 211th street. Beginning at Battery Park, in connection with Route No. 1, a two-track subway through Battery Park and private property to West street, through West street to a point between Albany and Cedar streets; thence a four-track subway through West street and private property to Gansevoort street, through Gansevoort street to Ninth avenue, through Ninth avenue and Columbus avenue to West 110th street, through Morningside Park to Manhattan avenue at West 112th street, through Manhattan avenue, St. Nicholas avenue, Kingsbridge road, Broadway and Sherman avenue to West 211th street.

3.—Third Avenue Route. Beginning on private property south of Southern Boulevard, between Third and Lincoln avenues, in the Borough of the Bronx; a two-track subway through private property crossing Southern Boulevard, through private property in Lincoln avenue, through Lincoln avenue and Morris avenue to East 141st street, and through private property to East 142d street; through private property to Third avenue; south on Third avenue to Lincoln avenue.

Also two spurs running east and two spurs running west, from Third and Lincoln avenues, into East 138th street.

Section 2. A two-track subway beginning on private property south of Southern Boulevard, between Third and Lincoln avenues; thence to Southern Boulevard, and east through Southern Boulevard to Willis avenue; through Willis avenue, private property, East 132d street, Brown place and private property south of East 132d street to a terminal within such private property.

Section 3. A two-track subway beginning on private property south of Southern Boulevard, between Third and Lincoln avenues, through private property to tunnel under Harlem river to Borough of Manhattan at Third avenue and East 128th street; thence a four-track subway through Third avenue and the Bowery, to Chatham square; a two-track subway through New Bowery, Pearl street and private property to Broad street; through Broad street and private property to South street; through South street, Whitehall street and Battery Park, and around present subway loop to terminal under Battery Park.

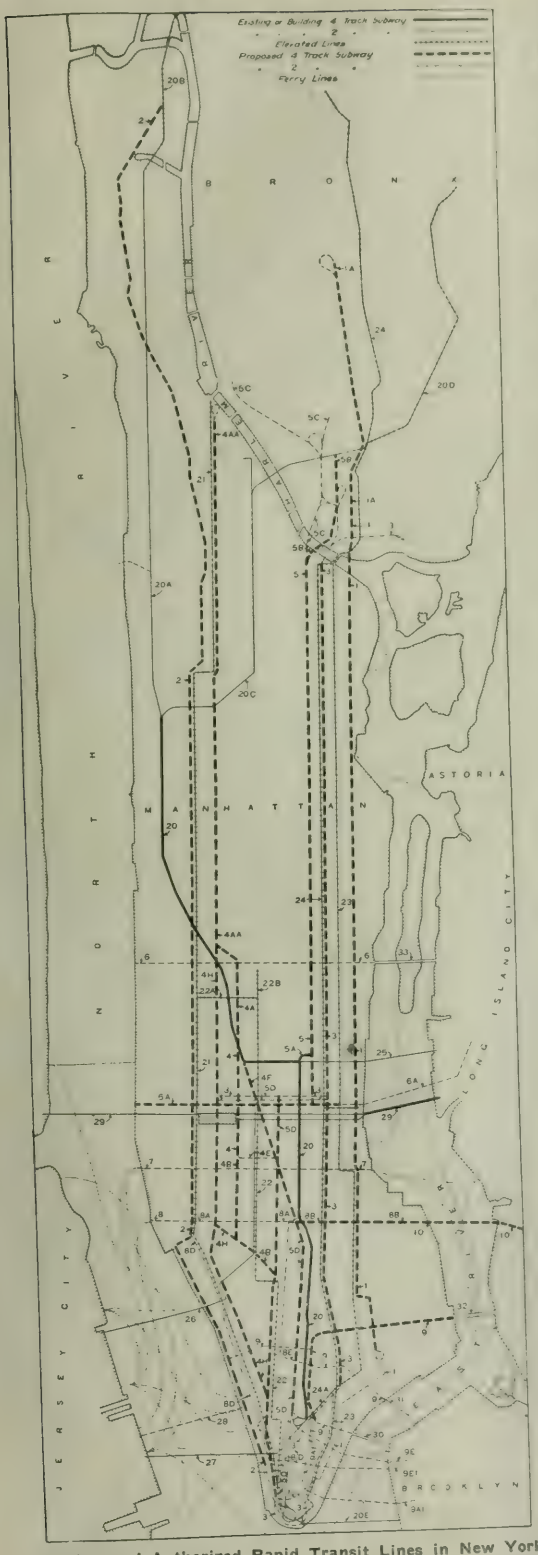
Also a two-track spur from Third avenue, near 36th street, through private property and East and West 36th street and private property to Eighth avenue to a connection with line on Eighth avenue.

Also a spur from West 36th street under private property to Seventh avenue, to a connection with line on Seventh avenue.

Also a two-track spur from Third avenue, near 35th street under private property to Seventh avenue, to a connection with line on Seventh avenue, near 34th street.

Also a two-track subway from Chatham square, through Park row, Nassau street and Broad street to Pearl street.

4.—On Seventh avenue a four-track subway, extending from



Existing and Authorized Rapid Transit Lines in New York.

West 153d street to West 125th street, with connection between West 43d street and West 47th street with present subway.

4A.—A four-track subway from West 153d street through Seventh avenue to West 59th street, under Central Park to Central Park West, at West 62d street.

4AA.—A four-track subway from West 62d street through Central Park West and Eighth avenue to Macomb's lane; thence a two-track loop under Macomb's lane, private property, 154th street, private property and Eighth avenue to the beginning of loop at Macomb's lane.

Also a two-track spur extending up Eighth avenue, from West 153d street at West 155th street.

4H.—A four-track subway, from West 62d street, through Eighth avenue and Hudson street to Chambers street.

Also a spur from Eighth avenue and Greenwich avenue produced, through Greenwich avenue to Seventh avenue produced.

4B.—A four-track subway from West 25th street through Seventh avenue, private property, Greenwich avenue, private property, crossing under Clinton place, private property and Washington square to intersection of West Fourth street and West Broadway.

4C.—A four-track subway from West Fourth street, through West Broadway to Chambers street.

4D.—A four-track subway from Chambers street, through West Broadway and Greenwich street to Battery Park, with a two-track loop and terminal under Battery Park.

Also a one-track loop beginning at West Broadway near Chambers street; thence under private property, Murray street, private property, Park place, private property, Greenwich street, private property, Barclay street, private property and West Broadway to a connection with main route.

4E.—A two-track subway from Seventh avenue, near West 25th street, under private property, and through West 25th street and private property to Broadway, thence a four-track subway through Broadway, Fifth avenue, and under Washington square to West Fourth street and West Broadway.

4F.—A four-track subway beginning at Broadway and West 25th street, through Broadway to West 43d street, connecting with present subway between 43d street and 46th street.

5.—A four-track subway through Lexington avenue, from East 129th street to near 42d street.

5A.—A four-track subway from Lexington avenue through private property and East 42d street, and private property to connect with present subway on Park avenue.

5B.—A four-track subway north from East 129th street through Lexington avenue, private property, and under the Harlem river; thence through private property, Third avenue and Morris avenue and private property to East 149th street to connect with present subway.

5C.—A two-track subway from East 129th street through Lexington avenue, under the Harlem river and private property to Park avenue; thence through Park avenue to East 156th street.

Also a two-track subway beginning at East 149th street and Park avenue; through private property to Mott avenue and East 153d street; thence in a northwesterly direction through East 153d street to East 157th street; through private property and under Cromwell's creek to Exterior street; through Exterior street to Jerome avenue; through private property crossing Sedgwick avenue to East 164th street.

Also a one-track loop beginning at Park avenue near East 151st street, through private property to East 151st street produced, connecting the two lines of route 5C.

Also a two-track subway spur, one running in a northeasterly and one in a southeasterly direction from Park avenue, near East 138th street, through private property to East 138th street; thence east on 138th street to a point on same street near Third avenue.

5D.—A four-track subway from near East 42d street through Lexington avenue to a point between East 37th street and East 36th street; thence two tracks through private property, East 36th street, private property, and Fifth avenue to a point on Fifth avenue near East 34th street.

Also a two-track subway on Lexington avenue beginning at a point between East 37th and East 36th streets, and running south to a point between East 36th street and East 35th street; west under private property and through East 36th street and private property and Fifth avenue, to connect with above line with East 34th street; thence a four-track subway under Fifth avenue, Madison square, Broadway, Union square, Broadway to Chambers street; thence a two-track subway under Broadway, private property, Vesey street, private property, Church street, Trinity place and Greenwich street to a terminal under Battery Park.

Also a one-track loop under City Hall Park from above line beginning near Broadway and Chambers street, and ending in Broadway, between Chambers street and Murray street.

6.—A crosstown two-track subway, through West and East 59th street, from Twelfth avenue to terminals of the Black-

well's Island Bridge; thence crossing bridge to Borough of Queens.

6A.—Thirty-fourth Street Crosstown Line. A four-track subway beginning East of First avenue and running through East and West 34th street to Ninth avenue. Beginning at Ninth avenue and running through West 34th street to Hudson river, a four-track subway. A two-track subway beginning in East 34th street, near Second avenue, running thence east under private property and East river to the Borough of Queens, and under private property, Borden avenue and Jackson avenue to a connection with a future subway on Jackson avenue.

7.—A two-track crosstown subway from West 23d Street Ferry to East 23d Street Ferry on 23d street.

8.—A crosstown two-track subway on West 14th street, from Hudson river to Ninth avenue.

8A.—A two-track subway on West and East 14th street, extending from Ninth avenue to University place.

8B.—A four-track subway on East 14th street, extending from University place east to a point between Avenues B and C, connecting with route under the East river.

8D.—A two-track subway beginning on 14th street, east of Ninth avenue; thence under 14th street, Hudson street and private property, Ninth avenue to Greenwich street; through Greenwich street to Charlton street, through private property to Washington street at Spring street; through Washington street and private property to Liberty street, through Liberty street to William street, to connect with the line under Liberty street and Maiden lane.

Also a one-track spur beginning at Liberty street, between Nassau and William streets; thence under Liberty street and private property, to connect with line on William street, near Cedar street.

8E.—A two-track subway beginning at 14th street and University place; thence through private property, University place, Washington Square East, Wooster street, private property to Canal street; through Canal street to Elm street, through private property to a connection with line on Centre street, south of Canal street.

Fort Lee Ferry Extension.—A two-track addition to the present Rapid Transit Railroad with the right to add a third track, beginning at Broadway near Manhattan street; thence westerly on Manhattan street to the Fort Lee ferry.

9.—Beginning at Brooklyn terminal of Williamsburg Bridge; thence crossing Williamsburg Bridge to Delancey street, in the Borough of Manhattan; thence a four-track subway through Delancey street to Bowery; thence parallel to Broome street under private property and intersecting streets to Centre street; through Centre street to proposed new terminal of the Brooklyn Bridge.

Also two two-track spurs, one southwest and one northwest, beginning in Centre street, near Grand street; thence running under Centre street and private property to unite in Grand street; thence through Grand street and private property under Varick street and private property, Canal street and private property, through Desbrosses street to Hudson river.

Also two two-track spurs, one southeast and one northeast, beginning in Centre street, near Walker street, running thence under Centre street and private property to unite in Walker street; thence east on Walker street, Harry Howard square and Canal street to Chrystie street, to connect with Manhattan Bridge route.

Also a two-track spur from proposed new terminal of Brooklyn Bridge; thence under and across Park Row and private property to William street; thence through William street to Beekman street.

9A1.—A two-track subway from Beekman street, through William street, Old Slip and private property, and under the East river and private property to Montague street, in the Borough of Brooklyn, through Montague street to Court street.

Also suitable connections with line under Maiden lane at William street.

9E.—Beginning at William and Beekman streets, a two-track subway through Beekman street and tunnel under the East river and private property to Cranberry street, in the Borough of Brooklyn; thence through Cranberry street and private property to Fulton street; thence through Fulton street to Pineapple street.

Also a two-track subway from William street to Beekman street and City Hall Park to City Hall loop of present subway in the Borough of Manhattan.

9E1.—Beginning at William and Liberty streets, a two-track subway through Liberty street and Maiden lane and tunnel under East river and private property to Pineapple street, in the Borough of Brooklyn; thence through Pineapple street and private property to Fulton street to connect with Route 9E.

10.—Beginning in North Seventh street, near Union avenue, in the Borough of Brooklyn, thence a four-track subway through North Seventh street and private property and a tunnel under East river and private property to East 14th street, in the Borough of Manhattan, to a connection with Route 8B on East 14th street, between Avenues B and C.

The lines already built or building are numbered on the map, beginning with 30 and running up to 33.

20.—Four-track subway beginning at City Hall Park and running north through Centre street, Elm street, Lafayette place, Fourth avenue, to 42d street; west through 42d street to Broadway; north through Broadway to junction above 96th street.

20A.—Three-track subway through Broadway to 145th street; two-track subway from 145th street through Broadway, Eleventh avenue and private property to Dyckman street.

20B.—Elevated road, a continuation of the subway north from Dyckman street through Naegle avenue, Amsterdam avenue, Kingsbridge road to Harlem river.

20C.—Two-track subway from junction north of 96th street through private property, 104th street, Central Park, Lenox avenue to 145th street. From Lenox avenue and 143d street under the Harlem river, through 149th street to Third avenue.

20D.—Elevated road, continuation of subway from Third avenue and 149th street, through Westchester avenue, Southern Boulevard, Boston road to West Farms road.

20E.—Two-track subway loop at City Hall Park. Two-track subway through Park Row, Broadway, Bowling Green to loop under Battery Park. Two-track tunnel from Battery Park under East river to Joralemon street, Brooklyn.

21.—Ninth Avenue Elevated. From Battery Park north through Greenwich street to Twelfth street, north through ninth and Columbus avenue to 110th street, west through 110th street to Eighth avenue, north through Eighth avenue to 155th street.

22.—Sixth Avenue Elevated. From Battery Park north through Trinity place, Church street to Murray street, west to West Broadway, north to Third street, west to Sixth avenue, north to 53d street.

22A.—Connection from Sixth avenue elevated through 53d street to Ninth avenue elevated.

22B.—Spur from 53d street north through Sixth avenue to 58th street.

23.—Second Avenue Elevated. From Battery Park through Front street, Coenties slip to Pearl street, north to Division street, through Division street to Allen street; thence north through Allen street and First avenue to 23d street, west to Second avenue and north to the Harlem river at 129th street.

24.—Third Avenue Elevated. From Chatham Square north through the Bowery and Third avenue to 129th street, west to Second avenue, north across bridge over Harlem river, through private property to Third avenue at 144th street, north through Third avenue to Pelham avenue. Also spur through 34th street to First avenue; spur through 42d street to Park avenue.

24A.—Spur from Chatham Square through Park Row to City Hall and Brooklyn Bridge terminal.

25.—Belmont Tunnel. A two-track tunnel under the East river from Long Island City to foot of 42d street, through 42d street to Grand Central station at Park avenue. Line building and nearing completion. Will carry trolley cars connecting with surface lines in Long Island City.

26.—Hudson Company's tunnel from Hoboken south of the D., L. & W. terminal. A two-track tunnel under the North river to the foot of Morton street, through Morton street to Hudson street, north to Christopher street, east to Sixth avenue, north to terminal at 34th street. Tunnels completed and subway building. Will connect in Hoboken with surface cars of the Public Service Corporation.

27.—Two-track tunnel under the North river from a point south of the Pennsylvania Railroad terminal in Jersey City to a terminal at Cortlandt and Church streets. Line building by the Hudson Company. Terminal station in New York building, but actual tunneling not yet begun.

28.—Proposed two-track tunnel under North river from Jersey City to the foot of Chambers street.

29.—Pennsylvania Railroad Tunnels. Two single-track tunnels through Bergen Hill, Weehawken, and under the North river to foot of 32d street, through 32d street to terminal station site between Seventh and Ninth avenues. A two-track tunnel under 33d street and a two-track tunnel under 32d street, east from the terminal site to First avenue. Four single-track tube tunnels under the East river to Long Island City. Tunnel under Bergen Hill partially completed; boring completed in North river tunnels; work in progress on terminal station site and crosstown tunnel; work in progress on East river tunnels.

30.—Brooklyn Bridge. Two elevated tracks and two surface tracks connecting with Rapid Transit lines in Brooklyn, but not in New York.

31.—Manhattan Bridge from foot of Pike street, Manhattan. Bridge authorized, but not yet begun.

32.—Williamsburg Bridge. Two elevated tracks and two surface car tracks with connection to surface car lines in Manhattan and Bronx; no elevated trains yet running over the bridge.

33.—Blackwells Island Bridge. Building over the East river from foot of 59th street to the Borough of Queens. Will have elevated and surface tracks.

GENERAL NEWS SECTION

NOTES.

Beginning February 1, passenger fares on the Fitchburg division of the Boston & Maine, Boston to Troy, etc., will be two cents a mile.

An officer of the New York Central says that the number of employees of that company who have lately had their pay increased from 7 to 10 per cent. is 30,000.

On December 21 the Southern Pacific lines in Louisiana and Texas gave several thousand dollars in gratuities to clerks who had continued to do their duties during the recent strike of clerks.

General Manager Morse, of the Grand Trunk Pacific, is reported as saying that the scarcity of labor in western Canada is so serious that only by the importation of Japanese or other foreigners can his company carry out its plans.

The total shipments of anthracite coal from the mines during the year 1906, as reported by the *Coal Trade Journal*, amount to 56,362,567 tons, which is about five millions less than in 1905, and about one million less than in 1904.

The Texas Railroad Commission, dealing with difficulties in the cotton traffic, has ordered all the railroads to send in descriptions of all their freight platforms, giving the size of each, and also to send reports of cotton shipments from each station for the past year.

James Peabody, of Chicago, the well-known railroad writer, and recently for some years in the statistical department of the Atchison, Topeka & Santa Fe, has been engaged by the Governor of Porto Rico to advise the government in revising the railroad tariffs in that island.

The Railroad Commission of Texas has notified the railroads of the state that when a shipper applies in writing for a car or cars the road must furnish the same "within the time prescribed by law," with no discrimination against shipments going to points in Texas beyond the company's line.

The Merchants' Association of New York City announces that the railroads have granted the usual buyers' excursions to New York at a fare and one-third for the round-trip on the certificate plan, as in former years. The tickets will be sold February 23 to 26 and March 16 to 19; return limit 15 days.

Press dispatches from Texas say that the strike of firemen on the Southern Pacific lines has failed; but other dispatches report the Firemen's Brotherhood as still threatening to extend it. At Dallas, one night last week, two dozen bars of soap were found in a tank from which locomotives are supplied with water.

Robbers secured about $800 in money and jewelry from the passengers in a sleeping car on the Seaboard Air Line, not far from Richmond, Va., on the night of December 30. The sleeping car conductor tried to arrest one of the robbers and was shot and wounded by him. The robbers stopped the train and escaped.

The Minnesota State Railroad Commission, acting on an investigation which it has been conducting during the past few months, has ordered reductions in the freight rate on hard coal from Duluth to St. Paul and Minneapolis of 15 cents a ton, or from $1.25 to $1.10. On soft coal the rate is reduced from 90 cents to 88 cents. Reductions are ordered to other points also.

The Department of Agriculture has taken measures to prosecute seven different railroads for keeping animals in cars more than 36 hours, in violation of the law requiring proper feeding and watering: the Great Northern, the Oregon Short Line, the Southern Pacific, the Union Pacific, the Lake Shore & Michigan Southern, the Chicago, Burlington & Quincy and the Atchison, Topeka & Santa Fe.

The Interstate Commerce Commission has promulgated a ruling that railroads may lawfully carry free men and materials for the telegraph company which operates on the railroad right of way. The legality of this is not affected by the use of the telegraph lines for commercial business, but the railroad cannot furnish such free or reduced-rate service for the benefit of a telegraph line off the line of the railroad.

In the United States Court at Omaha, December 24, J. E. Woodward & Company, of Dietz, Wyo., secured an injunction against the Chicago, Burlington & Quincy restraining it from confiscating coal shipped from complainant's mines to points in Nebraska and elsewhere. The petition claimed that the road was directly responsible for a famine in fuel in western Nebraska, alleging that the road had seized three successive shipments for one town when the supply of coal in that town was entirely exhausted.

The International Exposition of Safety Appliances, which is to be held in New York City under the auspices of the American Institute of Social Service, is to begin January 29 and continue two weeks. It will be held in the American Museum of Natural History. Applications for space to be sent to W. H. Tolman, 287 Fourth avenue. Space is free. The exhibits will include safety devices for wood and metal working machinery; stamping, grinding and polishing machines; safeguards for boilers, elevators, windlasses, cranes and hoisting machinery; textiles and building trades; safety lamps and explosives; quarrying and agriculture; chemical industries, safety from fire; railway and trolley safety.

The Passing of the Pass.

There never was more than one real class distinction in this country. Some people had more money than others, to be sure. Some lived more luxuriously and ostentatiously. Some had handles to their names, being colonels, judges, senators, presidents, and the like. But all these distinctions were superficial. The real cleavage was between those who were the servants and those who were the masters of transportation agencies; those who paid fare and those who rode on passes.

There was hardly a hamlet too humble to contain one or more members of this aristocracy. Shippers, politicians, editors, even clergymen, carried the stamped patents of their nobility. In the real heydey of pass-giving, the friends of the friends of the friends of the great secured favors for themselves. Undergraduates at the western state universities, which are usually situated at the state capitals, went to their local Assemblymen for passes on which to go home for Thanksgiving and the Christmas holidays. Every tiniest service to the railroad corporation itself was requited by magnificent largesse. "What do the initials of this road stand for?" asked a traveler of the lady who sat beside him. "Cheapest, Best and Quickest," replied the lady ingeniously. "Madam," interposed an official of the road who sat unrecognized in the seat behind, "here is a life pass over all this company's lines." Such were the stories told in the great days that are gone. Not since kings went about flashing signet rings and knighting casual acquaintances, has there been anything like their glamor and their expansiveness.

The disappearance of any privileged class involves great social changes, and this is no exception. One of the transformations is mentioned by a Washington correspondent:

"They do say that not in many years have so many national legislators come back to Washington at the opening of the session unaccompanied by their families. An unprecedented number of senators and representatives will live bachelor lives till after the holidays, and then be joined by their families. Many others who have been in the habit regularly of bringing their families at the beginning of the session will not bring them at all this winter; the three months of the short session doesn't constitute justification, in their minds, for moving the entire domestic establishment. . . . Down at the bottom of these troubles is the fact that free transportation is no more. The statesman who came to town on a pass would be a novelty. He wouldn't advertise the fact, however, because there is a growing feeling that the statesman who uses the pass isn't the most desirable public servant. The members, indeed, get liberal allowances of mileage for their travel, but there is no arrangement for transporting their families at public expense. They must have passes or pay."

The immediate question is whether our institutions can survive internal changes like this. We do not refer merely to the deterioration in legislation that must ensue when our members of Congress are deprived of their wives' advice. The unofficial pass-holders had functions, too, in the communities to which they belonged. They traveled, they saw the world, they shed in benighted communities a cheerful light of cosmopolitanism. Could the village remain self-centered and provincial when the owner of the rutabaga warehouse and the chairman of the County Committee spent their summers at Bar Harbor and their winters in California? Their wives sparkled at the Women's Club; even their youngest children—to change the metaphor—leavened the public school. The free railroad pass was the traveling fellowship of non-academic America.

If culture is to be spread it must be by other means, hereafter. The university extension lecturer, wending his laborious way through the land, the 10-cent magazine delivered along the rural free delivery route, the itinerant agent selling the thoughts of the world's best thinkers in half morocco, the picture postal card from distant parts, the correspondence school, the church lecture course, and the Chautauqua meeting must combine to do the work that was done efficiently, cheaply and automatically by the railroad pass of

other days. It is the fashion to glory in its extinction, yet we trust there are left some who are still poor enough to do it reverence.—*New York Evening Post.*

Output of the Baldwin Locomotive Works for 1906.

The Baldwin Locomotive Works built during the year 1906 2,652 locomotives, comprising 201 electric and 2,451 steam. Most of these were for domestic service, but 281 were exported. Of the 2,451 steam engines, 133 were equipped with compound cylinders. This represents the largest output of the Baldwin Locomotive Works in any year of its history. The following are the figures for the production of the year 1901 to 1905, respectively: 1901, 1,375; 1902, 1,533; 1903, 2,022; 1904, 1,485; 1905, 2,250. The number of men employed by the Baldwin Locomotive Works, exclusive of the Standard Steel Works, at this time, is about 19,000, and the number of working days for the year was 307.

Employers' Liability Law Declared Unconstitutional.

In the Federal Court at Memphis, Tenn., January 1, in the suit of Howard against the Illinois Central, Judge McCall held that the La Follette fellow-servant act was unconstitutional. Judge McCall said in part: I am unable to bring my mind to the conclusion that the liability of a common carrier to its employees for injuries is interstate commerce or commerce of any character within the meaning of the commerce clause of the Constitution. My conclusion is that Congress is not authorized, under the commerce clause of the Constitution of the United States, to enact this legislation, for the reason that the relation of interstate common carriers engaged in interstate trade or commerce to their employees, and their liability to them in damages for injuries sustained in their employment as the result of the negligence of any of its officers, agents or employees, or by reason of any defects or insufficiency due to its negligence in its cars, engines, appliances, machinery, track, roadbed, ways or works, is not commerce within the meaning of the Constitution. But if it were the act does not undertake to regulate this relation or liability, but simply announces by an act of Congress a new law on torts limited to a special class of those engaged in interstate commerce.

In the Federal Court at Louisville, Ky., December 31, in the suit of Brooks against the Southern Pacific, Judge Evans sustained the demurrer of the road and held the same act unconstitutional, because it would regulate commerce within the states. He adds: "A most patient consideration of the question in this instance has led to the conclusion—we think to the inevitable conclusion—that the act of June 11, 1906, only creates and imposes liability upon certain common carriers to their employees, and in no way prescribes rules for carrying on traffic or commerce among the states, and consequently in no way regulates such commerce. If the operation of the act could in any way affect commerce among the states, it would do so in a manner so remote, incidental, and contingent as in no proper sense to afford a factor of any value in determining the question now in contention. Indeed, it may be said that it is obvious that Congress, in the act referred to, had in contemplation no more than the creation of the liability mentioned, and it would be a most strained construction to hold that it included anything broader than that. Creating new liabilities growing out of the relations of master and servant, on the one hand, and regulating commerce on the other, are two things so entirely different that confusion of the judicial mind upon them is hardly to be expected under normal conditions. In the opinion of the court, the act does not regulate commerce among the states."

Block Signal Inquiry by Interstate Commerce Commission.

The Interstate Commerce Commission, which has been conducting a general inquiry into the block signal practice of the railroads of the country, under the Mann resolution, passed last June, announces that in connection with this inquiry public hearings will be held to inquire into the recent collision on the Southern Railway, wherein President Samuel Spencer was killed, and that on the Baltimore & Ohio, in the District of Columbia, December 30, when over 50 passengers were killed. It is said that the first hearing will take place in Washington, January 4.

Railroad Ferryboat Sunk in New York Harbor.

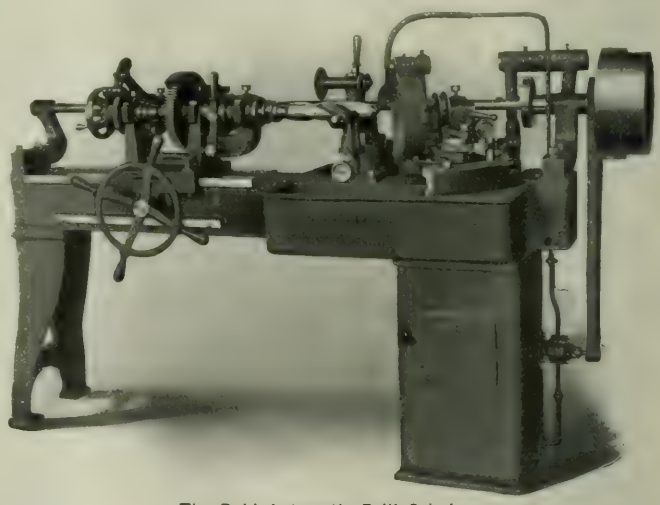
Erie Railroad ferryboat "Paterson," a single-decked side-wheeler, about 20 years old, running from Jersey City to Twenty-third street, New York, about 5 a. m. December 29, and carrying, besides the crew of seven, a dozen passengers, all men, and five trucks, was struck by a coal barge and sank in a few minutes. All the passengers and crew jumped in safety to the barge. There was some fog, but not dense. The accounts blame the captain of the tug that was towing the barge. The barge struck the ferryboat on her port side just forward of the paddlewheel, breaking through the guards and smashing the hull.

Forty-Nine Passengers Killed in Kansas.

Press despatches of January 2 report a disastrous butting collision of passenger trains at 4 o'clock on the morning of that day near Alta Vista, Kan., in which as many as 49 passengers are reported to have been killed, most or all of them being Mexican laborers riding in the smoking car of the southbound train. Some forty passengers were injured. The collision occurred on the Chicago, Rock Island & Pacific, between train No. 29 southbound and train No. 30 northbound. Most of the victims were asleep on the seats, and were crushed to death by the baggage car, which was pushed upward and backward and then fell through the roof of the smoking car. The wreck took fire within a few minutes, and was soon burned up. Many of the bodies of the dead were consumed. The cars of the northbound train were not seriously damaged. It is said that the operator at Volland, eight miles north of Alta Vista, failed to deliver a meeting order to the southbound train.

The Dahl Automatic Drill Grinder.

The Dahl automatic drill grinder, shown in the accompanying illustration, is capable of grinding twist drills from ½ in. to 3½ in. in diameter. It works entirely automatically and an unskilled operator can grind a drill to a true angle without difficulty. The drill is carried in a revolving head on a movable carriage and is supported on a fixed rest back of the point so that the center of the drill is at a fixed height with relation to the wheel and cutting takes place evenly on the lips. No centering is required as the grinding is done while the drill is revolving. A small wheel is provided for pointing the drills after grinding before they are removed from the machine. The feed of the drill in and out is automatic and has a wide range. Gages are provided on the head of the machine for adjusting the wheel for different diameters of drills, and there is also a micrometer adjustment to cover allowance for wear on the wheel. The wear on the face of the wheel is uniform and therefore no equalizing of the wheel is required. The machine is furnished a large emery wheel for grinding, a small wheel for pointing, bushings for taper shanks, water attachment, etc., and weighs 1,900 lbs It is sold by Manning, Maxwell & Moore, 85 Liberty street, New York.



The Dahl Automatic Drill Grinder.

A Superintendent of Materials.

The Philadelphia & Reading has established the office of Superintendent of Materials and Supplies, the incumbent of which will report to the First Vice-President. The announcement gives the duties of the new officer as follows:

1. He will have the supervision of all materials and supplies. All storekeepers report to him and be subject to his orders. All other persons charged with the custody of materials and supplies are to give him a monthly report, showing all materials and supplies on hand, that may be in their custody, and call his attention to any surplus obsolete material.

2. All requisitions are to be made in triplicate and forwarded through the head of the department making the same; one copy for information only, to the Purchasing Agent; two copies to the Superintendent of Materials and Supplies, who will note thereon

what, if any, portion of the materials or supplies called for is in stock and will be furnished from the storehouse. He will then send one copy of the requisition to the First Vice-President for approval, who in turn will forward the same to the Purchasing Agent as his authority for the purchase of the balance of the material called for.

3. The Superintendent, with the assistance and advice of the Superintendent of Motive Power and Rolling Equipment, and the General Superintendent, is to make a thorough examination of materials and supplies of every kind on hand, and select such articles as can no longer profitably be used, and the Purchasing Agent is to sell or dispose of them at the best price obtainable. Annually hereafter, before the close of the fiscal year, a like inspection is to be made, and all useless articles sold.

4. No requisition for supplies is to be honored by the Purchasing Agent, unless it is accompanied by a certificate from the Superintendent of Materials and Supplies that the articles cannot be furnished from stock on hand, beyond the necessary time that such stocks should be carried.

5. Whenever, in the exigency of business, an emergency arises, requiring any modification of these rules, the President alone, or in his absence any one acting for him, has the power to modify them.

6. Whenever, in the judgment of the Purchasing Agent, the market conditions are such that it will be advantageous to buy standard supplies in quantities, he must report to the President and obtain his authority for such purchases.

7. In emergency, where something is required for immediate use, the department's call for such articles will be at once honored by the Purchasing Agent without any formal requisition; the requisition to follow.

Local storekeepers are to report to the Superintendent of Materials and Supplies, but they are also to "carry out all instructions received from their respective Master Mechanics and Foremen of Shops."

Twenty-Three Killed in a Collision in Scotland.

In a violent snowstorm on the afternoon of December 28, near Arbroath, Scotland, a stalled passenger train was run into at the rear by a following train, and 23 persons were killed or fatally injured, and 30 or more others were badly hurt.

TRADE CATALOGUES.

Speed Recorder.—The December issue of *Ideal Power* contains an article on the Boyer speed recorder, made by the Chicago Pneumatic Tool Company. This machine records on a paper tape both the number of miles traveled and the speed. It can be applied to locomotives, cars or automobiles.

High Pressure Blowers.—Catalogue No. 140 of the B. F. Sturtevant Company is the first complete publication the company has issued describing these machines. It is well illustrated and aside from descriptions gives valuable formulæ for measuring volume, pressure and horse-power.

Reinforced Concrete.—The Reid-Turnbull Construction Company, New York and Philadelphia, sends a booklet describing the advantages of reinforced concrete, illustrated with examples of structures built by the company.

Rock Drills.—According to a pamphlet being distributed by the Ingersoll-Rand Company, New York, the 80,000 Ingersoll-Rand rock drills so far built and sold includes probably more than 95 per cent. of all the drills in this country.

Electric Power Equipment.—The Western Electric Company has published a pamphlet describing its Hawthorne works at Chicago. At this plant are built generators, motors, arc lamps, switchboards and auxiliary apparatus.

Reciprocity With Canada.—The November issue of the *Valve World* contains an article by R. T. Crane, President of the Crane Company, Chicago, commenting on J. J. Hill's recent speech on reciprocity with Canada.

London & North-Western.—This company is distributing an attractively illustrated souvenir booklet describing the interesting features of towns on its lines.

Denver & Rio Grande.—The passenger department sends a folder giving dates and rates for the Pacific Coast excursions planned for 1907.

Manufacturing and Business.

The International Railway Master Steam Boiler Makers' Association and the Master Steam Boiler Makers' Association will meet in a joint convention at Cleveland, Ohio, May 21, 22 and 23, to organize a single association of foreman boiler makers.

F. H. Taylor, formerly Second Vice-President of the Westinghouse Electric & Mfg. Co., has been elected a Vice-President and a Director of the Yale & Towne Mfg. Co., New York City.

The H. W. Johns-Manville Company, New York, makers of asbestos and magnesia roofings, insulating materials, lagging, packings and electric specialties, has opened a branch office at the corner of Baronne and Perdido streets, New Orleans, La.

S. F. Bowser & Co., makers of oil tanks, have opened a branch office at 299 Broadway, New York City, in charge of W. T. Hatmaker. During the past year the size of the Fort Wayne factory has been more than doubled and a new factory has been built at Toronto, Canada.

The Vulcan Iron Works Company has during the past year largely increased the capacity of its works. New buildings have been built, and additional boilers, air compressors and other new equipment have been installed. A separate factory has been built and equipped for repair work.

The Ryan Car Company was recently incorporated in Maine by W. M. Ryan and J. M. Hopkins. The company has bought the Northwestern Car & Locomotive Company's plant at Hegewisch, Ill., near Chicago, and will build new cars, will repair and rebuild cars and locomotives, and deal in second-hand equipment. Mr. Ryan, who is the President of the new company, has been Manager of the Western Steel Car & Foundry Company. Mr. Hopkins is Vice-President and Treasurer but will also continue to attend to the management of the Camel Company, makers of car doors and other special equipment.

Iron and Steel.

About 40,000 tons of steel—shapes, plates, etc.—will be needed to complete cars already ordered.

There is but little change in the rail conditions. A considerable tonnage of light rails has been ordered recently. For heavy rails at the present time the electric roads are the heaviest buyers.

The year 1906 was an exceptionally good one in the finished steel products, and orders have kept up well toward the end of the year. There was but a slight falling off in November and in December.

All the railroad work is now being let in extremely small tonnage. The Atlantic & Birmingham has given a large order for bridge work to the American Bridge Co. Other roads are putting in small orders, both for structural material and rails.

The American Bridge Co. during November sold about 50,000 tons of steel for structural work. This was but slightly below the average for the year. The average for the 12 months is about 60,000 tons a month, or 700,000 tons for the year, an exceptionally large amount.

The Erie, it is said, has given an additional order for 1,600 tons of bridge material to the American Bridge Company. Also one of the orders included in the last call for bids for bridges for the Erie barge canal. Other orders are still to be placed. The total is for 5,000 tons. The company has also been given an order for 800 tons for the Senate office building at Washington.

OBITUARY NOTICES.

Arthur Mills, Vice-President and General Manager of the Merchants Despatch Transportation Co., died suddenly in New York City on January 1. Mr. Mills was 56 years old. After graduating from Harvard, in 1872, he began railroad work in a freight station of the Burlington & Missouri River, now part of the Chicago, Burlington & Quincy. After working for several months in the general freight office of that road, he was made agent, at Boston, of the International Fast Freight Line. In 1877 he was appointed General Freight Agent of the Boston, Charleston, Fitchburg & New Bedford, and the next year went to the Boston & Albany as Assistant General Freight Agent. He was appointed General Freight Agent in 1880, and four years later was made General Traffic Manager. He resigned in 1898 to become Vice-President and General Manager of the Merchants Despatch Transportation Company.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Mobile, Jackson & Kansas City.—F. E. Dewey and J. L. Dantzler have been appointed Receivers.

New York, New Haven & Hartford.—H. A. Fabian, Private Secretary to the President, has been appointed Assistant to the President.

William Greenough, Acting Attorney, has been appointed Attorney, reporting direct to the President.

Pennsylvania.—James McCrea, First Vice-President of the Pennsylvania Lines West, has been elected President of the Pennsylvania Railroad, succeeding A. J. Cassatt, deceased.

Pennsylvania Lines West.—See Pennsylvania.

Yazoo & Mississippi Valley.—Michael Gilleas, Third Vice-President, has resigned.

Operating Officers.

Chicago, Rock Island & Pacific.—T. H. Beacom, Superintendent at Oklahoma City, Okla. T., has been appointed Superintendent at Chickasha, Ind. T., succeeding A. C. McColl, resigned.

Galveston, Harrisburg & San Antonio.—G. S. Waid, Trainmaster at El Paso, has been appointed to the new office of Assistant Superintendent at that place, and the office of Trainmaster has been abolished.

Grand Trunk.—See Union Pacific.

Great Northern.—F. S. Forest, Superintendent of the Montana Central, has been appointed Assistant General Superintendent of the Great Northern at Minot, N. Dak., succeeding J. M. Davis, resigned. P. C. Allen, Superintendent of the Willmar & Sioux Falls, succeeds Mr. Forest. R. I. Knebel, Assistant Superintendent of the Great Northern at Everett, Wash., succeeds Mr. Allen. C. C. Leverich succeeds Mr. Knebel.

Gulf, Colorado & Santa Fe.—S. B. Hovey has been appointed Superintendent, with office at Cleburne, Tex., succeeding J. W. Robins.

Mexican Central.—The office of Assistant to the General Manager has been abolished, H. Putnam having been promoted.

Montana Central.—See Great Northern.

Mt. Jewett, Kinzua & Riterville.—D. W. Boh, Signal Inspector of the Alleghany and Bradford divisions of the Erie, has been appointed Superintendent of the Mt. Jewett, Kinzua & Riterville, with office at Kuashequa, Pa., succeeding B. J. Barnett, resigned.

Oregon Short Line.—See Union Pacific.

St. Louis & San Francisco.—P. W. Conley has been appointed Superintendent of Terminals at St. Louis, Mo., succeeding B. W. Moore, resigned.

St. Louis, Iron Mountain & Southern.—J. L. Kendall has been appointed Trainmaster of the Natchez division.

Southern.—P. S. McManus, Superintendent of the Charlotte division, has been appointed Assistant General Manager.

Eleven new divisions have been created and officers appointed as follows: Durham division: G. V. Peyton, heretofore Assistant Superintendent at Greensboro, N. C., Superintendent, with office at Durham, N. C. Winston-Salem division: J. M. Bennett, heretofore Trainmaster at Charlotte, N. C., Superintendent, with office at Winston-Salem, N. C. Greenville division: J. A. Heether, heretofore Superintendent at Pinners Point, Va., Superintendent, with office at Greenville, S. C. Spartansburg division: A. M. Smith, heretofore Assistant Superintendent at Rock Hill, S. C., Superintendent, with office at Columbia, S. C. Rock Hill division: R. E. Simpson, heretofore Assistant Superintendent at Atlanta, Ga., Superintendent, with office at Rock Hill, S. C. Mooresville division: D. W. Newell, heretofore Trainmaster at Asheville, N. C., Superintendent, with office at Winston-Salem, N. C. Murphy division: T. S. Boswell, heretofore Assistant Superintendent at Asheville, N. C., Superintendent, with office at Byson, N. C. Coster division: E. E. Norris, heretofore Assistant Superintendent at Knoxville, Tenn., Superintendent, with office at Knoxville, Tenn. Chattanooga division: C. C. Fodger, Superintendent, with office at Chattanooga, Tenn. Columbus division: W. J. Bell, heretofore Trainmaster at Atlanta, Ga., Superintendent, with office at Williamson, Ga. Selma division: J. Lasseter, heretofore Assistant Superintendent at Birmingham, Ala., Superintendent, with office at Williamson, Ala. W. S. Andrews, Superintendent at Greensboro, N. C., has been appointed Superintendent of the Danville division, with office at Danville, Va. E. P. Pelcer has been appointed Superintendent of the Nashville division, with office at Nashville, Tenn.

Union Pacific.—W. E. Costello, Assistant Superintendent of the Grand Trunk at Battle Creek, Mich., has been appointed Superintendent of the Wyoming district of the Union Pacific and of the Utah division of the Oregon Short Line, with office at Salt Lake City, Utah, succeeding H. V. Hilleker, resigned.

Willmar & Sioux Falls.—See Great Northern.

Traffic Officers.

Denver & Rio Grande.—J. D. Kenworthy has been appointed Assistant General Freight and Passenger Agent, with office at Pueblo, Colo.

Northern Pacific.—A. B. Smith, Assistant General Passenger Agent, has resigned to become Traffic Manager of the New York, New Haven & Hartford Electric Lines.

Pennsylvania Lines West.—L. B. Freeman has been appointed to the new office of Assistant General Passenger Agent at Columbus, Ohio. J. B. Modisette has been appointed Assistant General Passenger Agent at Cleveland, Ohio.

Tehuantepec National.—E. M. Cousin, General Agent of the Southern Pacific at Mexico City, Mex., has been appointed to the new office of General Freight and Passenger Agent of the Tehuantepec National.

Engineering and Rolling Stock Officers.

Chicago, Rock Island & Pacific.—J. G. Bloom, Engineer of Maintenance at Topeka, Kan., having been assigned to other duties, the authority of H. F. White, Engineer of Maintenance at Chicago, Ill., has been extended over all Rock Island Lines.

John McGie, Master Mechanic at Shawnee, Okla. T., has been appointed Master Mechanic at Little Rock, Ark., succeeding E. D. Andrews, resigned.

Denver & Rio Grande.—T. B. Purves, Jr., has been appointed Superintendent of Motive Power and Car Departments, with office at Denver, Colo.

Erie.—W. H. Willis has been appointed Signal Engineer, succeeding C. H. Morrison, resigned to go to another company. See New York, New Haven & Hartford.

New York, Chicago & St. Louis.—A. J. Himes, Bridge Engineer, has been appointed Assistant Chief Engineer. G. H. Tinker succeeds Mr. Himes.

New York, New Haven & Hartford.—C. H. Morrison, heretofore Signal Engineer of the Erie, has been appointed Signal Engineer of the New York, New Haven & Hartford, with office at New Haven, Conn.

E. E. Pratt, Jr., has been appointed Superintendent of Buildings, with office at New Haven, Conn., succeeding G. B. Mitchell, resigned.

Special Officers.

Philadelphia & Reading.—J. H. Rankin has been appointed Superintendent of Material and Supplies, with office at Reading, Pa., and the office of General Storekeeper has been abolished.

LOCOMOTIVE BUILDING.

The Philadelphia & Reading has ordered 25 switching engines.

The National Railroad of Haiti has ordered two locomotives from the Baldwin Locomotive Works.

The Las Vegas & Tonopah will soon order two additional locomotives, but the type has not yet been definitely decided on.

Moorhead Bros., Sharpsburg, Pa., have ordered one four-wheel, 32-ton, saddle-tank locomotive from the Hicks Locomotive & Car Works.

The New York, Chicago & St. Louis is in the market for six passenger engines, three consolidation type (2-8-0) and six switching locomotives.

The Japanese Government Railways have ordered through the American Trading Company some locomotives from the Baldwin Locomotive Works.

The Kansas City, Mexico & Orient will order 20 Allfree-Hubbell type simple (2-6-0) locomotives, for July and September, 1907, delivery. The specifications are as follows:

General Dimensions.

Type of locomotive	Allfree-Hubbell
Weight, total	163,000 lbs.
Weight on drivers	143,000 "
Diameter of drivers	63 in.
Cylinders	20 in. x 28 in.
Boiler, type	Wagon top
" working steam pressure	200 lbs.
" number of tubes	300
" material of tubes	Seamless steel
" diameter of tubes	2 in.
" length of tubes	12 ft. 9 in.
Firebox, length	108 in.
" width	40 "
" grate area	30 sq. ft.
Heating surface, total	2,177 "
Tank capacity	7,000 gals.
Coal capacity	12 tons

Special Equipment.

Air-brakes	Westinghouse
Boiler lagging	Franklin
Brake-beams	Chicago Railway Equipment Co.
Brake-shoes	American
Couplers	Tower
Headlights	Handlan-Buck
Injector	Ohio
Journal bearings	Cicero bronze
Piston rod packings	Perfection
Valve rod packings	Perfection
Safety valve	Crosby
Sanding devices	Economy
Sight-feed lubricators	Chicago
Springs	Railway Steel-Spring Co.
Steam gages	Crosby
Wheel centers	Davis type; cast steel.

The Great Northern, as reported in our issue of December 21, has ordered 100 simple Prairie (2-6-2) type, 15 simple Pacific (4-6-2) type and 25 Mallet compound locomotives from the Baldwin Locomotive Works for February, March and April, 1907, delivery. The specifications are as follows:

General Dimensions.

	Prairie.	Pacific.
Types of locomotives		
Weight, total	209,000 lbs.	227,000 lbs.
Weight on drivers	151,000 lbs.	
Diameter of drivers	69 in.	
Cylinders	22 in. x 30 in.	
Boiler, type	Belpaire.	
" wkg. stm. pressure	210 lbs.	
" No. of tubes	301	
" material, tubes	Shelby steel.	
" diameter of tubes	2¼ in.	
" length of tubes	18 ft. 6 in.	21 ft.
Firebox, length	126¼ in.	
" width	66¼ in.	
" grate area	54 sq.ft.	
Heating surface, total	3,488 sq.ft.	3,931 sq.ft.
Tank capacity	8,000 gals.	
Coal capacity	13 tons.	

General Dimensions.

Type of locomotive	Mallet
Weight, total	288,000 lbs.
Weight on drivers	250,000 "
Diameter of drivers	55 in.
Cylinders	20 and 31 x 30 in.
Boiler, type	Belpaire
" working steam pressure	210 lbs.
" number of tubes	301
" material of tubes	Shelby steel
" diameter of tubes	2¼ in.
" length of tubes	21 ft.
Firebox, length	121¼ in.
" width	66¼ "
" grate area	54 sq. ft.
Heating surface, total	3,914 "
Tank capacity	8,000 gals.

Special Equipment.

Bell ringer	Simplicity
Boiler lagging	Magnesia
Brake-beams	Buffalo
Brake-shoes	Ross-Meehean
Couplers	Tower
Headlights, for Prairie and Mallet	Adams & Westlake
Headlights for Pacific	Pyle-National
Injector	Ohio
Journal boxes	Aurora
Piston rod packings	Great Northern standard
Valve rod packings	Great Northern standard
Safety valves	Ashton
Sanding devices	Leech
Sight-feed lubricators	Ohio Bull's-eye
Springs	Simplex
Steam gages	Ashton
Steam heat equipment (for Pacific)	Gold
Tires (driving, truck and tender wheels)	Standard
Wheel centers	Baldwin

CAR BUILDING.

The Grand Trunk is asking prices on 10 passenger coaches.

The St. Louis & Belleville Electric is in the market for 500 coal cars.

The New York, Chicago & St. Louis has ordered 10 baggage cars for automobiles.

The Illinois Central has ordered 1,500 gondola cars from the Pressed Steel Car Co.

The Louisville Cotton Oil Co. has ordered six tank cars from Robert M. Burns & Co.

The Philadelphia & Reading has ordered 1,000 steel coal cars of 100,000 lbs. capacity.

The Union Oil Company of California has ordered 16 tank cars from Robert M. Burns & Co.

The Atlanta, Birmingham & Atlantic has ordered 300 coal cars from the South Atlantic Car Co.

The National Railroad of Haiti has placed a car contract with the American Car & Foundry Co.

The Lehigh Valley has ordered six passenger coaches and six buffet baggage cars for May, 1907, delivery.

The Colorado & Southern is in the market for freight equipment in addition to the 2,200 box cars ordered from the Pullman Co.

The O. F. Jordan Co., Chicago, has ordered fifteen 36-ft. flat cars of 60,000 lbs. capacity from the Hicks Locomotive & Car Works.

Fairbanks, Morse & Co., Chicago, have ordered three box cars of 50,000 lbs. capacity from the Hicks Locomotive & Car Works.

The New York, Chicago & St. Louis, as reported in our issue of December 21, is in the market for two parlor buffet cars, five first class passenger cars, six baggage cars and 35 cabooses.

RAILROAD STRUCTURES.

CHICAGO, ILL.—The city council has passed the ordinance permitting the Chicago & North-Western to put up its proposed large new passenger terminal. It provides that work must be started within two years, and completed before January 1, 1912.

The Chicago & Western Indiana is planning to put up a new passenger station to replace the present structure at Dearborn street.

JAMAICA, N. Y.—Plans for a new passenger station are being made by the Long Island Railroad. It is proposed to put up a new structure half a mile west of the present station, where the company already owns a site. There are to be 12 tracks into the station, with underground passenger subways connecting the platforms.

LONDON ONT.—The Grand Trunk is raising its tracks in this city from Edgerton street to Hyde Park Junction. In some places the roadbed is being raised as much as 35 ft. The work will take several months. The company is also planning to enlarge its station and freight sheds at a total cost of several hundred thousand dollars.

NEW CASTLE, PA.—The Buffalo, Rochester & Pittsburg, it is said, will build big terminals and new shops at this place.

STRATFORD, ONT.—The Grand Trunk, according to reports from Montreal, has decided to spend about $250,000 improving its terminals, and extending its repair shop at this place. The work also includes the building of a new station.

TEXARKANA, TEX.—Plans have been completed for the new Kansas City Southern general office building, to replace the structure destroyed by fire last March, and contracts for the work will shortly be let. The new building is to be three stories high, and will cost about $50,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

AMERICAN-MEXICAN.—An officer writes that contracts have been given by this company to W. C. Bradbury & Co., of Denver, Colo., for building this line from Phoenix, Ariz., via Tucson to Nalo, 250 miles. Lyman Bridges is President and Chief Engineer, Tucson.

ARIZONA & COLORADO.—See Atchison, Topeka & Santa Fe.

ATCHISON, TOPEKA & SANTA FE.—An officer of the Arizona & California writes that this company, which has extended its road in Arizona for about 30 miles, to mile post 80, has given contracts to the Grant Brothers Construction Company, Los Angeles, Cal., for an extension from that point to mile post 107, 27 miles.

ATLANTA, BIRMINGHAM & ATLANTIC.—An officer writes that this company, which in 1906 built a line to La Grange, Ga., 60 miles, has given contracts to C. D. Smith & Co., of Memphis, Tenn.; the Callahan Construction Co., of Knoxville, Tenn., and Wright, Williams & Wadley, of Roanoke, Ala., for building from La Grange to Birmingham, Ala., 165 miles; also from Chalybeate to Atlanta, Ga., 77 miles. Surveys are being made for further extensions which, when built, will make a through line from Atlanta to New Orleans, 500 miles.

BEAUMONT & GREAT NORTHERN.—This road, which was extended to Onalaska, Texas, last year, is making surveys for an extension from that place to Livingston, 15 miles.

BROWNSVILLE, MASONTOWN & SMITHFIELD (ELECTRIC).—An officer writes that this company, which has $150,000 capital, has secured five miles of its right of way, and during this month will secure ten miles additional. The line has been surveyed from Masontown, Pa., west to Riverview; also for a line from Masontown north via Lardin to Edenborn, Lambert and Brownsville; and for one from Masontown via Martin to New Geneva, a total of about 15 miles, through a new coke country. W. J. Sheldon, of McKeesport, is President; E. L. Schmidt is Chief Engineer, and C. A. Smith, Superintendent of Construction. Both of the latter are at the headquarters of the company.

CENTRAL ONTARIO.—Contracts have been given by this company to Wm. G. Gibson, of Port Hope, Ont., to extend this road from Bird's Creek to Maynorth, 11 miles. Surveys are also under way for a further extension from the latter place to Whitney, an additional 30 miles.

CHEWAHWAH VALLEY.—An officer writes that this company, which was recently incorporated in Washington to build 30 miles of road in Chelan county, will let contracts about April 1. (Nov. 30, p. 152.)

CHICAGO, ROCK ISLAND & GULF.—An officer writes that contracts have been given to the Lantry-Sharp Constructing Company, of Kansas City, Mo., for building its proposed line from Irving, Tex., to Carrollton, 10½ miles.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—An officer writes that surveys are being made by this company for extending its road from Mt. Carmel, Ill., south to Evansville, Ind., 34½ miles.

Coal River.—This company, which last year completed six miles of its road from Hollyhurst, W. Va., to Lick Creek, seven miles, and from Sproul to Cobbs, seven miles, has given contracts to Carpenter Bros., of Clifton Forge, Va., for extending the road from Lick Creek to Racine, seven miles, and from Cobbs to Seng Camp, an additional 36 miles.

Council City & Solomon River.—An officer writes that this road, which was extended last year 15½ miles to Penelope Creek, is making surveys for a further extension to Council City, an additional 23 miles.

Deepwater.—An officer writes that this road is under construction from Micajah, W. Va., mile post 73 to the West Virginia-Virginia state line, mile post 114, to a connection with the Tidewater Railway, 41 miles.

Denver, Northwestern & Pacific.—An officer writes that this company has completed about one-half the grading on an 85-mile extension of its main line from Kremmling, Colo., northwest to Steamboat Springs.

Duluth, Missabe & Northern.—An officer writes that this company is building, with its own forces, a branch from a point on its main line in Minnesota to the Wacootah mine, 1.74 miles; and one from Myer's mine to Hartley mine, one mile; also one from Glen mine to Pillsburg mine, .9 mile.

Kansas City, Mexico & Orient.—An officer writes that work under construction for which contracts have been given to the Union Construction Co., and the International Construction Co., of Kansas City, Mo., includes the following: Clinton, Okla., to Knox City, 152 miles; Sweetwater, Tex., to San Angelo, 75 miles; Aguatos, Mex., to Los Tascates, 62 miles, and from Elfuerto, Mex., to Lajunta, 55 miles; a total of 244 miles.

Louisiana & Arkansas.—This company, which during the past year completed 30½ miles of road to Tioga, La., has projected a line from the latter point to Pineville, about five miles.

Louisville & Nashville.—This company, which is revising its line and grades on the Henderson division between Greenbrier, Tenn., and Guthrie, Ky., 26 miles, has completed 16 miles, and will have the rest of the work completed during 1907. On the Kentucky division the revision of line and grades from Corbin, Ky., to Livingston, is now under way. Thirty miles were completed last year, and the remaining 11 miles will be completed in 1907.

Under the name of the Pine Mountain work will soon be started on a line from Williamsburg, Ky., to Trace Branch, 22½ miles.

On the North Alabama Railroad, the Skelton Creek extension of the Cane Creek branch will be built in 1907. This is from Vulcan, Ala., to Skelton Creek, about 14 miles. A short line from the Skelton Creek extension, starting at a point 11½ miles from Vulcan, and running to the mine of the Lacey-Buek Iron Co., 2½ miles, will also be built this year.

Work is under way on double-track and changing grades between Graces, Ala., and Hardy, 17 miles. This will be completed soon. The company is also building a branch from the main line near Helena, Ala., into the Actin coal basin, six miles; a track from the O'Conner branch of the Alabama Mineral division at Gadsden, Ala., 1½ miles long, and one extending the Hogeland branch about two miles to coal properties.

Minidoka & Southwestern.—See Oregon Short Line.

Minneapolis & Rainy River.—An officer writes that this company, which recently extended its road to Big Fork, Minn., is building with its own forces an additional 13 miles, and has projected a further extension of 80 miles to International Falls.

New York, Chicago & St. Louis.—This company is laying 50 miles of second track in Illinois, Indiana and Ohio.

North Alabama.—See Louisville & Nashville.

Oregon & Eureka.—An officer writes that this company has projected an extension of its road from Luffenholtz, Cal., north for about 18 miles.

Oregon Short Line.—An officer writes that the line which this company is building under the name of the Yellowstone Park, recently completed from Marysville, Idaho, to mile post 40, is being extended from that point to mile post 70, about 30 miles. Ten miles of the line will be in Montana. The Utah Construction Co., of Ogden, is the contractor.

This company is also extending the Minidoka & Southwestern from Twin Falls, Idaho, to Buel, 15 miles. The Corey Brothers Construction Co., of Ogden, Utah, is the contractor.

Orford Mountain.—This company, which recently completed seven miles of railroad to Mansonville, Que., will build an additional four miles from that place to North Troy.

Pine Mountain.—See Louisville & Nashville.

Plant City, Arcadia & Gulf.—An officer writes that contracts have been let to Davis & Bushnell, of Manatee and Plant City, Fla., for extending its road from Welcome, Fla., for 20 miles.

St. Louis, Rocky Mountain & Pacific.—An officer writes that this company has given a contract to the Utah Construction Co., of Ogden, Utah, for building 25 miles of road from the present end of its track to Des Moines, N. Mex., and that all the grading and bridge work will be completed early this month.

Southern.—An officer writes that in addition to the new line built by this company last year, the company completed double track work at various points, which has been put in operation as follows: Between Danville, Va., and Spencer, N. C., 45 miles; between Knoxville, Tenn., and Morristown, Tenn., 20 miles, and between Payton and Austell, Ga., four miles, a total of 69 miles.

Temiskaming & Northern Ontario.—Bids are about to be called for by the Railway Commission of the Ontario Government for extending this road from the point at the junction of the Black and Abitibi rivers, where the present contract ends, to a connection with the National Transcontinental Railway, about 40 miles. The extension will make the total length of the road from North Bay 250 miles.

Tidewater.—An officer writes that this road is now under construction from mile post 100 to the Virginia-West Virginia state line mile post 332 to a connection with the Deepwater Railway, 232 miles.

Washington, Idaho & Montana.—This company, which has completed nine miles of road from Harvard, Idaho, east, has given a contract to Wren & Greenough, of Spokane, Wash., for extending the line from that point to Bovill, an additional 19 miles.

Western Pacific.—An officer writes that this company, which completed 113 miles last year on its line from Salt Lake City west to the Pacific coast, has given contracts to the Utah Construction Co., of Ogden, Utah, and to E. B. & A. L. Stone, of Oakland, Cal., for work on 816 miles between these two points.

Wisconsin & Northern.—This company, formerly the Green Bay, Oshkosh, Madison & South Western, has completed clearing the right of way and will carry on grading during the present winter on a line from Norway Dam, Wis., to Landglade, 14 miles.

Yellowstone Park.—See Oregon Short Line.

RAILROAD CORPORATION NEWS.

Chicago, Kalamazoo & Saginaw.—This road, which runs from Pavillion, Mich., to Woodbury, 55 miles, and has $946,000 stock outstanding and $225,000 bonds authorized, has, according to press despatches, been sold to New York Central interests for a price said to be $900,000.

Chicago, Rock Island & Pacific.—This company has arranged for the sale of $10,000,000 refunding mortgage 4 per cent. bonds of 1934 to Speyer & Co., New York. These bonds are a part of a total authorized issue of $163,000,000, of which $44,342,000 are now outstanding. The issue is secured by a first mortgage on 1,148 miles of road, on the Moline, Ill., shops and terminal property at St. Paul, St. Louis and Minneapolis, and also by a junior lien on 5,655 miles of road.

Delaware & Hudson.—An annual dividend of 9 per cent. on the $40,954,500 stock has been declared, payable in quarterly instalments beginning March 15, 1906. The annual rate has been 7 per cent. since 1900.

Mexican Railway.—It is reported that the Mexican government is negotiating for the purchase of this road, which runs from Mexico City to Vera Cruz, 264 miles, with 57 miles of branches, and has outstanding $39,000,000 stock.

Mobile & Ohio.—A dividend of 2½ per cent. on the $6,070,600 outstanding capital stock has been declared. In June, 1906, 3 per cent. was paid; in 1905, 4 per cent., in 1904 and 1903, 2 per cent., and in 1898, 1 per cent.

Mobile, Jackson & Kansas City.—F. E. Dewey and J. L. Dantzler have been appointed receivers of this road on the application of a committee representing the holders of about $1,000,000 bonds and $500,000 stock of the Gulf & Chicago, whose road is leased and bonds guaranteed by the Mobile, Jackson & Kansas City. The M., J. & K. C. controls directly 200 miles of road, and the Gulf & Chicago owns 203 miles. The M., J. & K. C. has outstanding $4,000,000 first consolidated mortgage 5 per cent. bonds of 1953, $210,000 4½ per cent. equipment trust notes and $4,000,000 common stock. (See editorial columns.)

New York Central Lines.—See Chicago, Kalamazoo & Saginaw.

Vandalia.—A dividend of 5 per cent. payable in two instalments of 2½ per cent. each, the first being made on February 5, has been declared on the $14,649,546. The annual rate paid heretofore was 4 per cent. in 1906 and 2 per cent. in 1905.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns OUR OWN opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:

Investigation of Terra Cotta Collision	31
A British Freight Pool	31
Revised Railroad Accounts	32
Smoke Prevention in Cities	32
The Harriman Influence	33
Automatic Stopping of Trains by Congressional Enactment	34
Prussian State Railroads	34
Mr. Hill on Permissive Blocking	34
New Publications	34

ILLUSTRATED:

Progress of the Quebec Bridge	37
The United Railways of New Jersey	39
Locomotives for Italian Government Rys.	50
A Cast-Steel Bumping Post	54

CONTRIBUTIONS:

Traffic and Rates in India	34
Split Rails at Highway Crossings	34
First Government Railroad in America	35

MISCELLANEOUS:

New Cuban Service	36
The Alta Vista Collision	37
Railroad Delays in Massachusetts	37
Pensions on the Intercolonial	43
December Railroad Law	44
Train Loads	44
Investigation of Terra Cotta Collision	44
Alexander Johnston Cassatt	47
Cross-Tie Conditions in Some Foreign Countries	47
James McCrea	52
Investigation of the Harriman Roads	52
The Great Corporations	54
The Largest Wire-Rope Conveyor (Note)	54

GENERAL NEWS SECTION:

Notes	55
Trade Catalogues	57
Obituary	58
Meetings and Announcements	58
Elections and Appointments	58
Locomotive Building	59
Car Building	60
Railroad Structures	60
Railroad Construction	60
Railroad Corporation News	62

VOL. XLII., No. 2. FRIDAY, JANUARY 11, 1907.

The Interstate Commerce Commission has begun its first accident investigation (Terra Cotta), but has adjourned with only a few of the witnesses heard. From what has come out at the coroner's investigation it is evident that there will be conflicting testimony on vital points, and it is therefore impossible to reach a conclusion now. Some important points are, however, quite evident already. When we wrote last week, the two principal questions appeared to be first as to a distant signal, and, second, as to the record of the engineman and of the superintendent as regards his supervision of enginemen. As to the signal, it is already shown that there was the faulty, though very common, condition of a stop signal immediately in front of the office (where the signal man could not see the lamp) and no distant signal. With no distant signal, enginemen, unless rigidly disciplined, are very apt to take chances when, on account of fog, they cannot see the signal far away, and this appears to have been common at Takoma. As for the engineman, he had been on duty so long—48 hours, with only two periods of four hours each for rest—that no one can have confidence in his assertion that he was wide awake when passing the signal stations, however honest he may seem to be. The officer in charge of enginemen appears not only to have taken insufficient action to know how the enginemen were worked, but to have taken positive action to encourage a practice which involves grave danger; that is, he allowed long hours and allowed the trainmaster or some one performing trainmaster's functions to request overwork to such an extent that the dereliction must be regarded as flagrant. An officer can hardly be regarded as excusable for being ignorant in such a case. In closing, at 6:30 p.m., a block office (Takoma) which is kept open during the day, the signal arms are fastened in the all-clear position, but the signal lamp is extinguished. This being the practice, an engineman can excuse himself for going past such a station without looking for it. This excuse is given by Engineman Hildebrand in this case. His excuse, poor as it is, depends, however, on authoritative knowledge by the engineman as to the hour when an office should be closed and on the accuracy of his watch; and also on his making no mistake in reading the time from his watch. Trusting enginemen thus to keep track of the closing hour of signal stations is a troublesome practice at best; and even if carefully managed, it is a violation of the best block signal practice, one of the principles of which is that all movements shall be safe, irrespective of small errors in reading timepieces. The only proper practice is to leave the signal light burning, and require enginemen to see the signal the same as though the block station were open. The semaphore arms being put in the proceed position, there certainly can be no inconsistency in leaving the light showing "proceed." On the Chicago, Milwaukee & St. Paul, the Chicago & Alton and the Seaboard Air Line, the lights in such cases are left burning. A proceed signal showing at such a station may interfere with necessary or desirable permissive blocking of freight trains during the night, but if this were a serious difficulty it would be practicable to provide a distinctive light. It would seem desirable to devise such a light even if it were found necessary to use an extra lamp or two to do it.

Just at this time, when passage of a law to allow pooling of railroad traffic has been advocated by the President in a message to Congress, an important experiment of handling traffic under this system is being put in effect in England. An immense tonnage of grain, timber, machinery and other bulky freight is received at Liverpool by sea. A number of railroad lines compete for this traffic out of Liverpool. The lines which directly serve that port have agreed to put in effect a pool to last for 10 years, covering unmanufactured grain, timber, incomplete machinery and railroad material carried between Liverpool and all competitive stations of the various lines. Companies in the traffic agreement are the London & North Western, the Lancashire & Yorkshire, the Great Western, the Midland, the Great Central, the Great Northern, the Cheshire Lines and the Great Central-Midland joint lines. Except for towns in which the London & North Western and the Lancashire & Yorkshire have a joint monopoly, which is covered by an agreement made two years ago, all towns directly fed by two or more of the roads mentioned come within the operation of the pool. Traffic received at competitive junction points from roads not in

the agreement is also included. The pool, as nearly as can be learned from the press despatches, is a straight pool based on the percentages of the traffic which have during the past year or so been handled by each of the different roads. Beginning January 1 each company is to receive this agreed percentage no matter how much or how little of the traffic is carried. Obviously, such an agreement would be impracticable in this country without a further provision covering the situation when one road carried considerably more or less than its agreed percentage. This question has apparently been put under the entire control of the English Railroad Clearing House which is to regulate the movement of traffic over the different lines. If that institution is able to carry on so delicate a duty as this of apportioning a large traffic among many competitors with success, it will be an added tribute to its importance as a part of the English railroad machinery. Unfortunately America is too large and too far stretching to make it probable that a similar institution could here be established with success. If the time does come when railroad pools shall be authorized, however, it should be possible to find men fair minded and respected enough to carry out the provisions of such arrangements with satisfaction to all concerned.

The new rate law gives to the Interstate Commerce Commission the fullest authority over railroad statistics and accounts. With the power, not only to prescribe what accounts shall be kept and how, but to forbid the keeping of any unapproved statistics, the Commission has a remarkable opportunity to bring about improvement in the form and substance of returns of railroad operation, more particularly of annual reports. This side of the Commission's work is in charge of Prof. Henry C. Adams, and is so complicated and extensive in its possibilities that it must be accomplished slowly. The committee on corporate, fiscal and general accounts of the Association of American Railway Accounting Officers has been co-operating with Mr. Adams, and at a meeting held last month in Washington the question was raised whether results of "outside operations" of a railroad should be included in its operating earnings and expenses, or carried directly to the income account, and if so carried, whether as a gross or a net item. This question is important, first, because comparison between the report of a road which had such outside operations and one which does not would be misleading; and second, because inclusion of the results of outside operations, with the results of strict railroad operations, improperly affects such statistical units as revenue per train-mile, revenue per ton-mile, revenue per passenger-mile and the operating ratio or percentage of operating expenses to gross earnings. After considerable discussion this question was referred to a special committee made up of the general auditors of the Lackawanna, Erie, Lehigh Valley, Pennsylvania and New York Central. As a result of the consideration of the subject by this committee and Prof. Adams a circular has been issued with the purpose of learning the methods by which outside operations are now treated by railroads and the opinions of accounting officers as to the way in which such operations should be treated. "Outside operations," according to the committee, include all operations for which specific arbitraries are allowed in billing for a special service other than rail transportation, or for which an additional collection is made from shippers, consignees or passengers for a special service performed. They include ferry lines, lighterage departments, lake lines, coal transfers, coal storage plants, coal and ore docks, cold storage plants, grain elevators, stock yards, cab and omnibus lines, baggage and express transfers, express lines, eating houses, hotels, dining cars, sleeping and parlor cars and passenger and vehicle toll service on bridges. It will make railroad accounts much more open and clear to have definite rules which must be followed by railroads in making returns from these various operations which are outside of the pure business of rail transportation. The fact that these outside operations have been sometimes used to cover up underhand operations is an important though a secondary reason why some such definite system should be adopted. The main importance of new rules in this regard will be a potential one, for it is probable that few instances of dishonest or illegal practices are being hidden under the cloak of outside operations; but the opportunity for such dishonest practices will be taken away. It should be possible under the amended rules to make a comparison which is fair between different roads because no matter how different and various their operations they are put on the same basis in their reports. In this way the solid facts of a railroad's operations will be presented without the need of making a guess at the effect on the total of certain indeterminate outside factors.

SMOKE PREVENTION IN CITIES.

Smoke prevention in those cities which draw their supply of fuel from the soft coal districts has, on the whole, made little progress in recent years. This is perhaps due to the fact that so far as the public has been a factor in the problem, dependence has been placed upon ordinances which have been merely prohibitive. It is likely that laws prohibiting smoke, if unaccompanied by constructive legislation, will always be insufficient to cope with so complicated a problem. To decree that there shall be less smoke is a simple matter, the real difficulty appearing when it is attempted to devise and to secure agreement upon a system of procedure which, if followed, will lead to the desired result. The sources of city smoke stated in very general terms are domestic fires, small industrial fires including those under boilers of less than 100 horse-power, large industrial fires, including those employed in metallurgical furnaces and boiler plants of considerable size, and locomotive fires. In the elimination of smoke, the fires of each of these groups will need to be dealt with as a separate problem. Existing domestic fires, for example, may be entirely suppressed by serving a city with a supply of low-priced gas for cooking and by the installation of stoker-equipped central stations of large capacity for heating. It can be shown that there is nothing impracticabzle in this suggestion. The cost of gas production diminishes as the amount which can be sold is increased and at existing prices gas is much used for cooking in many of the cities of our country. The practicability of heating from central stations is also well demonstrated, though in no city has there as yet been worked out a comprehensive plan which can be depended upon to deliver heat to all of its homes. The small and large industrial fires must in a similar manner be attacked. Dependence upon central stations will permit the complete suppression of many small boiler fires which to-day are prolific sources of smoke. The introduction of stokers under many of the larger fires, and the substitution of gas producers for others, will go far to solve the problem. These statements, while brief and fragmentary, are sufficient to disclose the magnitude of the problem and to suggest a procedure which, if followed under the leadership of a competent engineer, would permit most cities to develop gradually into a condition of practical smokelessness. A plan of co-operation must be outlined which will attract capital to central station work, and which will induce large manufacturers to make extensive use of producer gas. This accomplished, the way is open for prohibitive legislation with good prospect that it may be effectively enforced.

The fact is recognized that any general scheme which has for its purpose the reduction of smoke in cities, must necessarily involve the steam locomotive. None understand this better than those who are responsible for the management of our great railroads, and none are more serious in their desire to improve practice in this particular. The vast expenditures of the New York Central for the purpose of securing electric traction within the limits of its New York terminal, may be accepted as a measure of the cost to a single corporation in a single city, of complete smoke suppression. The decree of November 17 of the Commissioners of the District of Columbia, prohibiting the use of any except electric locomotives in drawing trains into the new Union Station, is evidence of a growing disposition on the part of the public to insist upon some relief from the present-day conditions. But the cities are few which can reasonably expect, during the lifetime of the present generation, to be exclusively served by electric traction. Relief from present conditions, however, does not necessarily involve electricity. It is likely that a large number of cities will, in the next decade or two, admit to their precincts only such steam locomotives as are fired by smokeless fuel, while the remainder will need to be satisfied with such reduction of smoke as may result from the progress which will naturally be achieved in the art of firing the normal locomotive using normal fuel.

In the matter of smokeless combustion in locomotive service there are many things to learn, and facts which are already well established must be widely apprehended. It is well known that the use of small jets of steam properly arranged above the fires will reduce materially the amount of smoke emitted from the locomotive stacks. It has been assumed that the use of such jets necessarily involved loss in the efficiency of the boiler through the consumption of steam by the jets, and because of their cooling effect upon the firebox. But the extent of the loss resulting from such jets has never been determined, and it is not unlikely that if properly proportioned and arranged, they will add as much as they take away.

Another most promising field for experimentation is to be found

in the use of the so-called "sized coal." Satisfactory combustion demands that all portions of a fire be uniformly exposed to the currents of air passing through it. Obviously a fire made up of lumps of fuel varying in size, is not thus exposed. A large lump, when thrown upon a bed of burning coal, shuts out the passage of air from the area it covers. Moreover, the currents which pass up and around the lump are deprived of much of their oxygen by the burning coal below. Such a lump first smokes, then gradually ignites and continues to smoke, until the process of combustion has so broken it up that air may pass through it. Similarly a heavy shovelful of very fine coal, if not well spread, checks the draft at a point where it falls, producing results similar to those which take place in the presence of the lump. Such inequalities in the distribution of air throughout the area of the grate with the resulting smoke are reduced, and will sometimes almost disappear if the coal, of whatever quality, is sized before it is fired. While formal instructions frequently assume that the fireman will size his coal before using it, the work cannot be perfectly accomplished upon the locomotive. A crusher and screen, however, if installed and operated at important coaling stations, would permit locomotive tenders to be supplied with coal sized as uniformly as standard anthracite. The use of such fuel would result in a two-fold advantage; it would make possible the maintenance of better fires and consequently would permit locomotives to be worked to higher power, and it would effect a material reduction in the amount of smoke they would give out from the stack.

Another possible source of relief is to be found in the use of coal briquettes. While it has been generally assumed that the low price at which coal can be bought in this country will not justify briquette making, it is by no means clear that such a conclusion is justified. Experiments which are now being conducted under the direction of the United States Geological Survey at St. Louis and elsewhere, in the course of which many different kinds of coal are briquetted have developed a number of interesting facts. So promising have been the results that the Survey proposes to give, during the coming year, a large amount of attention to this phase of its work. It is argued that coal of inferior quality, which under existing conditions is left in the mine, may be successfully handled by briquetting. It is believed that mine operators will find it advantageous to install briquette plants which, when possessed, may be employed in working off grades of coal which are now not marketable. Such a process is likely to supply large quantities of comparatively low grade fuel. The experiments have already involved the use of briquettes upon locomotives, and while the Survey has made no report covering this phase of its work, one result of the accurate sizing secured through the process of briquetting, will be a diminution in the amount of smoke emitted.

In view of the facts presented, it is evident that those who seek to diminish the amount of smoke given out by locomotives will find much to interest them in propositions involving the steam jets, the use of sized coal and the promised early introduction of the briquette.

THE HARRIMAN INFLUENCE.

The Interstate Commerce Commission is at work on an investigation of the Harriman lines. Already important facts have been brought forth—facts previously guessed at or believed to be true, but now a matter of public record. In the first place, Mr. Harriman's power in the conduct of railroads of which he is the head is, to all intents, absolute. The ultimate authority in the organization of a railroad lies normally with the board of directors. Within recent years it has come to be not an uncommon practice for the full board to delegate its power when not in session to an executive committee made up of four or five of its most prominent and representative directors. The Union Pacific, the corner stone of the Harriman operations, has carried this process one step further. By resolution of the board the chairman of the executive committee is authorized to act with all the powers of the executive committee when the committee is not in session; that is, with all the powers of the board of directors, or, to be still more definite, with absolute power over the road. Mr. Harriman is the chairman of the executive committee.

Back in 1901, with funds which he was able to command, Mr. Harriman entered upon his famous Northern Pacific purchases. Though he was in the end defeated in his purpose of getting control of the Northern Pacific, the investments which he made in the stocks of the two Hill transcontinental lines turned out to be most profitable. This fortunate investment or speculation, whichever it may be called, has been the basis of his later operations in the securities of other railroad companies. The annual report of the Union Pacific for the year ended June 30, 1906, showed that the company had cash and demand loans outstanding amounting to $56,000,000. It was also exceptionally strong financially in other ways. The investigation by the Commission has already brought out how these large cash resources were used. Since June 30 the Union Pacific, or the Oregon Short Line which amounts to the same thing, has bought the stock of other railroads as follows:

	Amount	Per cent of this issue	Par value total stk outstanding.
Illinois Central	$28,123,100	30 per cent	30 per cent.
Baltimore & Ohio preferred	7,206,400	12 "	18½ "
Baltimore & Ohio common	32,334,200	24 "	
N. Y. Central & Hudson River	14,285,745	8 "	8 "
Atch., Topeka & Santa Fe pf	10,000,000	9 "	4* "
Chi., Milwaukee & St. Paul com	5,690,000	4½ "	2 "
Chicago & North-Western com	2,572,000	3 "	2½ "
St. Joseph & Grand Island com.	2,000,000	66 "	
St. J. & Grand Isld. 1st pf (abt)	922,300	17 "	38 "
St. Joseph & Grand Island 2d pf	1,425,000	36 "	

*Including $30,000,000 more held in the Harriman interest, 15 per cent.

It was also brought out on Tuesday of this week at the hearing in Chicago that $30,000,000 more Atchison, Topeka & Santa Fe stock is held by Mr. Harriman and his associates, making a total of $40,000,000, or about one-seventh of the total capitalization of the great Santa Fe system held in the Harriman interest.

Of these great purchases of the securities of other railroads, only one can be considered to be a natural one in the development of the Union Pacific system under old-fashioned ideas of railroad development. The St. Joseph & Grand Island is a road which will form a link in a new through line which the Union Pacific is making from Kansas City to its main line in Nebraska, thus doing away with the necessity of hauling through traffic from Kansas City west over the old Kansas Pacific to Denver and thence north to Cheyenne, a roundabout way with much less favorable grades than the main line. The new cut-off is already built from Topeka northwest 37 miles, and by the construction now under way of about as much again, will meet the St. Joseph & Grand Island at Marysville, Kan., whence that road runs to Grand Island, Neb., on the Omaha-Cheyenne main line.

The other purchases mark the extension of the Union Pacific's influence in an entirely different way—the reaching out into traffic territories untouched by the Union Pacific as a railroad. The Illinois Central is the best line between Chicago and the Gulf. The Baltimore & Ohio has come to hold a place second only to the Pennsylvania and the New York Central as a St. Louis and Chicago to New York trunk line. The New York Central controls not only its own lines ending at Buffalo, but western connections to Chicago and St. Louis. The Chicago, Milwaukee & St. Paul and the Chicago & North-Western are the two most important granger lines and eastern connections of the Union Pacific main line at Omaha. Also the St. Paul is at work on a line to the Pacific coast at Seattle, a point to which the Union Pacific is now extending its Oregon lines. The Chicago & North-Western, too, while it has not definitely committed itself to a Pacific extension, already parallels the Union Pacific on the north for about 1,000 miles west from Omaha. It did not need the testimony of President Ripley on the stand to prove that the Santa Fe is a competitor of either the Union Pacific or the Southern Pacific throughout its length.

A company is not actually controlled by less than 51 per cent. of its stock, but experience has shown that a condition approximating control can be obtained by an aggressive interest which holds much less than a majority of a railroad's stock. Putting the case not as strongly as this, however, but only considering that the Union Pacific purchases give it an influence in directing the policies of the various roads whose stock it has bought, the Harriman power is far-reaching. In the territory between the Missouri river and the Pacific coast everything with three exceptions is under Harriman ownership, control or influence. The exceptions are the through Gould line which will be completed from St. Louis to San Francisco by the building of the Western Pacific, and the two Hill roads, the Northern Pacific and the Great Northern. The rest can be depended upon to carry out the will of "Harriman and associates." Between the Missouri river and Chicago the Union Pacific has always lacked its own connection. The Illinois Central offers it one, the North-Western and the St. Paul each another. In trunk line territory the Union Pacific will share with the Pennsylvania the management of the Baltimore & Ohio, and with its friends, will have no small share in the management of the New York Central. The dominating line from Chicago to the Gulf appears to be already well within its

control. Thus the Harriman influence is stretched out over the whole country, except the far Northwest and the Southeast.

There are several things to be considered about this campaign of acquisition carried on by Mr. Harriman. First and most important, does it violate the Sherman anti-trust law? Opinion on this point will, no doubt, first be passed by the Commission and later, if necessary, by the courts. Leaving aside therefore this side of the question, there are two other important viewpoints. No one man should have so great power to speculate with the resources of a great and rich system of railroads, with all the incidental opportunities for personal profit, as Mr. Harriman has had. It is wrong economically and morally, if not legally. Yet at the same time it must be recorded that in the main that great power has been exercised by Mr. Harriman with an ability and a success as reflected in returns to shareholders which mark him as a railroad genius. His campaigns have been such as might have brought disaster to all but himself and his close associates. Instead they have brought profits to the holders of his securities. This favorable result appears to be due in about equal portions to his genius for railroad management and to the striking prosperity which has come to the territories through which his railroads run.

The immediate future holds no more interesting development of the railroad situation in this country than the final decision as to the status of the Harriman system and influence. If the methods which have been followed are legal and approved, it is not too much to say that there will soon be a concentration of railroad ownership in this country far greater than ever before. If the Harriman methods are condemned and forbidden, what is to be the ultimate situation of the associated railroad companies?

The Interstate Commerce Commission in a formal notice, signed by the chairman, has advised Congress that it "is credibly informed that automatic devices for preventing railroad collisions have been so far perfected as to justify thorough experimental tests of their practical usefulness; that the Commission is of the opinion that such tests should be conducted by officials of the Government and at its expense; and that the Commission therefore recommends that suitable legislation be promptly enacted authorizing the Commission, or some official body, to supervise and conduct experimental tests of such safety devices as appear to be meritorious, and that an appropriation be made sufficient to secure the most competent experts and defray the other expenses. * * *." The Commission is evidently looking for new worlds to conquer. Congress is struggling with ship subsidies and tariff subsidies, and now it is to be asked to establish a subsidy for inventors who cannot prevail upon the railroads to test and adopt their numerous and highly meritorious devices for saving human life. Will the Commission, if it finds one or a dozen sure cures, ask Congress next to compel the railroads to adopt one or all of them?

The Prussian government contemplates two changes in the administration of the State Railroads, which the growth of traffic and the experience of recent years have shown to be desirable. The first of these is simply an increase in the staff of officers attached to each "directory," said directory being the groups of general officers managing definite systems, usually 800 to 1,200 miles in extent. The regular staff have duties approximating those of general officers of one of our railroads, and are regularly assigned by the Ministry. The change will enable the President of such directory to draw from the administrative corps of high engineering and operating officials assistants to such general officers, to serve either temporarily at times of unusual pressure of business or permanently, as the case may require. To do this Parliament will be asked to provide for an increase of officials of these grades. The other change is the creation of a Central Railroad Bureau, for the performance of duties which affect all the railroads, or at least of several of the directories. Purely administrative duties, as heretofore, will be conducted by the Ministry; but heretofore in such matters as the distribution of rolling stock among the several lines, the study and testing of improvements in road, apparatus and equipment, and methods of operation, etc., each subject has been assigned to some one of the operating directories, and as these are more and more occupied with their regular duties, it is thought best to have a special office for such general duties. It may be added that the most effective administrative officers are not always, perhaps are seldom, the best for inquiring into new methods; and that the very highest talent is sometimes not fitted for strenuous executive duties. Another advantage of a Central Bureau is that it will be in close touch with the Ministry, while all but one of the directories are more or less distant.

Mr. James J. Hill is reported as saying in substance that when he travels on a railroad nowadays he takes his life in his hands; he wonders whether the journey is to be his last. The only fact which he gives to justify this statement is that permissive block signaling is practiced everywhere. Mr. Hill probably did not expect to be quoted, and it is doubtless unfair to analyze his statement in much detail; but it has been published all over the country, and it serves as a good example of how easily facts may be perverted. It is true that two trains are run in the same block section frequently on every road; but it is also true that this is done with passenger trains very rarely and only under rigid restrictions. It is done a good deal with freight trains, but at very low speeds; speeds at which collisions do occur, it is true, but usually not disastrous ones. The practice jeopardizes the life of Mr. Hill and other passengers only when enginemen are careless, and then only in situations where a collision of freight trains might derail or damage a passenger train on an adjacent track. As to careless enginemen, Mr. Hill could probably furnish expert information as to whether that element of danger is any worse than it was five, 10 or 20 years ago; and if it is, what good reason exists for the deterioration. It is also true that there are differences between railroads. On well managed roads—and not all railroads are badly managed—permissive blocking is forbidden, even with freight trains, in times of dense fog. As Mr. Hill is well acquainted with railroad presidents possibly he could do a useful public service by naming names.

CONTRIBUTIONS

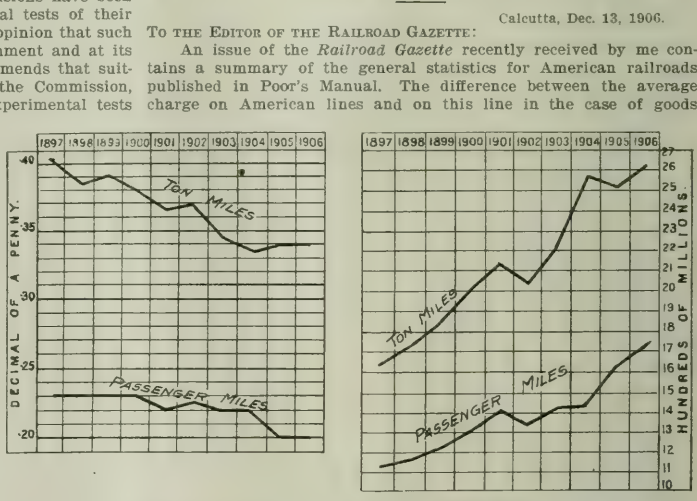
Traffic and Rates in India.

Calcutta, Dec. 13, 1906.

To the Editor of the Railroad Gazette:

An issue of the *Railroad Gazette* recently received by me contains a summary of the general statistics for American railroads published in Poor's Manual. The difference between the average charge on American lines and on this line in the case of goods traffic is not great, though we are appreciably lower, but there is a remarkable contrast in the charge in the two countries for the conveyance of passengers. You charge 2 cents a mile; for this amount we take a passenger five miles. You will see that our figures, both the passenger unit miles and goods ton mileage, are very high, I think exceeding the figures of any American line except the Pennsylvania.

W. A. DRING,
General Traffic Manager, East Indian Railway.



Rates and Traffic on the East Indian Railway.

1,885 Miles open in 1897. 2,263 miles open in 1906. Left-hand diagram, shows charges per unit of traffic. Right-hand diagram, traffic movement. Average charge per passenger, 1 penny (2 cts.) for each 5 miles. Average ton-mile charge, .68c.

Split Rails at Highway Crossings.

Ottawa, Ont., Jan. 2, 1907.

To the Editor of the Railroad Gazette:

I wish to call your attention to a small but interesting matter that came under my notice some time ago, and that I have never seen reference to in print. On a part of our road running over a sandy plain we found the rails splitting down through the center of the ball, at public road crossings, and only at those places. Naturally we wanted to know why, and here is the result of our study

of the matter. The vehicle traffic over crossings deposited on the rails a small quantity of sand. The vibration of the rail ahead of a train caused this sand to collect in a small ridge on the ball of the rail, in the very center, and the cutting power of the sand under the wheel in time splits the rail.

When I point out an evil I like to give the remedy, but in this case I cannot. Can some of our older track men?

E. J. M'VEIGH.
Grand Trunk Ry.

The First Government Railroad in America.

Vienna, Nov. 15, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of September 7th you published an interesting article by Mr. C. H. Caruthers under the heading, "The First Railroad Owned and Operated by a Government." This article being principally devoted to the technical history of this line and the locomotives used thereon, many of your readers, especially Americans, will doubtless be interested in the political and commercial history of this first state-owned railroad and its methods of carrying on business. Avoiding recapitulations I beg to quote some abstracts from my book published in 1883, "The means of communication in the United States of America."* For information with reference to the Pennsylvania Railroad I am indebted to the veteran engineer, Mr. James Worall, C.E., Harrisburg, who was at that time engaged in the construction of the lines.

The excellent results of the Erie canal and the ensuing unlooked for prosperity of the state of New York instigated other states to a stirring activity, to offset the influence of New York on the internal commerce. In November, 1824, 48 commercial men of Philadelphia and others founded the "welcomed Pennsylvania society for the promotion of the internal improvements," and accumulated their funds partly by the annual contributions of the members, partly by donations from corporations and private persons. In the following year the society was enabled to send an engineer to Europe in order to "gather information about all valuable improvements regarding canals, railroads, bridges, etc., appropriate to promote the scope of the society."

On April 11, 1825, the legislature of the state of Pennsylvania made a law "for the construction of communications between the eastern and western waters by canals and navigable rivers, to advance agriculture, commerce and industry, to join the mutual interest of the vast natural sections of the state, and consequently to open a rich source for the state revenue. The interest of the state demands that such works were the property of the nation and that the government enters upon their speedy accomplishment with zeal and energy." For this purpose surveys are to be ordered between Philadelphia, Pittsburg and the Lake Erie, also between Philadelphia, the Cayuga and Seneca lakes to the northern boundary of the state in the districts of Cumberland and Franklin as far as the Potomac river, and estimates of the cost prepared for consideration. The long ago planned connection with the great lakes and the so-called Laurentian—the Mississippi and Ohio valley were already partly achieved by the construction of macadam roads, but it needed a more rapid and efficient means of communication. With reference to the reports, the state authorities resolved on February 25, 1826, upon "the construction of a system of canals, especially the Pennsylvania canal, and railroads at the expense of the state between the Susquehanna and the Ohio, to be commenced simultaneously at both ends, and to raise a loan amounting to $300,000. The work on the canals was commenced in the same year on July 4, the great national holiday.

The Allegheny mountains, dividing the eastern from the western half of the state, formed a serious obstacle. On the eastern side the line was to follow the course of the Juniata as far as Hollidaysburg, on the other side from Johnstown along the Kiskiminetas and the Allegheny river to Pittsburg; between them there lay the ridge, the crossing of which was to be considered and determined by the appointed railroad and canal commission. The commission had also to investigate, if a connection were possible farther north between the Susquehanna branch and the Allegheny river. After long discussions, whether it was desirable and feasible to build a continuous canal with a tunnel 4.5 miles long in an altitude of 1,900 ft., or a railroad, this important point was decided in favor of the latter, i. e., a railroad, from Hollidaysburg to Johnstown, with 10 inclined planes.

According to the recommendations of the commission, and to meet the demands of the traffic, the construction of a series of railroads and canals was decided upon and the state undertook to build them. So the gateway of the first state railroad was opened at a time when the doubt concerning the practicability of an iron road was scarcely overcome. Thus the connection between Philadelphia and Pittsburg consisted alternately of railroads and canals, viz.:

a. The Columbia Railroad (82 miles), the first easterly section from Philadelphia to Columbia on the Susquehanna, the law for the construction of which was passed on March 24, 1828, while the work itself was commenced in the following year. The line designed as double track started between Broad and Vine streets in Philadelphia and ended on the great canal basin of the Pennsylvania canal in Columbia. One track was finished in April, the other in October, 1834; the maximum gradients were 1.176; the minimum radius of the curves 630 ft. The line crossed 3½ miles beyond Philadelphia, near Peter's Island, the watershed of the Schuylkill and the Delaware, by means of an inclined plane 2,805 ft. long and 187 ft. high, with gradients 1.15. A second incline was erected at Lancaster 1,800 ft. long, 90 ft. high, gradient 1.20. Except the inclined planes the whole line was worked by horses or mules. In 1835, shortly after its opening, there came five locomotives from England, and these were put on the road; they occasionally ran up the incline, but without cars. The service being unsatisfactory, two of the locomotives were at once sold to the Camden-Woodbury Railroad. The later performance of a Norris locomotive, "George Washington," which pulled up the incline two loaded wagons on July 9, 1836, was a surprise to all railroad men.

After passing the Schuylkill bridge the trains had to be divided; a couple of vehicles were shunted to the foot of the incline and here fastened to the endless rope carried around horizontal pulleys. The traveling speed of the rope, 3 in. in diameter, was six miles an hour. When all the vehicles were brought up to the summit of the incline they were again coupled together, this requiring another half hour, and an engine was put in front. The traveling speed on the Columbia Railroad was considerably less than on other railroads, and for passenger trains was about 15 miles in ascending and 12 miles on the slope. For freight trains it was about 12 and 10 miles, respectively. The great loss of time, the exorbitant expenses for the maintenance of both the permanent way and the cables (which lasted hardly one year and cost over $2,000), especially the imminent danger in the case of a breakage of the rope, showed the mistake in the disposition of the whole work, which was regarded as a great failure and accordingly much attacked.

b. The eastern section of the Pennsylvania canal, commencing at Columbia, where it was connected by means of the Susquehanna canal with Havre de Grace, on the Chesapeake bay. The canal (44½ miles long, with an ascent of 116 ft., opened 1871) runs in a northwestern direction on the left bank of the Susquehanna, joins the Union canal in Middletown, proceeds through Harrisburg to Duncan's Island, crosses the Susquehanna and branches off both to north and west.

c. Near Duncan's Island commenced the Juniata section of the Pennsylvania canal, which ran by way of Mifflintown, Lewistown and Huntingdon to Hollidaysburg (127.5 miles long, ascent 554½ ft., opened 1830). More than six months every year the canal was blocked by ice. In 1838 heavy rainstorms burst the banks and swept 39 miles away; the traffic was stopped for half a year.

d. From Hollidaysburg started the second railroad line, the unhappily situated Portage Railroad across the Allegheny mountains. It crossed the glen of Blairs Gap at 2,491 ft. above the sea and sloped down along the Conemaugh valley to Johnstown. The construction of this road, remarkable for its boldness, was decided on March 21, 1831, and completed in March, 1834. The rise from Hollidaysburg to the summit amounted to 1,398.7 ft., the slope to Johnstown 1,171.6 ft.; 2,000 ft. of the aggregate inclination were overcome by 10 inclined planes from 1,500 to 3,100 ft. long, with gradients from 1:10 to 1:14.3, giving a total length of 4.39 miles, besides a tunnel 900 ft. long. The transition from the permanent way to the incline was formed by vertical curves. On the summit level of each plane there were two stationary engines of 35 h.p., but only one at a time in service. A train consisted as a rule of four vehicles with a safety car at the rear end to avoid a sliding back; on longer levels between the planes locomotives were used; on shorter ones, horses. To travel the whole distance, 36.7 miles, required 4½ hours in passenger trains and between 7 and 9 hours in freight trains. The maintenance of the road was very expensive, its efficiency because of the coating of the ropes with ice much reduced, so that the proposition to cover the planes by sheds was favorably received. But that was never done. Moreover, as the railroad depended upon the traffic of the canals on either side, the service had to be discontinued during the winter months.

e. From Johnstown the western section of the Pennsylvania canal led through the valley of the Conemaugh, Kiskiminetas and Alleghany rivers (104.75 miles, with 70 locks and an aggregate rise of 470 ft.) to Pittsburg. The length of the whole main system, both railroad and canals, amounted to 395.45 miles, that is 31.75 miles more than the original Erie canal. The failure of the system in 1834 was chiefly due to the highly unfavorable meterological situation; nevertheless it had its share in the speedy development of the Pennsylvania. A series of important political questions arose with regard to the state as a transporter, and were publicly discussed; they had to be answered before the traffic could be initiated.

*Die Verkehrsmittel in den Vereinigten Staaten von Amerika, Leipzig, Duncker & Humblot.

As to the canals, the state of things was quite simple; they could be used by every one who paid a certain due.

But question arose as to the mutual relations between a railroad and a turnpike road. Judge James Kent, appointed by the commission, argued on this point in his report that, in virtue of the concession, Act 1804, the societies of turnpipe roads were at liberty to build railroads on their turnpikes for the transportation of both persons and freight, provided that the said turnpike roads showed over their entire length a smooth surface, in order that they might be used by any ordinary vehicle. With regard to the simultaneous use of steam cars and ordinary wagons upon this same road, another question had to be considered, but it has nothing to do with the legal question. Stress was laid on the principle that railroads be not regarded as objects upon which any person or corporation has an exclusive right—their use must be free and the construction of railroads can take place on the property of any person whosoever, and consequently also on a territory for which a charter for a common road has been granted. A turnpike was nothing else than an artificial road, for the use of which the licensees have a right to collect a way toll and to erect turnpikes or closing gates for this purpose. Therefore the traffic on such roads is (under certain conditions) free.

Other not less important questions were: should the railroads be public or private roads; that is, should they be administered, operated and exploited by the state or by private persons, and was the user to be at the same time proprietor of the motive power and the means of transportation? While there was no precedent, either in England or in other European countries—for railroads were throughout private enterprises—a special committee was established and charged to advise. This committee started at the beginning from the point of view that the public funds were intended to serve the public interests, especially to benefit the commerce between the east and the west, and could not therefore be spent on a limited locality. The chief task was to reduce the transportation rates for all products of the west, such as grain, lumber, coal, iron, spirits, salt, etc., all of which had only a small (!) intrinsic value; these means of communication had further to serve as competitors with the other eastern ports and their commerce. It was therefore essential that no disposition should be made which could in the least be regarded as a tax upon this commerce or as an aggravation thereof.

There was a conflict of opinion between two parties of the commission as to who should own the means of transport. While one party said that it was an exclusive business of the state, which should administrate the lines by the aid of officials expressly appointed, the other party pleaded eloquently for the lease to a contractor as a most advantageous means. The former suggested that when a monopoly could not be avoided, it were better in the hands of the state than otherwise; the latter believed this motive to be a feigned one, for the transportation of the United States mail was profitably leased to contractors; it was only necessary that the rates for the conveyance of each article per ton-mile should be fixed. Should the state only furnish the motive power then the dissimilarity of the vehicles owned by private persons, who were besides guided by inappropriate economy, would be a great evil; it was therefore in the public interest that the motive power as well as the vehicles should be furnished by the same hand, i.e., the state. In the case the management of the lines were trusted to private persons it was to be properly advertised and the contract not to be concluded for more than three years because it was a first experiment.

In spite of this judgment, the law passed on April 15, 1834, provided that the railroads were public highways upon which everybody had a right to convey passengers or goods. The state as builder of the roads gave them free for public use towards reimbursement of certain charges. Every person, without exception, was permitted to put his own passenger carriages or freight cars on the lines. Because of the regularity and safety of the traffic the state only furnished the motive power, owning no other rolling stock except for the use of the maintenance of the lines.

Each shipper provided his own equipment; some owned but a single car, some a great number. The success of the new industry led, in fact, to the formation of transport companies which owned up to 50 four and eight-wheeled box and flat cars as well as boats on the canals, and were at liberty to fix the rates. As most of the merchandise from Philadelphia went all the way to Pittsburg and had to pass two railroads and two canals it was necessary to devise some means to avoid a threefold trans-shipping. Some of the companies, therefore, had wagons consisting of several boxes which were lifted from the trucks by cranes and deposited in the boats or vice versa, and they had boats divided into three or four separate sections which were carried on flat cars over the mountains and put together on the canals.

The disparity between the vehicles caused frequent stoppages and delays regarding the scheduled time in consequence of their irregular course and even numerous injuries to passengers. In September, 1835, a by-law was passed that all the vehicles on the lines were to be built according to the models and patterns designed by the state. It is now interesting to review the methods of managing the traffic. The passengers mounted the carriages at different places in town pointed out by the state's agents and were conveyed to the depot, where also the freight wagons from the different magazines stood ready at a fixed hour. Here a train consisting, as a rule, of four passenger carriages and a baggage van or a freight train was formed. Each shipper, after receipt of the merchandise, had to fill out a declaration stating kind and quantity of the different articles, the number of cars loaded, upon which the name of the proprietor and the loading capacity were inscribed, and hand it to the state agent, who calculated the toll according to the tariff and collected the amount. Thereupon the shipper received a manifest as quittance, which had to be produced upon every request to the accompanying train official and delivered at the place of destination. The state agent also took a memorandum of the number of passengers carried each day and the miles traveled, and prepared a return for settling the account. The companies charged per passenger and mile 4 cents, from which the state received 1 cent as way toll, 1 cent as motive power toll, besides 1 cent way toll and 2 cents motive power toll for each four-wheeled passenger car, and the double amount for each eight-wheeled car, so that the companies pocketed on the average 1.8 cents per passenger and mile for their service. The state tolls for goods differed widely, namely, according to a scale of 12 rates from 0.6 to 4 cents and 2 cents on the average per ton-mile; the tolls were low for iron, coal, lumber, stone, lime, and the highest for general merchandise, dry goods, furs, etc. The state compensated the companies for the transportation of the mail with $^1/_{1000}$ cent for every 10 lbs. per mile. The state collected on the average 2 cents as way toll, 1.2 cents as motive power toll and 2 cents for each wagon with three tons loading capacity, so that these charges amounted to 3.8 cents in the aggregate per ton-mile, whereas the shippers collected about 9 cents per ton-mile. The tolls on the Portage railroad were the same, except a higher motive power toll. At the end of 1835 the state of Pennsylvania owned 265 miles of railroad, including the sidings.

The report prepared by the Railroad and Canal Commission for the year 1839 recommended the repeal of the law of April 15, 1834, and suggested that the state should at least handle the passenger traffic which but required the appointment of a few more employees and would raise the revenue of the Columbia railroad for more than $150,000 a year. "The private companies enjoy at present a large gain out of this business and there is no reason why the state should not draw the greatest possible profit out of its enterprise. A chief obstacle to use the main lines of our interior communication is due to its character, namely, that railroads and canals alternate, which causes both considerable delay and cost. Those engaged in the freight transport must possess ample means, whereas not wealthy persons cannot devote themselves to that business. If the state by also taking charge of the freight traffic could enable every proprietor of a canal boat to ship his goods from Philadelphia to Pittsburg and have them delivered there without the interference of a special agent a considerable reduction of rates would follow by this competition and the state lines would receive a large share of the traffic which is now diverted in other directions."

In the report for 1840 the commissioners advocate the abandonment of the two inclined planes, the management of both the passenger and freight traffic by the state, and suggest the substitution of anthracite coal instead of wood fuel besides some ameliorations and economies with regard to the working of the lines. In compliance with this recommendation the second incline was discontinued and replaced with an enormous sacrifice of capital by a circuit railroad of six miles length, with maximum grades of 1:150. In 1840 the state owned 36 locomotives, each of which pulled 35 wagons with a capacity of three tons.

The excessive cost of construction and maintenance, the inadequate traffic which never exceeded 20,000 tons in any year, the operating difficulties explain the failure of this enterprise, the results of which did not in the least equal the anticipations; it was subjected to a great deal of criticism both from the operating and financial point of view. In the early fifties the state relieved itself of this heavy burden, which became the nucleus of one of the most important railroads in the United States, viz., the Pennsylvania Railroad Company.

P. F. KUPKA, C.E.,
Imperial Councillor: Delegate to the International Ry. Congress.

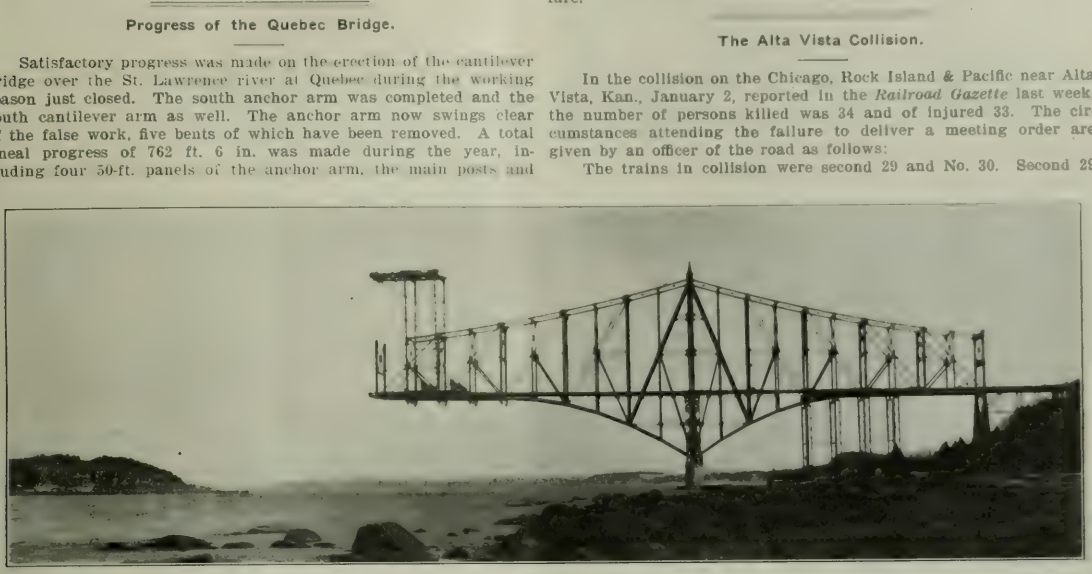
New Cuban Service.

An interesting commentary on the changed relations of the Illinois Central and Southern Pacific is found in the advertisement of a joint winter service from Chicago to Havana, effective Jan. 11. The Illinois Central's "Cuban Special" leaves Chicago at 10 a.m., daily, and on Saturdays (train leaving Chicago Friday) the special runs direct to the ship's side at New Orleans. The new steamship Momus, which made her maiden voyage to New York a few weeks ago in the Morgan Line fleet of the Southern Pacific, leaves New Orleans at 1 p.m. Saturdays, arriving in Havana at sunrise Monday morning. With a sea journey as short as this (597 miles) in as

excellent a ship as the Momus, which is as large as the older steamers of the Cunard and French lines now engaged in transatlantic passenger service from New York, the Havana passenger service should be greatly stimulated.

Progress of the Quebec Bridge.

Satisfactory progress was made on the erection of the cantilever bridge over the St. Lawrence river at Quebec during the working season just closed. The south anchor arm was completed and the south cantilever arm as well. The anchor arm now swings clear of the false work, five bents of which have been removed. A total lineal progress of 762 ft. 6 in. was made during the year, including four 50-ft. panels of the anchor arm, the main posts and



Progress of the Quebec Bridge at the End of the Working Season, 1906.



Driving Main Top Center Pin 375 Feet Above the Water.

the entire cantilever arm 562 ft. 6 in. long. The erection has been carried on with a traveler built of steel and enveloping the trusses. It is 54 ft. long, 105 ft. wide and 220 ft. high, with 70-ft. top and bottom extensions, and fully rigged weighs 1,120 tons. The bridge is being built by the Phoenix Bridge Co., Phoenixville, Pa.

The Paris, Lyons & Mediterranean Railroad has been running a Riviera express since November 3 which it claims to be the fastest long-distance train in Europe. From Paris to Marseilles, 536 miles, the time is 10 hours and 24 minutes, with six intermediate stops. From Marseilles to the Italian border at Ventimiglia, 162 miles, there are 10 stops, and the time is 4 hours and 47 minutes. The passenger leaving Paris at 9.05 a.m. reaches Nice at 10.50 p.m. Between Paris and Marseilles the average speed is 51½ miles an hour; but for the line along the coast only 35 miles an hour. Passengers by this train pay 2 francs for a seat besides the first class fare.

The Alta Vista Collision.

In the collision on the Chicago, Rock Island & Pacific near Alta Vista, Kan., January 2, reported in the *Railroad Gazette* last week, the number of persons killed was 34 and of injured 33. The circumstances attending the failure to deliver a meeting order are given by an officer of the road as follows:

The trains in collision were second 29 and No. 30. Second 29 took the siding at Volland to let No. 14 pass. After 14 had gone by, but while second 29 was still standing on the siding, the despatcher, having ascertained the fact from the operator, gave an order for it to wait there for No. 30. While the operator was taking this order, second 29 backed out on to the main line and started west. Noting this, the operator, as he claims, while still copying the order, reached around with his left-hand and threw the lever to set the signal against the train. But the train failed to stop at the station, or at the water tank west of the station where engines usually take water.

One point for consideration in the investigation was whether the despatcher did wrong in sending a meeting order to the meeting point, this being contrary to the rules, except in emergency. Superintendent Tinsman has expressed his belief that the despatcher is not technically responsible, the conditions fully justifying giving the orders as he did.

The operator has told conflicting stories. Even though the visible signal was set by him as claimed (which the officers disbelieve, thinking he expected the train to stop at the tank, and would deliver the order there) he was required by the rule to place audible signals (torpedoes) on the rails, one on each rail, opposite the signal post, which he did not do. It now appears that he is only 18 years old. His signed application for employment shows him to have been 23 on August 30, 1906, and to have been an operator in the service of various roads since 1900. He had been in the service of the Rock Island only three days at the time of the accident. The total number killed was 34; 26 bodies were recovered, the remainder being destroyed by fire. There were 33 Mexican laborers on the train, of whom 31 were killed; these, with white passengers and one porter, make 34 in all. Twenty-three passengers and ten employees were injured.

Railroad Delays in Massachusetts.

The following extracts are taken from the careful and thorough report of the Massachusetts Railroad Commissioners dealing with delays on the railroads having terminals in Boston:

Vexatious delays in passenger and in freight transportation are not peculiar to Massachusetts. Throughout the country railroads are choked with freight and passengers annoyed with delayed trains. The explanation given is that the magnitude of the business has been greater than the expectation of even far-sighted railroad men. This is undoubtedly true, and yet the regular growth of business and the outlook for the future has for a considerable time foretold an era of prosperity. Present conditions are not, therefore, in all cases to be wholly charged up to unexpected demands. There is good reason to believe that more than one management has taken chances with equipment from a policy too appre-

hensive lest expenditures threaten the maintenance of dividends. In dealing with delays on railroads there are always certain obstacles to the regular running of trains that must be reckoned with. No matter how high the standard of equipment weather conditions will interfere with speed. A zero temperature cuts down the power of locomotives, and blinding storms and fogs hide signals. Safeguards are essential to safety, and yet the observance of them must upon occasions hold up trains and prevent the making of schedule time. To the extent that safe operation is alone responsible for train delays companies are justified in asking the public for favorable and not adverse criticism, and we are inclined to believe that the soberly thinking public is always ready to accord it.

Again, train schedules in late years have been adjusted to favorable rather than to unfavorable conditions of weather. Such schedules must inevitably in the winter season be accompanied by the occasional and at times seemingly frequent delays that are the result of our peculiar climate. A return to the old-time practice of lengthening out winter schedules would mean a generally slower speed, but closer adherence to time-tables.

Another disturbing element is the through train that enters the state with a load of tribulation of its own accumulated in other territory, and adds to the unpleasantness in a most aggravating way by disturbing the local service upon our lines. The inability of certain long-distance "flyers" to make their schedule time is historic.

Many weeks ago the frequency of delays in the movement of Boston & Albany trains led the Board to take up the matter with the management and to request a report of delays from all railroads for the month ending December 25. It must be admitted that the period selected is always a trying one on account of the uncertainties of holiday traffic and the sudden changes of weather.

The situation upon the Boston & Albany has been exasperating. Eliminating unreasonable complaints and dismissing the chronic faultfinder and the reckless critic, the official record and the personal experience of passengers justify the indignation which has been expressed. Time-tables have been in a large degree worthless; inquiries of officials as to what train and as to when any train would next arrive or move out have been much of the time to no purpose. In the days of the stage coach such uncertainties were discounted, but in these days they are disastrous to personal comfort and convenience and to the transaction of important private and public business.

In 1900, after a long debate, the Legislature approved the lease of the Boston & Albany Railroad to the New York Central & Hudson River Railroad Company. Men of affairs urged the advantages to be realized through the lease in the development of export and other traffic and a better through connection with western territory, advantages which, it was argued, must be of direct benefit to the commercial interests of Boston and of the large cities along the line of the road. Opponents of the lease predicted trouble in handing over this road to the control of a foreign corporation that might have selfish interests in favoring other commercial centers rather than those in this Commonwealth. The predictions of both classes of prophets seem to have been realized in greater or less degree. This is a day, however, when the obvious and suspected delinquencies of a railroad management, rather than its accomplishments and virtues, are the attractive theme of discussion, and a day of prejudice against what in an unneighborly way is called foreign control. Then, again, the public is apt to be keenly alive to the faults of a new administration and kindly forgetful of the shortcomings of its predecessor. The "good old days" of the Boston & Albany Railroad bring to mind an excellent roadbed, handsome stations, with most attractive grounds, a prosperous management, and that most important feature, an admirable esprit de corps; but it can be recalled that it was an administration which partook of the lassitude that is apt to accompany a large income under comfortable conditions, and that it showed little ambition to develop further a business which was already of pleasing dimensions. It is only just to say that the regime of the New York Central has added many trains, increased facilities for through travel, export and general traffic, and made an outlay in excess of that required under the lease in improvements at East Boston. Nor has it, as often alleged, stripped this road of equipment or enriched itself from the receipts of the line. An inventory taken by the board when the lease went into effect affords us the opportunity for disproving the first charge, and figures furnished in response to our request for information seem to clearly disprove the last charge.

That weather conditions affect train movements; that safeguards against accident interrupt them; that overdue through trains disturb local service have all been noted, but neither singly nor together do these causes fully account for conditions which have existed upon the Boston & Albany Railroad. The company contends that all serious interruptions in its service not explained in the causes above named are due to the unexpected volume of business and excusable lack of equipment and facilities.

Without a shadow of doubt, the immediate management of the Boston & Albany Railroad has been facing a great increase in business under an unfortunate combination of circumstances, including insufficient coal and poor coal, lack of engines, track and terminal facilities, as well as difficulties in securing trainmen; but the question is, has the New York Central, as the lessee of this road, upon whose resources the public had a right to rely, really been caught at an untoward time without fault of its own as an unwilling victim of a great flood of business.

About three months ago the New York Central after long negotiation entered into an agreement with the New York, New Haven & Hartford Railroad Company by which large quantities of freight formerly handled by that company would thereafter be daily turned over to the Boston & Albany road. The arrangement was one mutually profitable, and one which would in every way have been desirable had the New York Central possessed or had it provided adequate facilities for carrying it out. As it neither had them nor provided them, the arrangement was one that jeopardized the interests of the traveling public that is dependent upon the Boston & Albany Railroad. In the light of that traffic agreement, it is idle for the company to point to the extraordinary increase in business as an excuse for its failure to furnish proper accommodation. Fuel is the factor of all others with which a steam railroad cannot afford to take chances. In contracting for the year's supply the New York Central dealt with companies along its lines and in part with companies in which it had a proprietary interest and purchased large quantities of coal that had in the market a reputation for inferior quality. The coal companies, presumably not for the first time in the experience of the contracting parties, hurried deliveries to other purchasers, who paid higher prices and postponed railroad deliveries. In consequence the supply of coal on the Boston & Albany at one time was not more than enough to last three or four days. Such a policy, if deliberate, in purchasing coal wantonly trifles with the public interests. It is true that manufacturers have been unable to fill orders for equipment; true that the demand for labor has been greater than the supply, and true that abnormal shipments have helped to congest tracks; but these excuses have been given too often. Patrons have heard too much about cars and engines which have been ordered, but not delivered, and are looking for cars and engines in use; they are weary of listening to vague plans for future improvements. The root of the matter is that in too great zeal for economy the administration has been content to risk the comfort and convenience of the traveling public and has been too slow to appreciate the fact that the maintenance of service and not the maintenance of dividends is to be given the place of first importance and that if a risk is to be taken it must be the risk of a temporary failure of returns upon capital rather than a failure of reasonable accommodations. With conditions and causes known the question is one of remedy. Two paths are open, one pointing to legal proceedings to terminate the lease; the other to an improved service under the lease. In the belief that the latter may well be deemed at this time the better course, we recommend that the New York Central & Hudson River Railroad Company in dealing with the Boston & Albany division abandon hand-to-mouth methods, and adopt a policy of making the expenditures necessary to establish a high standard of train service and to provide the tracks and terminal facilities requisite for the demands of business.

The Boston & Albany Railroad as a great avenue of transportation affording direct communications between the vast territory beyond our state lines and a chain of the most flourishing cities of New England ending with the second port of the country, offers a splendid field for railroad enterprise. The public interests call for a broad and progressive railroad administration and equally for no timid or provincial policy on the part of the state. If our railroads are operated, charges made, accommodations provided, and capitalization restricted under state supervision, it matters little whether it be one or another monopoly that holds stockholding interests. It should simply be made sure that however far the management of affairs extends beyond our borders, within them there is given a public service of the first order. It is such a service that was expected under the lease. The paragraph inserted in the lease to secure it reads: "The said railroad company during the term of said lease shall not diminish or permit to be diminished the facilities for travel for business over the Boston & Albany Railroad or any part thereof, or lower or permit to be lowered the standard of its service as shown in the quality and equipment of its cars, in the construction and care of its stations, station grounds and approaches thereto and in the provisions made for the security and convenience of the public." It is to be regretted that the standard of the future was tied to the performance of the past. Relative merits, too, as a test must become more vague and indefinite as the years go on. Still more unfortunate is this phrase in view of the actual equipment of the Boston & Albany at the execution of the lease. The inventory then taken by the board showed that "of 336 cars then in use forty-seven were of the modern type, 150 modern in construction, but of old pattern in respect to seats, and 169 of an old and unsatisfactory type throughout"; and that "of 248 locomotives eighty were heavy freight and passenger engines and nearly new, seventy-eight were of average character and

ninety were near the end of their usefulness." It cannot be believed that such an equipment was the ideal that was intentionally presented to the New York Central management as the Massachusetts pattern and the goal of future endeavor upon the part of this lessee. But whatever the technical letter of the lease the true spirit of the arrangement and the true understanding between the parties warranted the expectation of a liberal and progressive management of this railroad. That and nothing less is to be demanded.

The United Railways of New Jersey.

BY C. H. CARUTHERS.

The earliest mention of a railroad in New Jersey which appears among the manuscripts at the writer's command is a statement that in 1812 John Stevens applied to the legislature of that state for the necessary authority to build a railroad within its borders. Between whatever points this line was intended to be built, it doubtless was meant to be of the same type as the "tramways" then in use throughout the coal regions of England, and it is scarcely probable that the use of the steam locomotive upon it was contemplated at the time. Following this we find a statment that the portion of the Camden & Amboy Railroad, between Bordentown and Amboy, covering a distance of 26½ miles, was completed and put in operation in 1831. The section from Camden to Bordentown was not finished until the following year, at which time trains began running over the entire line, and from that date the road was the chief means of communication by land between New York and Philadelphia for many years. The traffic was heavy and several serious accidents occurred. Probably the most disastrous was that at Hammill station, near Bordentown, in 1855. A single track only was used, and through a blunder two express trains running in opposite directions were allowed upon that part of the road at the same time. The engineman of the northbound train saw the other approaching and started his train back to reduce the shock, or perhaps entirely prevent it. A physician failed to notice the backing train and drove his buggy on a grade crossing. The rear coach struck the horses and was derailed, the other coaches piling upon it. As a result of the overturn and the collision of the oncoming train which occurred almost immediately afterward, 21 people were killed and 70 were injured.

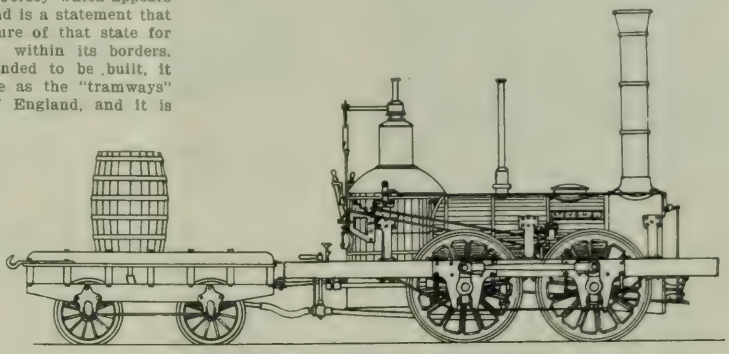


Fig. 1—The Stevens (Re-named John Bull).
As built for the Camden & Amboy Railroad in 1831.

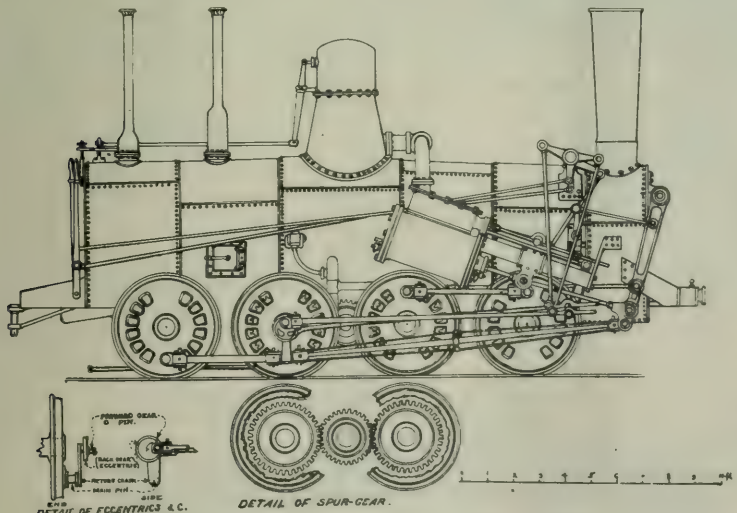


Fig. 2—The Monster; Camden & Amboy Railroad, 1834.

The Elizabeth & Jersey City Railroad is mentioned as having received a locomotive from the Rogers works in 1838, and the New Jersey Railroad & Transportation Company is similarly referred to at various periods from 1837 onward.

It is to be regretted that but little data seem to be attainable of the Belvidere-Delaware Railroad, or the Philadelphia & Trenton Railroad, but as the Camden & Amboy appeared to be that upon which most of the early experimental work in the various lines of railroad practice was done, it is but natural that these latter roads came into less prominence at that time.

Near the close of the sixties these four roads were combined under the name of the United Railways of New Jersey, and in this combined form were afterward, in December, 1871, leased to the Pennsylvania Railroad Company, since which time they have formed the New York, the Amboy, and the Belvidere divisions of that company.

Through the courtesy of Mr. Andrew Carnegie and of General William J. Palmer, the following letter is permitted to form a part of this article, and in connection with the lease of these roads and their wonderful development since that lease was consummated, is strangely prophetic in view of the fact that it was written in 1859, twelve years before this merging of the identity of the New Jersey roads in that of the Pennsylvania:

Altoona, Pa., June 18, 1859.

W. J. Palmer, Esq., Philadelphia.

Dear Sir:—(Here follow some matters not pertinent to this article which are therefore omitted.—C. H. C.)

Much obliged for the "Press" lent me. We shall certainly be able after a while to get a satisfactory line to New York, via the Pennsylvania Central, and Philadelphia, Allentown, or Tyrone. I vote for the former and hope the C. & A. Co. will soon see it to their interest to form a close offensive and defensive alliance with the "Great Provincial."

A proper effort on their part will enable them to secure or rather retain the trade. If it once is compelled to seek other channels, its recovery will be less easy.

Truly yours,

(Signed) A. CARNEGIE.

The equipment, stations, permanent way, and some features of practice of these roads in the olden days differed considerably from the lines followed on railroads to-day. The Camden & Amboy at first used several styles of track, beginning with the wooden rail capped with bar iron and resting on stone blocks. Other sections were of wrought iron edge-rail weighing 36 lbs. to the yard; and at another point iron rails 16 ft. long, 3½ in. high, and 2⅛ in. wide at the bottom were used. These rails weighed 40 lbs. to the yard. The Stevens "H" and "T" rails were also used. The latter had iron webs riveted to their vertical sections, to enable them to be properly secured to the sleepers. There were no sharp curves on the line, and difficulty found in keeping the first locomotive on the track must have been caused by imperfect alinement.

The station platforms were built on a level with the floors of the passenger coaches, and while awaiting a train at Bordentown in 1900, I was informed that the station house then in use had been built almost fifty years before, and had undergone but few changes in all those years.

Where double tracks existed upon these lines trains were run to the left as in England, and this practice continued for some time after the lease to the Pennsylvania was consummated. At points where the grade crossings were protected by gates, the rather flimsy "safety-gate" as we now see it, was not used, but instead was a heavy framework covered with wide and high palings, and this was raised vertically by hand-controlled mechanism. Some of these gates were in use as late as 1878.

Another feature of the old-time practice of the Camden & Amboy was still followed in the great train shed of the Pennsylvania at Jersey City in 1905, and probably is not yet discontinued. Large baggage trucks or vans are drawn along the platforms by a horse, who performs his duties apparently with an utter obliviousness to the movements of the massive engines filling the shed with the reverberations of their exhaust.

The locomotive equipment of these roads, especially during their earlier days, like that of many other lines of the period, was of a very diversified character. The first engine of which accurate records are preserved is the well-known John Bull, which came to the road from the Stephenson works at Newcastle-on-Tyne, England, in August, 1831, and ran continuously until 1866, is still in running order, and is preserved in the National Museum in Washington, D. C., having been presented to that institution by the Pennsylvania Railroad. Until 1881, at least, it appeared regularly upon the performance sheets of the Pennsylvania Railroad as "601, Stephenson, England." This engine was named "Stevens" by its English builders, but was changed to the more familiar "John Bull" by the Camden & Amboy people soon after its arrival in America, and it is probable that but few have known the original name. Those who have seen it will recall that the dome is an oval affair attached to a saddle at the forward end of the boiler, while a cap is bolted to the hemispherical roof-sheet. Originally the dome occupied this position and the cap was over the saddle referred to, which now carries the dome.

The peculiar truck which was long used at the front of the engine is one of the devices of Isaac Dripps, the master mechanic at the time of the "John Bull's" arrival in America, and was found necessary to enable the engine to pass around the numerous curves of the line instead of accomplishing that part of the trip by way of the Jersey swamps. Mr. Dripps also removed the coupling rods from the drivers, and arranged one wheel of the forward pair in such a manner as to permit it to rotate independently of its mate on the axle. Of course, this arrangement considerably reduced the adhesion and naturally the tractive power of the engine, but it afterward kept on the track and rounded the curves better. Its original wheels were of locust wood centers, with wrought-iron hubs and tires. The latter were shrunk on the wooden felloes in the same manner as a wagon maker shrinks tires on a cart or wagon wheel. No tender came with the engine, and that used in later years was of a type generally seen on the earlier engines of the line until after 1850. The first tender of the "John Bull" was simply a truck to carry the wood and having an empty whisky barrel set upon it for a water cistern. This was connected to the pump by a leather hose made by a shoemaker. The eccentric rods were carried forward through an opening in the lower part of the smokebox to the front of the engine, terminating at that point in hooks which operated the valves, the stems of the latter, of course, entering the front of the steam chests. At the time of this engine's retirement from active service in 1866 it had a smokestack of about the same type as is shown on engine "Stevens," and retained this when at the Centennial Exposition in 1876.

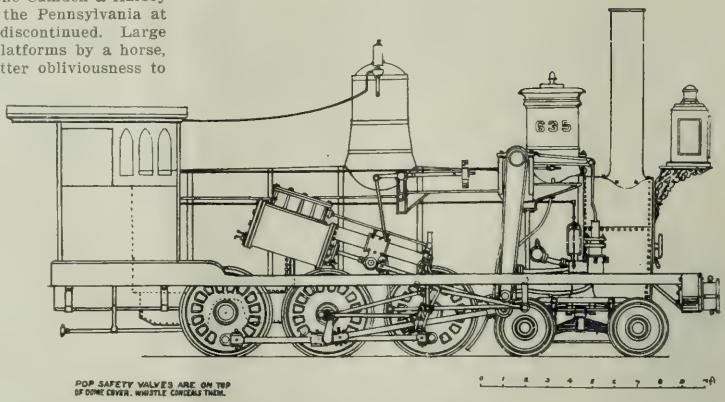


Fig. 3—Rebuilt Monster, 1869.

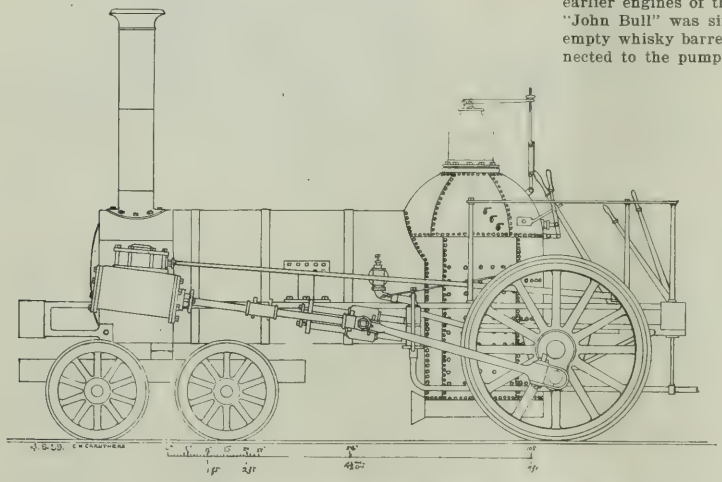


Fig. 4—Black Hawk; Philadelphia & Trenton Railroad, 1853.

The "Monster," Fig. 2, was a most remarkable engine. It is alleged to have been built by the Camden & Amboy Company in its shops at Bordentown, N. J., in 1834, and is claimed to be the first locomotive designed especially to use anthracite coal as fuel. The rear two pairs of driving wheels were coupled in the usual manner and driven from the cylinders through the medium of a large rocker to which both the piston and the connecting rod were attached. The forward axle of these two pairs of drivers was provided with two spur-gear wheels

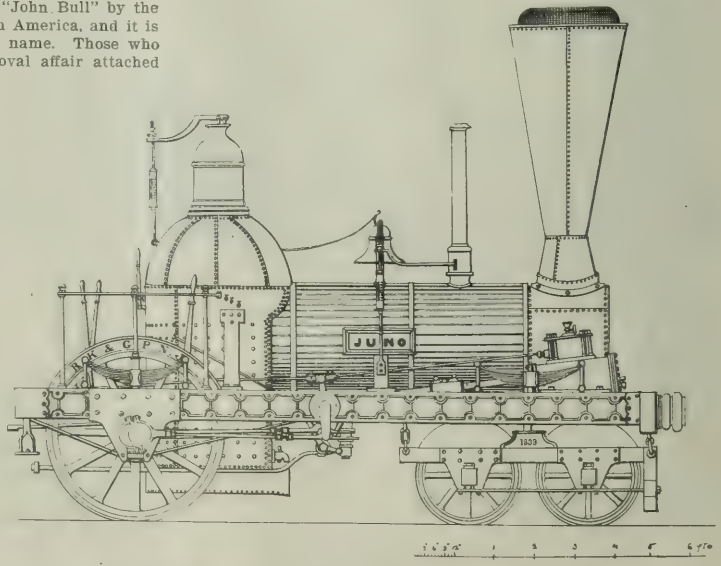


Fig. 5—The Juno.

Built by Rogers, 1839, for the Jersey City & New Brunswick Railroad.

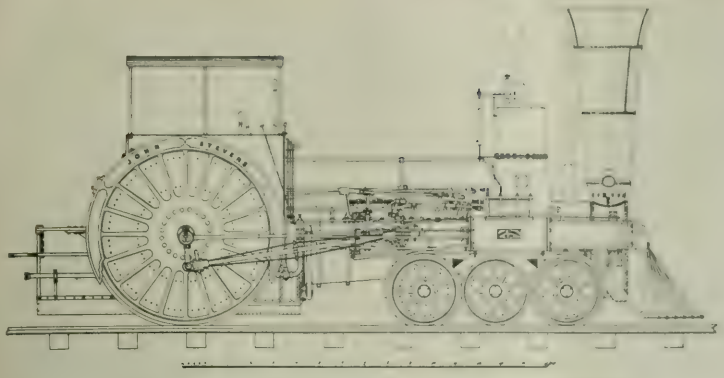


Fig. 6—The John Stevens; Built by Norris Bros., Philadelphia.

which meshed into intermediate spur-gear wheels, and these in turn meshed into two more attached to the rear axle of the forward two pairs of drivers, these also being coupled together by parallel rods. The valve-gear was of the "D" hook type, with independent half-stroke cut-off. The full stroke gear was driven by an eccentric and a pin attached to a return crank on the main pin, as shown, and the cut-off was driven by a rod connecting its rocker to the large driving rocker already referred to. The mode of reversing and of controlling the cut-off will be readily seen in the drawing. The peculiar shape of the top of the boiler will be recognized as practically that of many locomotives of the standard classes now used on the leading railways of America. The principal dimensions were:

Cylinders	18 in. x 30 in.
Diameter of drivers	48 "
Steam ports	15⅝ x 10 "
Exhaust ports	25⅝ in. x 10 "
Travel of valves	4¾ "
Flues, number of	135
Flues, diameter	2 in.
Flues, length	130 "
Firebox, width	43 "
Firebox, length	84 "
Firebox, depth	30 "
Total heating surface	745 ft.
Total weight	60,910 lbs.

The original tender was probably of the same design as shown on rebuilt "Stevens," Fig. 7. The rebuilt "Monster" had a tender with two trucks, one of six wheels and one of four, most likely of the same design as those in Figs. 8 and 9. Data in possession of the Pennsylvania people states that the rebuilt "Monster," Fig. 3, was originally built at the C. & A. Co.'s shops at Bordentown, N. J., in 1850, with hook motion, etc., and was rebuilt as shown, in 1869. If this date of original building is correct, it must either have been built on the lines of the "Monster" of 1834, or else the date usually assigned to the building of the first engine of the type is incorrect. One thing rather singular in this connection is that the driving wheels shown under both engines are alike and are of a peculiar type, apparently similar to those placed under three "Phleger" engines built by R. Norris & Son for the Pennsylvania Railroad in 1858, and which I have never found in drawings of engines of earlier date. The rebuilt "Monster" was originally No. 35 of the Camden & Amboy, and was changed to 635 after its transfer to the Pennsylvania in 1871. Reference to the second drawing of the "Monster" will show that it underwent considerable change in rebuilding. The spur-wheels were removed from the driving axles, and the second, third and fourth pairs of driving wheels were connected by parallel rods, and a four-wheel truck of Bissell type replaced the forward pair of drivers. Gooch links were substituted for the hooks, and I regret that the drawing from which my reproduction was made is not distinct in the point of the connections between the radius bar and the rocker shaft, which, it will be noted, stands directly over the link. It is almost certain that the radius bar was carried forward to a swinging hanger, from which a coupling bar attached to the same pin extended backward to the lower arm of the main rocker; and that the radius bar at the end connected to the link block, was continued backward a sufficient distance to be properly attached to the lifting hanger of the reversing shaft.

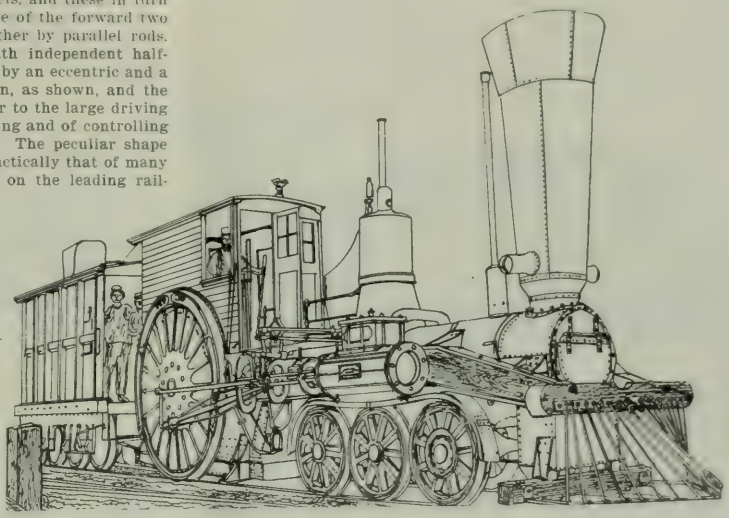


Fig. 7—The Stevens; Camden & Amboy Railroad, Rebuilt 1850.

Built by Norris Bros., Philadelphia, 1849. Cylinders, 13 x 18 in. Drivers, 96 in. Run on passenger train in 1852 with anthracite coal.

From the different data at my command, and the record of the Pennsylvania people that 635 was originally built at Bordentown, conflicting with the statement of another that it was built at Trenton by Van Cleaf & Co., it would almost indicate the existence of more than one different "original" types of this engine, or else matters have become mixed up. Be that as it may, there are many similar "ear marks" on each.

The "Stevens" was one of seven built by Norris Brothers, at Philadelphia, in 1850, for the Camden & Amboy. This engine had cylinders 13 in. x 38 in., and driving wheels 8 ft. in diameter. These

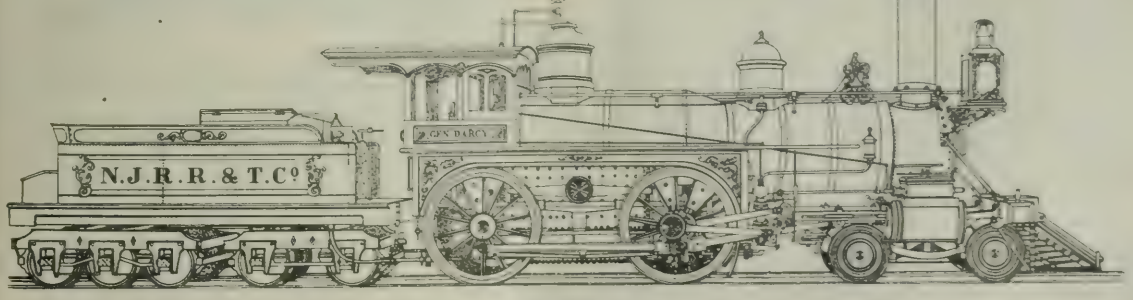


Fig. 8—The Gen. Darcy; New Jersey Railroad & Transportation Company, 1867.

wheels, it will be noticed by reference to the illustration, were of a composite type. The full stroke eccentrics for both fore and back gears were on the driving axle, but the independent half stroke cut-off was driven from a return crank attached to the main pin. The firebox end of the boiler was built with a sloping top to enable it to be carried under the driving axle. Wood also entered into the construction of the frames. It is said that one or two of these engines were fitted with trucks having but four wheels, although the illustration, which is from a copy of the original drawing, shows six, and this number is likewise on the drawing shown of one of the engines after alterations had been made. This latter drawing shows a cab and also some changes in the position of a few of the parts. It also shows a type of tender referred to in the description of the "John Bull."

In 1846 M. W. Baldwin built a passenger engine for the Camden & Amboy which had four driving wheels connected and a four-wheel truck, but with a half-crank on the forward drivers. Its cylinders were 13¾ in. x 18 in., and the drivers were 60 in. diameter. This was the second engine of the type and it proved very successful.

In May, 1835, the "Black Hawk," Fig. 4, was built by M. W. Baldwin for the Philadelphia & Trenton Railroad. It was the first Baldwin engine with outside cylinders, the first to use an invention of E. L. Miller whereby part of the weight of the tender could be thrown upon the engine when necessary, and bore Baldwin construction number 11. Its valve-gear was under the foot-plate, and both back and forward motion was obtained from the same eccentric. From the time it was placed in service until 1840 it averaged 21,000 miles per annum.

Five locomotives of this type were built during 1835, 1836 and 1837 by M. W. Baldwin for the New Jersey Railroad & Transportation Company, as follows:

Newark (M. W. B. No. 16)	1835
New Jersey (M. W. B. No. 21)	1836
New Brunswick (M. W. B. No. 27.)	1836
Rahway (M. W. B. No. 70)	1837
E. Townsend (M. W. B. No. 87)	1837

These were all of the type shown in Fig. 4, and in a letter to Mr. Baldwin, dated June 12, 1838, Mr. Sykes, the engineer of the railroad company, pays a high compliment to their merits, and states that they readily draw 20 four-wheel cars containing 26 passengers (probably to each car, although this is not stated) at a speed of 25 miles per hour on grades of 26 ft. to the mile.

In 1837 Thomas Rogers had about completed the engine "Sandusky" for this company when it was seen by some parties interested in the Mad River Railroad, of Ohio, and so impressed itself upon these men that they induced Mr. Rogers to sell it to them and build another in its place for the N. J. R. R. & T. Co. This latter engine was named "Arreseoh," and although heavier than the "Sandusky," was of the same design, Swinburne having prepared the drawings for both engines. The "Arreseoh" was placed in service in 1838.

The "Juno," Fig. 5, was built in 1839 by Rogers at Paterson, N. J., for the New Brunswick & Jersey City Railroad. It is doubtless of the same general proportions as the "Arreseoh," and was of practically the same design.

The two remarkably neat engines, "N. Perry," Fig. 9, and "General Darcy," Fig. 8, which are illustrated in connection with this article, were built at the company's shops at Jersey City, about 1867, from designs by John Headden, who was Master Machinist at that time. Their chief peculiarities consist in the arrangement of the Stephenson shifting links and their connections on the outside of the driving wheels, the trussing of the parallel rods, and the six-wheel truck under the rear end of each tender. The "General Darcy" was used on express passenger trains between Jersey City and New Brunswick, and the "N. Perry" drew local passenger trains between Jersey City, Rahway and Perth Amboy. Both of these engines had brass casings on the steam chests and cylinder heads, and the front and back boiler jacket bands, dome casings, edges of running boards, bands covering the joints of the "built-up" sand-boxes, and the hand rails, with their stanchions, were all of brass. The cabs were of black walnut decorated on the outside with scroll-work in gold leaf, and paneled on the inside with alternate strips of chestnut. The wheels were painted vermilion, and the other parts of the engines, as well as the tenders, were black, with ornamental striping, etc., in gold-leaf. Through the courtesy of Mr. J. Sanford, of the Meadows Shops, I am informed that at the time these engines came into possession of the Pennsylvania Railroad the cylinders of the "Darcy" were 16 in. x 24 in., and those of the "Perry" were 15 in. x 24 in., and that the drivers of both were 60 in. in diameter, including the tires. From the drawings showing them as originally built it is evident that those of the "Perry" were 72 in. at first, and must have been afterward cut down. After the union of the roads, the "Darcy" became number 103, and the "Perry" number 115. When they passed into the ownership of the Pennsylvania the "Darcy" was renumbered 703, and the "Perry" 715. The latter company substituted its standard diamond frame four-wheel trucks for those shown under the tenders, and substituted a standard straight stack for that of balloon shape shown on the drawing of the "Perry," but made no other changes of any

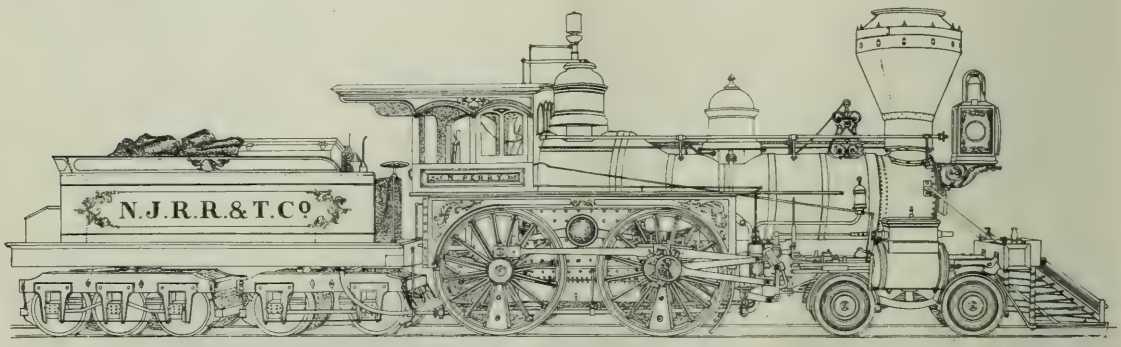


Fig. 9—The N. Perry; New Jersey Railroad & Transportation Company, 1867.

moment. The "Darcy" was cut up in 1882, and the "Perry" in 1877.

In 1863 the Rogers Locomotive & Machine Company built the engine appearing in Fig. 10 for the N. J. R. R. & T. Co. It is generally admitted to be the first "Mogul" ever built, although J. P. Laird had rebuilt the Pennsylvania Winans "Camel" "Seneca," No. 131, at Altoona in 1862, on practically the design of a "Mogul," although he placed the driving wheels all in front of the firebox.

The locomotive equipment of the Belvidere-Delaware Railroad numbered 31 on passing into the hands of the Pennsylvania. Of these, five were built at the Baldwin works, 15 by the "Bel-Del" Company, one by Danforth, Cooke & Co., and two by the Trenton Locomotive & Machine Company. The remaining eight were taken out of service soon after the change of ownership and replaced by

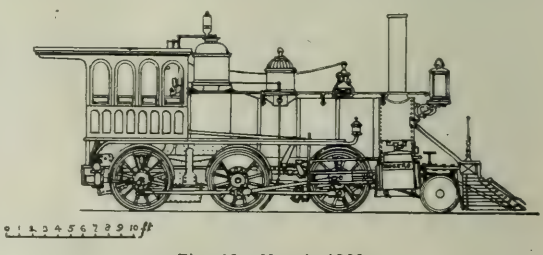


Fig. 10—Mogul, 1863.
Built by Rogers for N. J. R. R. & T. Co.

engines built at Altoona, and while efforts to obtain data concerning them have been unsuccessful, it is more than probable that they were from some of the firms already named. Fig. 11 shows an engine built for this division at the Trenton Locomotive Works in 1855. It had 16 in. x 22 in. cylinders, 60 in. drivers, and outside valve-gear as on the "Darcy" and "Perry," but differing from these engines in using the Gooch, or suspended, link, which was applied to some extent about that time to quite a number of American locomotives. Instead of two eccentrics on the return crank, the "Assanpink" had one eccentric for the top rod, and a pin set in this eccentric to actuate the lower rod, as in the original "Monster." The driving wheel springs were underhung, and those of the truck

seem to have performed the duties of both springs and equalizers. The frames were of the slab type throughout. The engine was named after a small creek at Trenton.

Turning now from the locomotives to the early passenger equipment of these roads, the writer distinctly recalls his first ride over the Camden & Amboy from Philadelphia to New York in 1859, and although but a small boy at the time, was impressed with the light character of the construction of the passenger coaches, as compared with those of the Pennsylvania, upon which he frequently traveled. The windows of these C. & A. coaches were small and the sash containing the glass could not be raised, but the panels between the windows could be opened if fresh air was desired. These panels were not over six inches wide, and effectually prevented any one from putting his head or arms outside of the coach. Some of the cars had windows which could be raised or lowered in the usual

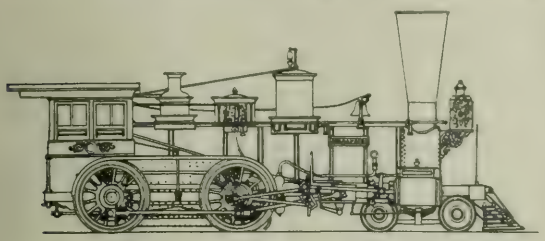


Fig. 11—The Assanpink.

manner, but these, too, were of light construction, and the divisions between the windows were not over four inches wide. No clear-stories were used, but several ventilators were arranged along the center of the roof. From the bottom of each car canvas extended along its entire length and reached almost to the ground. At the ends of the cars other pieces of canvas were so arranged as to be readily attached to the parts already referred to after the cars were coupled together, thus forming a continuous chamber or passageway, for the purpose of collecting the dust raised by the passage of the train, and in dry weather this dust could be seen pouring out in a blinding cloud at the rear of the last coach.

The passenger coaches, and also the freight cars, were built with two huge side-sills shaped like a double-ended sled runner, and very like those of many of the pressed steel cars now used on most of the leading roads. No center or intermediate sills were used, but numerous cross timbers bound the two sides together. An old box car having this type of bottom stood in the Pavonia, N. J., yards, off its trucks, and used as a tool shed only five years ago, and is possibly still at the same place.

The trucks of all these cars were of the wooden frame type, and those for passenger service differed from those for freight only in

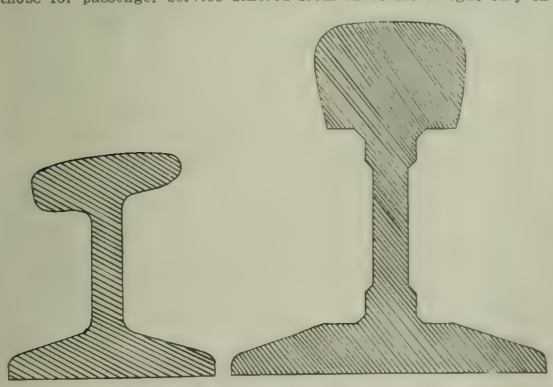


Fig. 12—Old Camden & Amboy Rail After 30 Years' Service (Left); Belvidere-Delaware 72-lb. Rail (Right).

the number and arrangement of the springs. A car inspector who worked for the Erie Railway Company at Jersey City many years ago stated that he was much interested in a type of spring with which the Camden & Amboy people were experimenting at that time, and which, as well as he could recall it, consisted of two hollow cylindrical sections with one end of each closed and of slightly different diameters. The smaller fitted like a piston into the larger, and was provided with a leather packing ring to prevent the escape of compressed air with which the interior of the cylinders was filled. A small quantity of molasses was pumped through the filling plug from time to time in order to assist in keeping the leather packing tight. The device does not appear to have given satisfaction, from the fact that the number in use was not added to, and those referred to were taken out after a prolonged test.

During the trip already referred to, the writer also saw one or two cars which had side entrances in addition to the customary doors at the ends, and is almost certain that the buggy-top arrangement to which more extended reference will be made in the portion of this article relating to the locomotive equipment, was used on at least some of the baggage cars.

The passenger cars which passed from these railroads into the possession of the Pennsylvania at the time the lease was consummated numbered nearly 300, and as many, especially of those received from the Camden & Amboy, were small and of very light construction, these were soon withdrawn from service and taken to Altoona, where they remained on a storage track for at least one year before being cut up. The rest being larger and of modern designs, were easily brought up to the requirements of their new owner, and were retained in service for many years, some being still running as late as 1886. Many of these cars were finished inside in a more costly and elaborate style than the cars of the Pennsylvania in use at that time. Some had six-wheel trucks, and many of the four-wheel trucks had the side-bearings arranged on the outside of the truck frame in a manner somewhat similar to that recently applied to several Pennsylvania passenger coaches.

The use of small cars for baggage and express goods, made of such form as to enable several to be placed on a flat-bottomed car and taken in the trains along with standard baggage cars, was at one time followed on some of the roads, and probably is possessed of some merits.

The closer contact of officials and employees in those earlier days appears to have in many instances formed very close friendships between these two classes of railroad men. This was strikingly evidenced as I rode from New York to Philadelphia on a September day in 1878. Superintendent G. W. Barker had just died, and almost every employee one met seemed deeply affected, as much, indeed, as if a loved member of his own household had passed away. Doubtless this friendly relation added to the marked loyalty of the employees to the company during the troublous times of the preceding year, which culminated in the riots and destruction of property at Pittsburg, Pa.



Old Stone Block Structure.
Camden & Amboy Railroad.

The names which stand out most prominently in connection with these roads are John Stevens, Robert L. Stevens, and Isaac Dripps. It seems singular that so prominent an engineer as Alexander Holly does not figure in their development, but the only mention of him found among the data collated for this article is that upon one occasion while working in the locomotive shops at Jersey City he laid a wager with a fellow-workman that he would run an engine one mile over the meadows without steam, fire, or water, on condition that no other person be allowed on the engine with him at the time of making the experiment. Permission to use an engine which had just been thoroughly overhauled and had the boiler empty, was obtained from the officials, and attaching a "live" engine to it, he was hauled some distance over the meadows, and then uncoupling from the engine drawing his "dead" one, he ran his mile back toward the shop without any trouble and won his wager. He had allowed the engine to be drawn with the links reversed, and the throttle and cylinder cocks open, thus filling the boiler with sufficient compressed air to enable him to make his run. It seems strange that so bright an intellect was not led, from the result of this trial, to consider some of the uses to which compressed air is now put in railroad practice.

In addition to the gentlemen already named in this article, much of its interesting matter is attributable to the courtesies of James White, a former employee of one of these old railroads, and to Mr. Herbert T. Walker, all of whom kindly permitted the use of interesting data and drawings.

Pensions on the Intercolonial.

A pension system or, as it is called in Canada, an annuity fund, will be put in force April 1 on the Intercolonial and the Prince Edward Island railroads, the Government lines of Canada. One and one-half per cent. each month of the wages of all officers and employees must be contributed toward the fund. These payments

are compulsory except in the case of the employees who come under the civil service act. The fund thus acquired, which may also be added to by contributions of the Government out of the gross earnings of the roads to an amount not exceeding $100,000 annually, is to be handed over to the Crown. Interest will be paid on it at 3 per cent. A board, made up of the general manager, two chief officers and two members elected by the employees, will control and administrate the fund through the Minister of Railways.

This fund will be available for a number of different classes of employees as follows:

Class A.—Those who are 70 years old and have been at least 15 years in the service.

Class B.—Those who are between 61 and 69 years old, have been at least 15 years in the service and have become mentally or physically disabled or incapacitated.

Class C.—Those who are 65 years old, have been at least 15 years in the service and have requested to be retired.

Class D.—Those who, having been at least 25 years in the service, are permanetnly disabled.

Class E.—Those who, previous to the operation of the act, entered the service at an advanced age and reached the age of 70 years, after having been 10 years, but before having been 15 years in the service.

No pension will be paid for any service less than 10 years, and no new employee can join the fund who is over 35 years old. The pension is computed on the basis of the average monthly pay during the last 10 years of service, but not including in this average service at an age older than 70 years. No pension of less than $20 a month shall be paid, nor shall any employee receive more than two-thirds of his average monthly pay for the 10 years immediately preceding retirement. To qualify for joining the fund six months' probation and a medical certificate are necessary. Those who fail to pass the requirements will have their contribution refunded. Men who voluntarily retire or have been discharged for cause cannot participate in the pension fund. The board can contribute to a beneficiary one-half of what a contributor paid into the fund in case of the death of an employee who had paid continuously for 10 years. In the case of any employee discharged for the good of the service the amount paid in, without interest, can be paid back. A life insurance fund and a disability fund are already in operation on the Intercolonial. It is provided that employees must drop the disability fund as soon as the new system goes into effect. The monthly allowances paid under the act shall not be alienated or liable to attachment or seizure by any legal process whatever.

December Railroad Law.

The following abstracts cover the principal decisions in railroad cases handed down in December by the United States Supreme Court and the other federal courts.

Release of damages.—A person injured in a railroad accident accepting a sum of money and signing a written release of damages to the company without reading it is negligent and cannot afterwards go into court and have the release set aside on the ground that the contents were misrepresented to him unless he can show some good reason for his failure to read the document or have it read to him before he signed it. Heck vs. Missouri Pacific Railway Co., 147 Rep. 775.

Jurisdiction of Federal Courts.—A railroad company organized under the laws of another state which can be sued in the courts of the state where operated only in counties in which it does business, cannot be sued in a federal court in such state unless it does business in some one of the counties within the territorial jurisdiction of the particular federal court. Kibbler vs. St. Louis & San Francisco Railroad Co., 147 Fed. Rep. 879.

Crossing accident.—A traveler at a highway crossing struck by switched cars with knowledge that no flagman was maintained at the crossing cannot claim that the railroad company was negligent in not maintaining a flagman since in his case he was not misled thereby. In such a case it was held proper to admit in evidence the admission of the injured person that he was wholly in fault in that he thought he would be able to get across the tracks ahead of the cars. Chicago, Milwaukee & St. Paul Railway Co. vs. Clarkson, 147 Fed. Rep. 397.

Negligence in construction of side tracks.—It is held by the Circuit Court that the fact that a passing track at a railroad station is not so constructed as to take a rapidly running train in safety does not of itself alone conclusively show negligence in the construction of the track if it further appears that the track was safe for trains under control and moving slowly. St. Louis & San Francisco Railroad Co. vs. Bishard, 147 Fed. Rep. 496.

Inspection of hides before transportation.—The New Mexico statute which prohibits carriers from accepting uninspected hides for transportation beyond the limits of the territory is held a valid exercise of the territorial police power and not a violation of the commerce clause of the federal constitution since there is no congressional legislation on the subject. Territory of New Mexico vs. Denver & Rio Grande Railroad Co., 27 Sup. Ct. Rep. 1.

Repeal of tax exemption.—A repealable exemption from taxation of the property of a railroad company is repealed and withdrawn by a statute which expressly declares that the property of every railroad shall be assessed for county and municipal purposes. County Commissioners vs. Bancroft, 27 Sup. Ct. Rep. 21.

Construction of railroad as consideration for conveyances.—A condition in a conveyance of mineral rights in lands that the conveyance shall be void if the construction of a railroad to be built as part consideration for the grant is not commenced within a certain time does not require that the railroad shall be built on any particular line or even by the grantees in the conveyance. It is sufficient if the road is built into the territory by any one near enough to the lands to offer reasonable facility for the shipment of the mineral to market. Wilmore Coal Co. vs. Brown, 147 Fed. Rep. 931.

Priority of claims in a railroad foreclosure sale.—An interesting case relating to the priority of claims or foreclosure has just been decided by the Maryland Circuit Court. A railroad mortgage provided that in case of default a trustee representing 50 per cent. of the bondholders should take possession and operate the road or sell as directed. Upon the company's becoming insolvent a committee representing nearly all the bond and stockholders was appointed, being given the authority and power that the trustee under the mortgage would have had, on default, which default occurred shortly after its appointment. A sale was negotiated and consummated by the means of a friendly foreclosure suit, the bond and stockholders transferring their holdings to the purchasers to be used in the payment, receiving stock in the new company therefor. The court held that indebtedness incurred by the committee for supplies, advertising and operating expenses, after the bondholders might have taken possession by the trustee, were prior in equity to the mortgage debt and entitled to priority in payment from the property and therefore to be paid by the purchasers. Queen Anne's Ferry, etc., Co. vs. Queen Anne's Railroad Co., 148 Fed. Rep. 41.

Train Loads.

Our attention having been called to an error in the train load table published in the *Railroad Gazette* last week, a new table has been prepared, as below. Owing to certain changes in the form of computation, the Louisville & Nashville has been substituted for the Northern Pacific, affecting the totals, but making the comparison through a series of years more accurate.

Revenue Train Load; Tons.

	1906.	1905.	1904.	1903.	1902.	1901.
Atchison, Topeka & Santa Fe	307	282	270	280	248	243
Baltimore & Ohio	420	399	401	416	407	375
Buffalo, Rochester & Pittsburg	525	507	439	442	424	406
Chesapeake & Ohio	586	557	508	493	509	511
Chicago & Alton	381	347	336	361	316	288
Chicago, Burlington & Quincy	365	327	278	266	219	178*
Chicago, Milwaukee & St. Paul	282	265	245	244	254	237
Erie	455	412	400	406	377	370
Great Northern	530	523	447	447	418	381
Illinois Central	353	319	278	288	275	235
Lehigh Valley	504	501	486	486	467	464
Louisville & Nashville	231	229	234	231	231	222
Minn., St. Paul & Sault Ste. Marie	329	309	301	305	315	314
St. Louis & San Francisco	214	200	200	195	187	188
St. Louis Southwestern	280	267	254	252	232	218
Union Pacific	510	507	451	403	418	366
Wabash	348	299	286	302	285	283
Average for 17 roads	389	368	342	342	328	310

*Estimated.

Government Investigation of Terra Cotta Collision.

The disastrous rear collision on the Baltimore & Ohio at Terra Cotta, D. C., December 30, was reported in the *Railroad Gazette* of January 4, page 12; but the number of persons killed was overstated. The number of casualties is now given as 43 killed and 67 injured. The Interstate Commerce Commission, acting under the Mann resolution, passed by Congress last June, has begun an investigation of the accident, and we give below an abstract of the testimony taken on the first two days of the hearing. The principal facts in the case are as follows:

The stations involved are, beginning on the west:

Silver Spring, day and night block office.
Takoma, 1.2 miles, day block office.
Terra Catta, 3.2 miles (point of collision).
University, 4.3 miles, day block office.
Q. N., 5.3 miles, day and night block office.

The grade is descending at the rate of 1 per cent. from near Silver Spring to Terra Cotta. Passenger train No. 66 was just starting away from Terra Cotta and Extra, No. 2120, following, ran into it at high speed, wrecking all of its three cars; yet 2120 was not much damaged and the engineman and fireman were not injured. The fog was dense and neither man on 2120 saw the tail lights of No. 66. The engineman of 2120 claims that the signal light at Takoma was not burning, while the signalman claims that it was

burning and showing red. At Silver Spring No. 66 received a "double green" signal, indicating that a crossover in the block section was being used. As there is no crossover between Silver Spring and Terra Cotta this signal would indicate that the signal given at Silver Spring was intended for the block from Silver Spring to University. The testimony of the signalman at Silver Spring is, however, not yet taken. The engineman of 2120 asserts that he received the "double green" signal at Silver Spring, but the signalman has testified before the coroner that he gave a white signal.

There is conflicting evidence as to the time, the engineman of No. 2120 claiming that the collision occurred at 6.38, while other witnesses give the time as 6.35. The trains had started from Washington Junction, 35 miles west of Silver Spring, a considerable time apart, but Extra 2120, having no stops to make, gained on No. 66.

TESTIMONY.

Train Dispatcher Dent.—I have been dispatcher at Baltimore five years and was a telegraph operator eleven years before that. Was appointed dispatcher by the chief dispatcher on recommendation of dispatchers who had worked with me. My territory includes 83 miles of line, of which 16 miles is single track. I work from 4 p. m. to midnight; have a copying operator, who works 12 hours daily. Operators are examined as to proficiency, sobriety, etc., by the division operators. In Maryland now block-signal operators work only eight hours a day, this being the limit under a law passed this year. Formerly they worked twelve hours, except at busy stations.

On the day of the collision engine 2120 had a train of eight empty passenger cars from Cumberland and was bound for Baltimore via Washington. From Washington Junction, about 40 miles west of the point of collision, Nos. 2120 and 1865, the latter a freight train, ran on orders as extras and were directed in the order to "follow each other carefully under green signals," this meaning that they were to expect permissive signals at the block stations. At Tuscarora No. 1865, being a heavy freight, was passed by 2120. Asked why the order should say "follow carefully" when the green signal itself gave that indication, witness said he did it to make the matter more plain to the men in charge of the train.—I issue 35 or 40 train orders a day. There is one woman operator on the division. Takoma is open from 6:30 a. m. to 6:30 p. m. University is open from 7 a. m. to 7 p. m. After 7 p. m. there is one block from Silver Spring to the next station beyond University.

Extra 2120 passed Takoma about 6:31 and the signalman's report that the train had passed a red signal reached witness about 6:40. The operator, when asked why he did not report more promptly, replied that he went outside to see if the train had come to a stop beyond the station. The operator said he had witnesses that his signal light showed red.

Asked as to why he did not run extra 2120 ahead of regular train 66 from Washington Junction, witness replied that this would have delayed 66 about seven or eight minutes, and, 2120 being an extra, the ordinary procedure was to keep it entirely out of the way of passenger trains, except in case there should be some special necessity for doing otherwise.

Should extra 2120 look for a signal at North Takoma after 6:30 p. m.? A. Where signals are irregular, a train must stop and find out what is the matter. The rules require enginemen to "keep a constant lookout for signals." There is no rule which allows an engineman to disregard a red signal at North Takoma at any hour of the night.

Engineman Vermilion.—I have been in the service of the company 36 years. I was on regular passenger train No. 66. I received at Silver Spring a double green signal. A green signal is a permissive block. A double green, which at night is shown by a green lantern hung on the signal post some eight or ten feet above the ground, beneath the regular green light, indicates that a train must be expected at a cross-over within the block section. There being no cross-over between Silver Spring and Takoma, I concluded that Takoma was closed for the night. At Takoma, however, I received a white signal, showing that the obstruction at the cross-over, if there had been any, was removed. It was quite foggy on the night of December 30. A red light could probably be seen two engine-lengths. I was surprised to find the Takoma block station still open. Asked if he would have looked for a signal there in case he had been running a train not scheduled to stop, he replied yes, for the reason that it was proper to observe caution in a fog. Witness thought that the engineman of 2120 should have looked for a signal at Takoma if he had received double green at Silver Spring; this because of the fog and because of the general necessity for cautiousness.

The three cars of my train were vestibuled; I think they had recently come out of the shop. With double green shown at Silver Spring, it would be necessary to approach Terra Cotta under control, because there is a cross-over there. I watched for the signal at Takoma because I always watch every telegraph office. Witness had never known of any accident from the failure of the block-signal operators to give correct signals. He had never received an incorrect signal. Asked if enginemen ever ran by red block signals, witness replied yes. How far? A. Sometimes to the next station. Witness had never run past a red signal. If he did he would expect to be summarily dealt with. Asked if he had heard of operators giving false clear signals, he replied that he had. On cross questioning witness could name no instances of either of these errors, but finally recalled one case, three or four years ago, where a certain engineman was suspended for running by a red signal.

Fireman Crawford, of No. 66.—I have been in the service three years. It is my duty to see signals at block stations and speak to the engineman. I saw double green at Silver Spring. [This witness showed imperfect knowledge of the signal indications, but seemed to understand that "double green" indicated that the road was clear from the block station to the first cross-over.]

Trainmaster Kelly.—Have been trainmaster 20 months; before that was chief clerk to the general superintendent, and farther back was assistant trainmaster at Cumberland. New brakemen are required to run three or four trips to learn the road, and then are examined on whistle and hand signals, and on location of switches and stations. New men are examined by the trainmaster or the assistant trainmaster, but no record is kept of the examinations. Inquiries are made by letter of persons to whom applicants refer.

If a trainman has worked excessive hours, the question of whether he must lie off for rest is decided by the man himself. If he says that he cannot run because he is tired, he is excused. We try, however, to keep a check on the men and see that they do not run too hard; but with a large force this is difficult. We do not re-examine brakemen from time to time, but we keep informed of a new man by inquiry of the conductor with whom he runs. On freight trains the conductor should see block signals; on passenger trains also, if not busy. This is the practice. Enginemen are to sound one long blast of the whistle approaching every block station, and on receiving a "proceed" signal answer by giving one short and one long blast. The double green signal means that a train may be found anywhere in the block. If, at Silver Spring, about 6:30 p. m., an engineman received double green and did not wish to run under caution, he should stop and ask why the double green was shown. A single green could not have been accepted by No. 66, because passenger trains are not allowed to follow another train into a block when the leading train may be anywhere in the block. At 6:28 double green at Silver Spring would be improper, but the engineman would not, by accepting it, be relieved of observing the signal at Takoma. No. 2120 could accept single green at Silver Spring.

Harry H. Hildebrand.—I was engineman of 2120. Am 38 years old. Have been in the service 18 years, about eleven years as engineman. Was examined on the rules when promoted and had eyes examined about two years ago. Am an extra passenger runner. My longest trips are from Baltimore to Cumberland, usually taking about 24 hours, including a layover of 6, 8 or 10 hours at Cumberland. The average is perhaps six hours.

(The testimony of this witness showed that in the 48 hours preceding the collision he had been on duty 40 hours and had slept only 8 hours; and if he had finished this trip he would have been out two or three hours longer. The times were approximately as follows: Left Baltimore for Cumberland Friday night about 6:30—having been out of bed since 9 or 10 a. m.—stopped several hours in Washington and reached Cumberland about 5:30 a. m. on Saturday; slept from 7 a. m. to about 11 a. m., and about noon started back for Washington, empty, reaching Washington at 9 p. m. On the way was asked if at Washington he would be prepared to turn back for Cumberland, and replied that he would; that both himself and the fireman were in fit condition to run. He lay over in Washington about three hours—9 p. m. to midnight Saturday—and then started with a passenger train on his second run to Cumberland, reaching there about 5:30 a. m. Sunday, the same as on Saturday. He again slept from 7 to 11 a. m. and then started with the train of empty cars for Baltimore via Washington, reaching the point of collision at 6:35 or 6:38 p. m.)

At Silver Spring I received the double green signal. It was 6:31. As North Takoma at that time should be closed, I understood this to mean that the block extended from Silver Spring to University. I am sure it was 6:31, for I looked at my watch. The speed at Silver Spring was 18 to 20 miles an hour. (The grade from Silver Spring to Terra Cotta is descending most or all of the way at about 53 feet per mile. The witness' testimony as to the speed and the density of the fog was confused and uncertain, but he claimed that the fog was very dense and that the speed was around 25 miles an hour most of the way.)

I sounded the station whistle at Takoma, but saw no light. Asked why he sounded the whistle, witness replied because it was a passenger train. The semaphore at Takoma is on my side—on the right-hand side for eastbound trains. The light being out, did you see the semaphore arm? A.—I saw nothing. Q.—Did the fireman look? A.—He did not say. The air worked well all the way down the grade. My engine struck passenger No. 66 before either I or the fireman knew there was anything in

the way. (That is to say, neither of them saw the red tail light.) Being asked if he applied the brakes, witness answered that the brakes applied themselves by the breakage of the air-pipe on the front of the engine. Asked why he was not going more slowly at Terra Cotta, where there was a cross-over, at which he should have been expecting a train, witness replied that a train using the cross-over "had a right" to protect itself by flag and torpedo. Witness believed he was going 20 to 22 miles an hour when he struck the other train. Why did you not go slower? A.—Because I encountered no flagman at the proper distance back of the cross-over.

Asked as to his previous record, he said that he was suspended 30 days, three or four years ago, for not coming to a full stop when he passed a single torpedo. His engine struck the rear of a preceding freight train. The flagman who had put down the torpedo had gone to sleep. I have been suspended 30 days at other times, and once 60 days, when my crown sheet became loosened. Last suspension about two years ago. I never drink while on duty and have drank nothing since Christmas, though I take a glass of whisky now and then. Witness averred that he was not asleep on his engine. He was in good health or would not have responded affirmatively when asked at Washington Junction Saturday afternoon if he was fit to go back to Cumberland that night. Asked if surprise checking was practiced on the Baltimore & Ohio, witness had never heard of any. Asked his opinion of the block system, he believed the automatic signals recently put in use between Baltimore and Relay safer than the system in use between Washington and Washington Junction.

Cross-questioned about his hours of work, witness said that he had had a good night's sleep Thursday night and arose about 9 or 10 o'clock Friday morning; started out about 6 p. m. Did you not know that train 66 would be behind time on Sunday because of making 16 more stops than on week days? A.—They had a right to notify me if 66 was late. Asked about the possbility of passing a red light at Takoma in a dense fog without seeing it, witness simply reiterated his assertion that he saw nothing. Asked if he spoke to the fireman about the absence of a signal at Takoma, witness replied that he did not; did not speak with the fireman at all there. There is no rule requiring me to speak to the fireman at block signals. The second green light used for the "double green" is neither stronger nor weaker than the green semaphore lamp. Engine 2120 has a high boiler so that the engineman can see only high objects on the left-hand side of the engine. At Cumberland my watch was 15 seconds slow as compared with the conductor's. I do not know of any standard clock at Cumberland. Have never heard of an engineman going to sleep on duty in his cab. The request on me Saturday night to double back to Cumberland came to me from the despatcher's office through Operator Fisher; I do not know whether there was any signature to the communication. I have refused to work because tired, but not recently; perhaps seven or eight years ago. When on freights I sometimes went out against my inclination because the caller would say there were no other men available. This has not happened in the last four years, with any runner, so far as I know. Freight runs between Baltimore and Cumberland take one or two days.

On cross-examination witness had to acknowledge a rule in the book requiring enginemen and firemen to communicate with each other at signals; and also that he should have known of and used a standard clock in the despatcher's office at Cumberland. Rule 3 requires the condition of watches to be recorded on a "prescribed form," but witness had never heard of any prescribed form.

Fireman McClelland.—I am 26 years old and have been in the service three years. I saw the order given to Engineman Hildebrand at Washington Junction. It is my duty to see all orders given to the engineman. I keep a lookout for block signals. Asked if that was required by rule, witness did not know. Does the engineman speak to you, in case you neglect to call out the signals? A.—Yes. At Silver Spring I saw the double-green signal. It was on my side of the track. I looked for the signal at Takoma, but saw nothing. Q.—Why did you look? A.—I always look when the engineman blows his whistle for a station. Q.—How far could you see one of these block signals in a dense fog? A.—About six car lengths. Asked about the time that he left Silver Spring and other places, witness gave the same times as those given by the engineman, and said that he did not look at his own watch. The air-brakes were in good condition on that trip. I had not run with Hildebrand lately, except on this trip and the one before it. Ran with him a few times some months since. At Cumberland, when I went to sleep at about 7 o'clock Sunday morning, I knew that our engine would be the fifth one to be called. Q.—Were you asked if you were in good physical condition? A.—No. When running an empty engine, whom does the engineman compare watches with? A.—With the brakeman, I suppose. Witness proved to be ignorant of the rule about comparing watches, and of some of the block signal rules. Witness had refused on a few occasions to go out on a run because he was tired. Q.—Were you punished for not going? A.—I always went.

Cross-questioned by counsel for the road, witness said that at Cumberland the road foreman of engines told both Hildebrand and himself that if they were not fit to run through they should lie off at Cumberland and not have to give up their engine at some point along the road.

Milton W. Phillips.—I am telegraph operator and station agent at Takoma. Have been there 3½ years. I am married and live half a mile from the station. Q.—Do you drink? A.—Not as a rule. I take whisky perhaps once a week. The gateman at the street crossing, who helps me handle freight and mail bags, and, when necessary, with baggage, is 53 years old, and works on six days in the week from 8 a.m. to 11.45 p.m.; on Sunday he works from 8 a.m. to 10.30 p.m. My pay is $52.50 monthly, and the gateman's $41. I have 15 or 20 express shipments daily. The total number of regular passenger trains passing my station during my hours—6.30 a.m. to 6.30 p.m.—is about 22; and freight trains average six a day. My office is in the station, on the ground floor, and the semaphore signal is immediately in front, the post being set in the platform. From 6.30 a.m to 8 o'clock I have to attend the gate at the street. I cannot recall that my lamp ever was blown out by the wind. The rule to get good-night from the despatcher before leaving the office is not strictly lived up to. On December 30 the last train preceding No. 66 was No. 6, due at 4.27 p. m. Questioned about the lamp in his signal, witness said that immediately after it had been disregarded by Extra 2120 he walked up the track 38 yards and looked back to see if the signal could be plainly seen. It was unmistakably visible at that distance. Ordinarily the signal lever has to be held in the clear position until the train has accepted and used the signal; the lever, however, can be fastened in the all-clear position, and at night it is so fastened.

Detailing his operations on the night of the disaster, witness said that about 6.26 he reported train No. 66 to the stations both west and east of him; and the station on the west, Silver Spring, in acknowledging this, said "Extra next." I replied "66 last." I had already put the signal red behind train 66. Silver Spring then said "Extra 2120 east at 6.28." About 6.31½ I heard 2120 coming; it went by very fast, and I went out on the platform; by the time I got there the train had gone by. I went back and asked University if 66 had arrived, telling him that 2120 had gone by "running like hell." I had not heard this train whistle. Q.—Had the gate been put down for 2120? A.—I do not know. A visitor, H. E. Page, a former operator, was in the office at the time. His presence there, the witness admitted, was against the rules. The clock in the station office sometimes is two minutes out of the way. It is not subjected to any official examination, so far as the witness knew. He sets it every noon by Observatory time, if it is much out of the way, and if he is in the office. At 6.34 I entered No. 2120 on the sheet as passing at 6.31. I did not enter the time at first, because I thought the train would stop and back up. Witness had never known the signal lamp to fail. He was facing the track when No. 2120 passed. Asked if he was surprised at the high speed of the train, witness said that sometimes trains went past his station a long distance, perhaps a half-mile, and then backed up. This has happened times "too numerous to mention." I do not report the men in such cases, because I never knew any rule requiring it. If the men in charge of the train endeavored to stop, and came back and found out whether the signal was clear, I deemed that a proper compliance with the rules. Under the rules local passenger trains may at any time disregard a stop signal sufficiently to make the stop opposite the platform, where passengers usually board the train. Asked why he did not run after and try to stop No. 2120, he replied that he could not think but that the train would stop and come back. I did not report to University the time that the train had passed. I told him the time later. I did not see markers on 2120. Q.—Did you see markers on No. 66? A.—Yes. I was called to Baltimore to attend an investigation by the Superintendent on the night of January 1. The double green signal could not apply to any part of the road in this vicinity except at Terra Cotta, as that is the only station with a cross-over.

Cross-questioned by the counsel of the road, witness replied that he had never asked for a better clock. Q.—Did you see signals on the front of 2120? A.—I did not; I was not expecting him to go by my station so fast. Q.—Why did you not use torpedoes to stop 2120? A.—I never knew a case where a block signal was not sufficient. Q.—Did you ask Page to go out and look at the light? A.—I did not. I am quite sure that in going out the 38 yards I went alone. Gateman Lempke had also seen the red light. Q.—What did you say to him? A.—I told him that I was glad of that. Asked to affirm definitely that the lamp was not changed in any way after the accident, witness said that it was not in any way changed after the accident until about 2 o'clock on Monday morning. Asked again about trains disregarding his signal witness said the cases were too numerous to specify. On cross-examination, however, witness could not name any date on which such an occurrence had taken place within two weeks, although he felt sure that 25 such cases had occurred in the two years that he had been there. Had never known a case where a train disregarding the signal went through to the next station. Torpedoes are kept in the office, but witness could not say that the supply had been renewed within two years. The signal is inspected by the signal inspector two or three times a year.

Alexander Johnston Cassatt.

The Board of Directors of the Pennsylvania Railroad at a special meeting held January 2, upon the announcement of the death of Mr. A. J. Cassatt, the late President, adopted the following minute:

"On the 9th of June, 1899, Mr. Cassatt, after an absence of 17 years from the executive management of the company, assumed the responsible duties connected with its presidency. The events of the years which have elapsed since that date are too indelibly engraved on the minds of the members of the Board to require anything else than the briefest recital. There never has been a period in the history of the American railroads so pregnant with possibilities of evil, but thanks to the genius of Mr. Cassatt and his almost prophetic insight into the future, so fruitful of good not only to the Pennsylvania Railroad, but to all the great transportation interests of the country.

"When Mr. Frank Thomson's untimely death occurred, the forces that had been steadily disrupting the fabric of railroad prosperity had become so controlling that disaster was imminent. The recurrent waves of prosperity and adversity that marked almost every decade in our national life had strewn the path with the wrecks of railroad enterprises and the struggle for competitive traffic had forced down the actual rate paid by shippers to a point where none but the strongest and best equipped lines could earn a living profit. The agreements to maintain rates were not worth the paper on which they were written, and the rebates extorted by large shippers under a threat to divert their traffic, had built up industries whose development often worked injustice to smaller combinations of capital.

"It was at this point that Mr. Cassatt announced the policy of the Pennsylvania Railroad to be the abolition of the rebate system and the extension of equal rates and facilities to all shippers. This meant the observance and enforcement of law, the maintenance of tariff rates, a just recognition of the claims of competitors, and a conscientious and determined effort to secure the adoption of this policy by the other trunk lines.

"The records of the company show what he did. With the cordial support of the board and the shareholders he invested nearly $90,000,000 in the purchase of securities of the Baltimore & Ohio, Norfolk & Western and Chesapeake & Ohio, and used the influence obtained through these holdings, not for the selfish advantage of the Pennsylvania Railroad, but for the bettering and building up of those lines, with the conviction that in advancing their prosperity he was advancing the prosperity of the Pennsylvania Railroad and making it strong beyond peradventure. It is certain, nowhere else in railroad history can there be found another example of the pursuance of such a broad policy by a powerful company toward its weaker rivals.

"Not only did Mr. Cassatt thus aid far beyond the power of any legal enactment to destroy the evils that had so long existed, but he was one of the first to recognize that the trend of public opinion, and consequently of legislation, was toward the more complete regulation of interstate traffic by the national government. Instead, therefore, of glibly combating such legislation, he endeavored to so shape it (and it was largely through his unwearying effort and influence that it was so shaped), as to secure for the railroad property of the country under the recent enactment, the possession of the judicial tribunal, a right never before denied to the humblest citizen, but one which was almost wrested from the industry which has been the most potential in building up our national prosperity. Mr. Cassatt's part in these two great works has certainly not been overstated. Their influence for good stretches over a continent.

"And while thus broadening and strengthening the foundation of the entire railroad system, his work on the Pennsylvania Railroad has been monumental. Notwithstanding the fact that the policy of the company for a quarter of a century has been to provide in advance for its traffic, and to apply its surplus revenue toward making the crooked path straight, Mr. Cassatt saw that the tremendous impulse which had been certainly given to our national development would require an expenditure far beyond anything that has ever before been dreamed of, and that nothing but heroic measures would put the road in condition to handle the enormous business that would be thrust upon it.

"It is not necessary to recall here the increases of capital stock, the issues of convertible bonds, the bold financiering that to the outsider seemed to border on rashness, but which events have proven were absolutely necessary, and without which the road would seem to-day unable to do justice either to its shippers or its shareholders. Immense terminal yards, relief lines almost gigantic in conception and execution, enormous increases in motive power and equipment, have marked the expenditures during Mr. Cassatt's administration. And now, when a new line from the summit of the Alleghanies has almost reached tidewater, when the waters of the Hudson have been tunneled, when in the near future a great passenger station in New York will be the sign that the South and the Southwest and the Middle West have been united by continuous bands of steel to our great commercial metropolis; when farther south another magnificent station faces, not unworthily, the National Capitol, when the work of the last seven years has almost reached fruition, the end has come. And with the close of the year all that was mortal of Mr. Cassatt has been laid to rest in the quiet churchyard near his country home.

"To us who knew him so well it is no marvel that he accomplished so much. For 17 years he had been a member of the railroad profession. His technical education as an engineer has been followed by an active experience both in that line and in the operating and motive power departments, until from General Superintendent he had become, respectively, General Manager and Third and First Vice-President, and then, after serving as a Director for 16 years, President. In every position which he filled he had shown a thorough mastery of the problem entrusted to him for solution; a broad and comprehensive understanding of the questions at issue, intuitive perception of the underlying principles involved in their adjustment, and a keen sense of justice toward contending interests. It is no wonder, therefore, that not only his close associates, but all those brought into contact with him recognized in him one of the leading spirits of our age; one of the men who make a nation great, and one whose fame is a precious heritage for his country.

"But great as is his loss to the company with which he was so long connected, the personal loss to each member of the board, to the officers in all departments who have been associated with him, is almost beyond expression. When, on his 67th birthday he spoke of the fact that he was the oldest President of all those who had guided the company through its active life, it was little thought that in less than three weeks his brilliant career would have come to a close. And yet in our pride at his achievements, in our affectionate remembrance of the close friendship so long vouchsafed to us, we can at least endeavor to forget our sorrow in recalling the record that he made in the history of the company in whose service he lived and died."

Cross-Tie Conditions in Some Foreign Countries.

The following from E. O. Faulkner, Manager Tie and Timber Department, Atchison, Topeka & Santa Fe Ry. System, is self-explanatory.

In the early part of this year I sent copies of our tie statistics to all foreign members of the American Railway Engineering and Maintenance of Way Association, with a letter outlining some of the problems now before us in this country in connection with tie matters, and asked for some information concerning similar subjects on the railroad or in the country of which the member was an official and resident. Many of the gentlemen have been kind enough to reply, and the information furnished seems to me so interesting and instructive that I do not believe the writers will object to its being placed before the great body of railroad maintenance men. Some of the life service from ties is especially good, notably in Australia, where eucalyptus wood is used; in every case, however, the difference between the axle load of the foreign engine and car is very great as compared to that of ours; this may account for much of the increased life, but on the other hand they lay many less ties to the mile than we do, theirs being thinner but wider. We are sending to Australia for a number of eucalyptus ties of each variety that will grow in California and produce ties within a reasonable time, and when received will place them under the severest conditions of power and climate we have on the system, so as to learn what we may expect, and how far we would be justified in using them as compared with the present cost and life of domestic ties, while waiting for our own to grow.

E. O. FAULKNER, *Manager.*

MEXICO.

From J. N. Galbraith, General Manager, Tehuantepec National Railway, Rincon Antonio, Mexico.

"I regret that the records kept of ties and timber by the government and various contractors who had charge of the road previous to the time S. Pearson & Son took hold of it in 1900, are such as to afford very little data of any value on the subject. We did not use any chemically treated ties until the middle of 1904. These were Texas pine, and were treated with 12 lbs. of creosote at one of the creosoting plants on the Texas coast. So far they have given good satisfaction, but the time of their use has been so short as to make any estimate of the merit of the treatment of little value. The other ties used on the road are sawed, untreated Texas pine, and from the best data we have we secure from four to six years service from these, depending on the quality of the timber. We also have quite a large number of mahogany and other native timber grown on the Isthmus, and have fairly reliable data that some of the mahogany ties have been in the track between 12 and 14 years, and the removal of them so far seems to be caused by mechanical action by their being re-spiked several times, and the holes getting so large as not to be able to longer hold the spikes. Other native woods

of some 14 or 15 other varieties, from the best information we can gather, last from two to eight years. We find, however, that we secure the best results in the matter of ties and building lumber, from the California redwood, as there are redwood ties in the track now that have been there for 14 years with a very small percentage of them decayed. We use tie plates on all ties, but these have been put on during the past three or four years. The redwood ties that we have been forced to remove have been principally on account of the rail cutting into them, and decay caused by derailed cars destroying the fiber of the wood and causing rot to set in, but there has been a very small percentage of these. The ones we have taken up on account of being spike-killed after having been in the track on our dry section (similar to southwest Texas) show very little signs of decay on the bottom, and the redwood ties in the wet district promise to last quite as long as those in the dry district, although we have not had sufficient of them in this district long enough to say this definitely. The principal objection we have to the redwood ties is that it is difficult to keep the track in gage on the sharp curves, even with tie plates. On tangents, however, they give no trouble in this respect, and from our experience with them, are unquestionably the best and most economical timber we use.

"The same may be said of the redwood used for buildings and cars, Texas long-leaf pine rotting out in from three to five years, while the redwood siding on our cars and buildings shows no signs of decay after four or five years' use. In the flooring of poorly-ventilated buildings in our wet district here, the Texas pine flooring will rot out in from 18 to 24 months, while the redwood does not seem to be affected in the way of decay by the dampness."

GUATEMALA.

From D. B. Hodgson, General Manager Guatemala Central R. R., Guatemala.

"Our practice here, ever since this road was constructed, or since the year 1880, has been to use a tie cut from California redwood. Under ordinary conditions this was found to be a most satisfactory tie wood, for this section, which is divided into a wet and dry season of equal proportions. The life of this tie was formerly an average of eight years; at that time, however, much better timber was secured for ties than is possible to-day, when the active demand for merchantable redwood leaves available for ties only the tops of the trees and branches. The result is, with heavier traffic and this inferior wood, that the life of the tie is decreased notably, chiefly due to mechanical wear; but few ties, in consequence, reaching a condition of unserviceableness through decay. We use no tie plates. Our locomotives are 4-6-0 type; weight of engine and tender in working order, 65 tons. Maximum freight loads 40,000 lbs., with an average weight of car of 17,000 lbs.

"We have employed in some sections a native hardwood tie, which I would hardly know how to describe in comparison with anything in the United States—in fact, I doubt if there is anything similar to it there. These have given excellent results on curves, where they have been generally employed. As they are obtainable in small quantities only, we have been seeking a substitute for the redwood tie, and I have recently brought out a lot of Oregon pine creosoted ties, and another lot of Oregon pine treated with the 'Carbolineum' process. These have been under track but a short time, and not long enough to determine their relative qualities as compared with the redwood; although in degree of hardness of the wood, and resistance to weight of trains and traffic, I believe them to be superior. I might also add, for your information, that I am now corresponding with parties in Australia relative to a tie cut from a timber called Jarrah (eucalyptus), some of which have been used on the Interoceanic road, in Mexico, and are stated to have given excellent results."

ARGENTINE.

From G. Dominico, General Inspector of Railroads, Buenos Ayres, Argentine Republic.

"We use no other timber for ties than the splendid 'iron-wood' which we call 'Quebracho Colorado' (of the Anacardiaceæ order). It is much heavier than water (sp. gr. 1.30 to 1.60) and hard to work. This king of ties practically lasts forever; there is not a case known where sound quebracho without sap has rotted; on the contrary it gets harder with time. Quebracho Colorado has 30 per cent. more elasticity than oak and pine, three times more resistance against compression, 20 per cent. more against pulling strains and twice as much deflective resistance as oak. Some splendid pieces of quebracho ties were sent by me to the St. Louis Exposition, for which I got the gold medal. They consisted of a tie cut in two pieces and some other cross-sections of ties which had then been 25 years in actual service in the track, and were still absolutely sound, bearing the original rail which was worn out, not having been changed in 25 years. We have examples of this and other hard woods in mole and pier work, which after more than 50 years' service show no sign of change in the tide level parts. This is in fresh water; in salt or sea water they would resist the same were it not for the teredo.

"We use three types of ties: 9 ft. x 10 in. x 5 in. for the broad-gage (5 ft. 6 in.); 8½ ft. x 10 in. x 5 in. for the middle (4 ft. 8½ in.) gage, and 6 ft. x 10 in. x 5 in. for the narrow (3 ft. 3 in.) gage; these weigh 100 kgs., 85 kgs. and 70 kgs. respectively (1 kg. = 2.2 lbs.) and make a very solid road, using 12 to 15 ties for a 10-meter (33 ft. 4 in.) rail. In case of derailment the ties are seldom damaged. They are hewn from single trees of 10 in. to 12 in. diameter, or sawn from big ones of 2 to 3 ft. circumference and 50 ft. high, but with preference to the single trees, as the big ones are shipped in logs to Europe or the United States for tanning purposes. Last year over 400,000 tons of this timber were shipped abroad; this is causing a sharp increase in the price of ties, which last year were in American money, $1.15 for the large tie, 85 cents for the middle one and 55 cents for the small one, and this year are from 60 to 80 per cent. higher, so that if this increases much more we will have to use some other and inferior timbers.

"The Quebracho Colorado grows on vast plains in temperate (40 deg. to 60 deg. F.) climates, and can be worked almost as easily as oak. These plains reach from Santa Fe and Santiago del Estero provinces to the frontiers of Bolivia and Paraguay, and are covered with enormous and almost virgin forests of all classes of hardwoods. In recent years railroads have been built for the chief purpose of transporting these timbers, as streams and rivers cannot be used because these timbers do not float.

"On account of the hardness of our timber we use no tie plates. Up to recently we have used cut spikes but had to bore holes for them, and once the spike was driven in it was impossible to draw it for any purpose, consequently it had to be broken off and a new hole bored for another. We now use screw spikes so that the old difficulty is overcome. Dowels are not used here as we have no trouble from decay and our timber is very hard. It may be that as quebracho gets scarcer and dearer we will have to use soft wood with hard-wood dowels, but even then we would have good ties as we have several other kinds of timber with nearly twice the compressive strength, and lasting probably twice as long from decay as your oak and pine.

"We use no concrete sleepers, but have some concrete piles in our harbor works. Steel sleepers have been used on some lines with good results (15 to 20 years' service) in locations where there was no salt or saltpeter in the soil; where there is they have not lasted more than six years. Steel sleepers are only used on the sea coast, where they are cheaper than the hardwood ones which have to come by rail."

JAPAN.

From S. Sugiura, Supt. of Maintenance of Way, Nippon Ry., Tokio, Japan.

"The gage of our railroad is 3 ft. 6 in. and the size of cross-ties 7 ft. x 9 in. x 4½ in., different sizes being used for bridge and switch ties. In tangents we lay 13 to the 30-ft. rail and in curves 14 to 16, according to the degree of sharpness. The kind of wood now universally used in Japan is "kuri," very similar to your chestnut. The cost depends altogether upon the localities; our company's lines are situated in districts very favorable for tie supplies, consequently we get them cheap, the cost being from 45 to 55 sen each (a sen is nearly one-half the value of your cent). The average life of chestnut is about seven to nine years. No record of cause of removal has been taken, so we are unable to tell the percentage of mechanical wear and natural decay of removed ties. The fastening to the rail is the dog spike, American and English type. In Japan the use of treated ties is not yet general but four years ago our company started creosoting bridge and switch ties, the kind of wood used being Japanese pine, which is not so hard as 'kuri,' and the life service in the track only four or five years without treatment. The life of our treated ties is not yet determined on account of our short experience. The 'kuri' is already becoming scarce and we are using 'hiba' in its stead, the cost being 60 sen; its life is longer than 'kuri,' as it is durable—10 to 12 years in ordinary track—but it is not so hard as the other, consequently its mechanical life is shorter.

"The maximum axle load of our engines is 14 English tons. In the mountain sections where the ruling grade is 1 in 40, we use the 2-8-2, 2-6-2 and 0-6-0 type of engines for freight service, the maximum axle load being 14 English tons. In some sections where coal trains are run we use 2-8-2 type engines, the maximum axle load being 12 English tons. Our freight equipment will average seven English tons with five tons weight of car additional, all being four-wheel wagons."

	No. of ties in line.			No. of tie renewals.		
Year.	Cross.	Bridge.	Switch.	Cross.	Bridge.	Switch.
1902	2,140,594	73,044	37,814	270,410	6,397	6,308
1903	2,196,606	78,228	37,897	272,961	7,764	4,225
1904	2,231,804	80,676	37,932	295,412	8,774	5,704
1905	2,264,777	88,236	38,068	326,867	9,064	4,705

From Takuichi Ohmra, Chief Engineer, Hokkaido Coal Mine & Ry. Co., Iwanazawa, Japan.

"The treatment of tie timber in Japan was only recently started so that we have not as yet reached any conclusion in reference to it. The gage of our railway is 3 ft. 6 in., using a rail weighing 60 lbs. per yard, although we have some as high as 70 lbs., and a

little as low as 45 lbs.; it is fastened to the tie by cut spikes, generally of the American type. Our ties are 7 ft. x 9 in. x 5 in., of chestnut, oak, spruce, elm and 'yatitamo,' for which there is no English name, but the wood has a grain something similar to elm. The maximum life of these ties, untreated, is eight years, and the average life five years, the removal being in nearly every case due to natural decay. The maximum axle load of locomotives is 14 tons; freight cars are generally seven tons and ten tons capacity, with tares of three tons and four tons respectively; they are mostly four-wheel cars, but we have a few with bogie trucks. The climate of Japan is something like that of Texas."

RUSSIA.

From Theo. Schidlovski, Chief Engineer, Orenburg Tascha-Kent Ry., Orenburg, Russia.

"The construction of this railroad has only recently been completed, as it has not yet been operated a full year. The ties inserted during construction were untreated pine, but next year we expect to begin using treated ones. So far as I am informed, no reinforced concrete or steel ties have been used on any Russian railroad even for testing purposes, as the timber question is not to us a serious one and our forests are amply able to supply our wants."

INDIA.

From E. W. Stoney, Late Chief Engineer, Madras Ry., Madras, India.

"On the Madras Railway timber ties are used as little as possible, chiefly in station yards for points and crossings and on girder bridges. Until lately teak, untreated, was used for these purposes, and (I speak from memory, not having any papers to refer to now) their life was from 20 to 24 years; but teak has now become so expensive that its use is confined to girder bridge ties. Untreated indigenous timbers have also been used, but their life is very short, five to seven years; now, Australian jarrah (eucalyptus) ties are being largely used in Indian railroads, and these when of good quality have so far proved very satisfactory. The Madras Railway was at first laid with creosoted pine ties sent from England, but their use was given up some 40 years ago. They were replaced by cast-iron pot sleepers of the Graves type connected by wrought-iron tie rods. There is about 900 miles of 5-ft. 6-in. gage road laid with these sleepers, originally six to a 20-ft., 75-lb., double-headed rail, spaced 3 ft. 6 in. and 1 ft. 6 in. at joints. At first 65-lb. iron rails, double-headed, were used, then 75-lb., and now 80-lb. bull-headed steel rails are in use. On the Madras Railway these pot sleepers have been most satisfactory, the renewals being only some three miles per year in a total of 900 miles laid with them. It is essential, however, that good, clean, coarse sand ballast, or small stone, broken to say ½-in. gage, be used for padding them. These sleepers do not answer well in soft banks as they sink into the soil for some time, their bearing area (18 in. diameter) being small. On the lines northeast from Madras the timber and steel trough ties are being renewed, with Murray's pattern cast-iron sleepers, on which 75-lb. steel rails very much of the American standard section are laid. Various types of steel trough sleepers have been tried in this section, but they are not satisfactory, as if used with saline ballast, or in saline soils, they rust away quickly, and have no scrap value; if ballasted with good clean sand or stone, broken small, these steel sleepers do fairly well. Ferro-concrete sleepers have not, as far as I know, been yet tried in India. The cast-iron pot sleeper makes a very firm, thoroughly-well-tied-to-gage road, and the scrap value of the pots which have to be renewed, nearly always due to being cracked or broken, is high, as they are sent to the locomotive works and re-cast. The heaviest engines on the Madras Railway have only 15 tons an axle, that is 7½ tons a wheel. I am sorry I have not access to papers and statistics now to give you fuller and more definite information, but trust what I have said may be of some slight interest."

NEW ZEALAND.

From James Burnett, Inspecting Engineer, Government Railways, Wellington, New Zealand.

"On the New Zealand Government Railways—about 2,400 miles 3-ft. 6-in. gage, with rails varying from 30 lbs. to 70 lbs. per yard (the latter being the new standard for main lines)—we use from 2,000 (on the old light lines) to 2,500 sleepers (on the main lines and in all new work) per mile, the dimensions being 7 ft. x 8 in. x 5 in. On tangents the rails are fastened entirely by square spikes; on curves, bed plates and fangbolts are used in numbers varying with the sharpness of the curve. Screw spikes are now being experimented with and will possibly to a large extent displace the bed plates and fangbolts. Maximum axle load 11 tons, say 25,000 lbs., but most of our engines are lighter, say nine ton axle loads; types 4-6-2, 2-6-2 and 4-8-0.

"The sleepers used have been mainly New Zealand timbers:

1. Totara (*Podocarpus totara*).
2. Puriri (*Vitex littoralesa*).
3. Silver pine (*Dacrydium cupressinum*).
4. Kauri (*Agathis Australis*).
5. Birch (*Fagus fusca*).
6. Birch (*Fagus solandri*).
7. Rimu (*Dacrydium cupressinum*).
8. Kahikatea (*Podocarpus dacrydioides*).
9. Matai (*Podocarpus spicata*).

Of these the first three are durable and may be counted on to last 15 to 20 years as sleepers. The others have a life of only from five to ten years untreated, and of late years [illegible] abandoned, except that Nos. 6 and 7, rimu and kahikatea, are now being creosoted in considerable numbers, 50 to 100,000 per annum, by Boulton's process, with the result that their life is increased to certainly over 20 years. Of a lot of some 200,000 treated 16 years ago 40 per cent. have now been renewed and their calculated life on this basis works out to 24 years.

"Australian hardwoods, all of them eucalyptus, viz., jarrah (*marginata*), ironbark (*paniculata*), etc., gray gum (*propinqua*), and several others have been used to some extent, being strong, tough and extremely durable. Their life is probably anything from 25 to 30 years or even more, and they are used mainly on bridges and sharp curves for which they are suitable. The soft woods among our sleepers fail to some extent by mechanical wear, but the great bulk of renewals are through natural decay. The use of tie plates on the soft creosoted sleepers is being considered.

"Nothing has been done in the direction of experimenting with reinforced concrete or steel sleepers, and owing to their excessive cost we are hardly likely to consider their use for many years."

From James Marchbanks, Engineer, Wellington & Manawatu Ry., Wellington, N. Z.

"I do not use creosoted or Burnettized sleepers, but over 20 years ago, when in the government service, I put in a good many miles of creosoted red pine or rimu (*dacrydium cupressimum*) and white pine (*pedocarpus dacrydicides*). The red pine did not stand well, as it is a close-grained wood, and the creosote did not penetrate deeply. The white pine, which is a soft open-grained wood, stood well and gave an average life of nearly 20 years. This appears to be a somewhat longer life than you are getting. The New Zealand Government Railways are now using creosoted white pine sleepers pretty largely; they are 7 ft. x 8 in. x 5 in., and are creosoted after partially seasoning in stacks. The chief engineer informs me that they stand very well, but are soft and not good on sharp curves. The cost of these creosoted white pine sleepers runs about 4s. each, and as I can purchase first class Australian eucalyptus sleepers at that price, which are in every way more suitable for the purpose, there is no object in our using them. The reason the Government Railways use some of the creosoted soft-wood sleepers is to utilize the local timber and obviate the necessity of sending out of the colony for sleepers, though they use other local timbers, not creosoted, very largely. The principal timber of this class used is totara (*podocarpus totara*). This is a fine clean-grained timber, closer than cedar and resembling pencil cedar. It stands well in wet ground and I have sleepers now in the track with 20 years service, though you may take it that the average life is about 20 years. These sleepers fail principally through mechanical wear; the spikes do not hold and they crack, rot starts at the bottom at ends and gradually destroys them.

"We use now for sleeper renewals the hardwoods from New South Wales, principally ironbark, gray gum and tallow-wood, which are all eucalyptus. The sleepers are hewn 7 ft. x 8 in. x 5 in., and cost us about 4 shillings sterling each. I cannot speak too highly of these N. S. W. hardwoods for use as sleepers and for bridge work. The timber resists decay well, is heavy, strong and holds the spikes without trouble. We use on straight road ordinary $^9/_{16}$-in. square spikes, and on curves bed plates or sole plates at ends of rail, middles and quarters, with two fangbolts through the bedplate bearing on flange of rail. Fangbolts hold well, but are expensive, and we are trying just now some screw galvanized spikes, which appear to answer very well. Our rails are light, 65 lbs. to the yard, and 40 ft. long, being now standard. Originally 53-lb. rails were laid and a large number are still in the track after 18 years service. Our loads are light compared with standard American practice, being 22,400 lbs. maximum on 2-8-2 tender engines, and 2-8-4 tanks, and maximum freight wagons are 45,000 lbs. total on two four-wheel trucks."

COMMONWEALTH OF AUSTRALIA, STATE OF VICTORIA.

From Thos. Tait, Chairman Board of Commissioners, Victorian Railways, Melbourne.

"The sleepers in use in this state consist of hardwood which is locally grown and is of the eucalyptus variety, as shown hereunder:

Redgum (*Eucalyptus rostrata*)
Red ironbark (*Eucalyptus Sideroxylon*)
Gray box (*Eucalyptus leucoxylon*)

There are three different sizes of sleepers used, viz.:

For important lines [illegible]
For unimportant lines [illegible]
For unimportant lines [illegible]

And their average life is about 25 years, but artificial means are never used to preserve the timber. The principal cause for the replacement of sleepers on our lines is natural decay, but, of course, on the lines suburban to Melbourne, and on one or two of our main lines on which the traffic is very heavy, the chief contributing factor is mechanical wear. The fastening between the rail and the sleeper is a cut spike, locally known as a 'dog spike.'

"Regarding the axle load of locomotives, the maximum axle load is as follows:

Passenger	36,960 lbs.
Goods	34,720 "

"Our goods trucks are of 10, 12 and 15 tons carrying capacity, with a few special trucks of greater carrying capacity."

WESTERN AUSTRALIA.

From Thos. Watson, Resident Engineer, Government Railways, Coolgardie.

"We have 1,540 miles of railroad, mostly single road; heaviest engine and tender 81 tons, on eight-coupled wheels, 43 tons. Our ties are not treated in any way nor specially seasoned; they are hauled straight from the bush and put into track; no tie plates are used, nor, in my opinion, are they necessary, so good is our timber. On the whole the rail seats stand wear and tear splendidly, but both our engines and speeds are easy compared with really busy roads. I have just finished a close inspection of a piece of road built in 1893, rails 45 lbs. per yard, and ties of sawn jarrah (eucalyptus) 7 ft. x 8 in. x 4 in. laid 1,960 per mile. After 13 years' service only 5 per cent. had to be replaced, or 104 ties per mile."

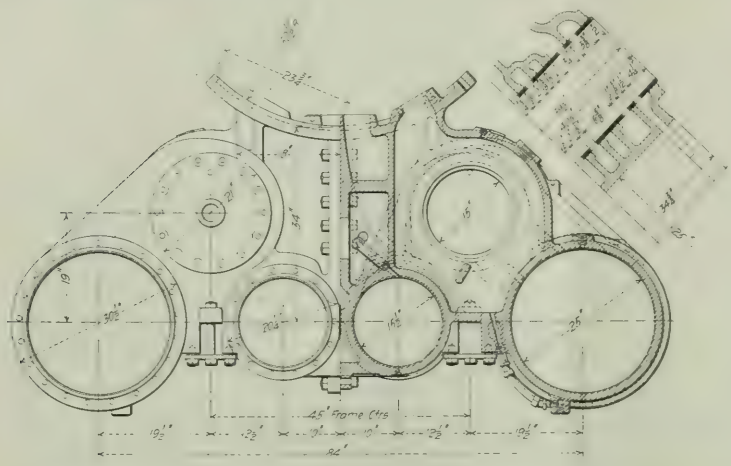
Locomotives for the Italian Government Railways.

The Baldwin Locomotive Works has recently built 20 locomotives for the Italian Government Railways. Ten of these are simple consolidation engines and the rest are four-cylinder balanced compound 10-wheel locomotives. The general design of these locomotives follows American practice closely. There are minor variations, such as canopy type steel cabs, screw reversing gear, Whitworth screw threads on all bolts and nuts, screw couplers and spring buffers. To test the efficiency of the two metals, five of the fireboxes of each type of engine are made of copper and five are of steel.

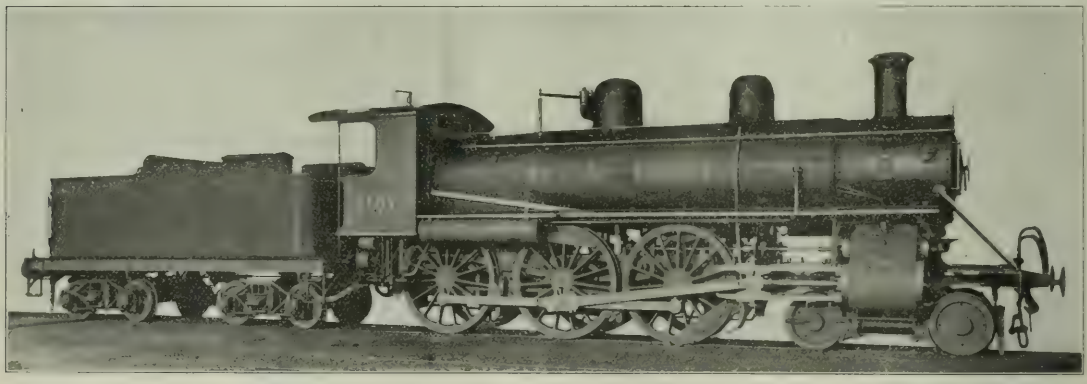
As will be seen from the drawings, the design of the copper firebox boiler does not differ from the usual practice in steel firebox construction except in the thickness of the inner sheets. The working steam pressure is the same in each class of boiler. The comparative thickness of the sheets is as follows:

	Firebox—Copper.	Firebox—Steel.
Side sheets	½-in.	5/16-in.
Back sheets	½-in.	5/16-in.
Crown sheets	5/8 in.	3/8-in.
Tube sheets	1 & ½-in.	½-in.

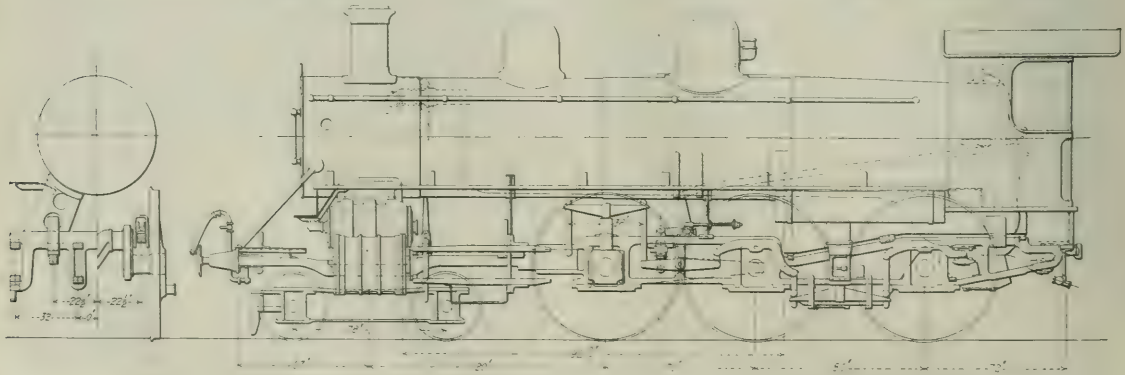
The copper tube sheet is thicker where the tube holes are cut than it is below the throat. The engine truck and tender wheels are of solid rolled steel made by the Standard Steel Works. All of the engines are equipped with the Stephenson link motion. In the compound locomotives, the high-pressure cylinders, which are inside the frames drive the leading pair of wheels and the low pressure cylinders drive the second



Cylinders for Balanced Compound Locomotive; Italian State Railways.



Four-Cylinder Balanced Compound Locomotive Built for the Italian State Railways by the Baldwin Locomotive Works.



Baldwin Four-Cylinder Balanced Compound Ten-Wheel (4-6-0) Locomotive; Italian State Railways.

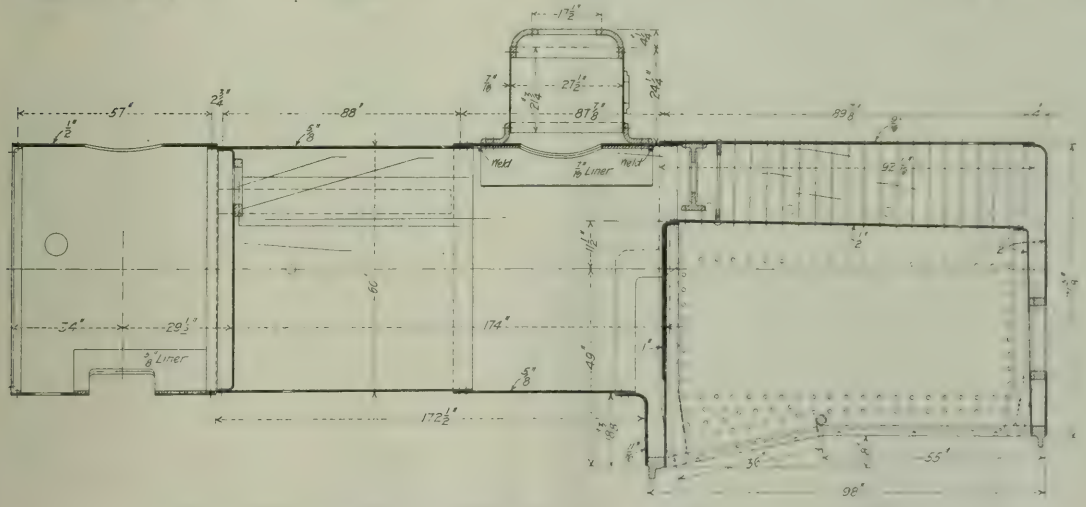
pair. Contrary to the usual practice, the length of stroke of the two cylinders varies; it is 24 in. for the high-pressure and 26 in. for the low. This makes the connecting rods for the high-pressure cylinder comparatively short. The four cylinders are arranged with their centers on the same horizontal line which is in the plane of the top of the single bar forming the front end of the frame. The ratio between the cylinder volumes is 1 to 2.82. When the compound locomotive was first introduced, a ratio of 1 to 2.2 was the accepted practice. Apart from the difference in length of stroke, the cylinders are similar to those used on the balanced compound locomotives previously built by the Baldwin Locomotive Works. One piston valve, 15 in. in diameter, is used for each pair of cylinders. All four guides are braced by one guide yoke. The crank axle is of the Z form and is forged in one piece.

The following are some of the principal dimensions:

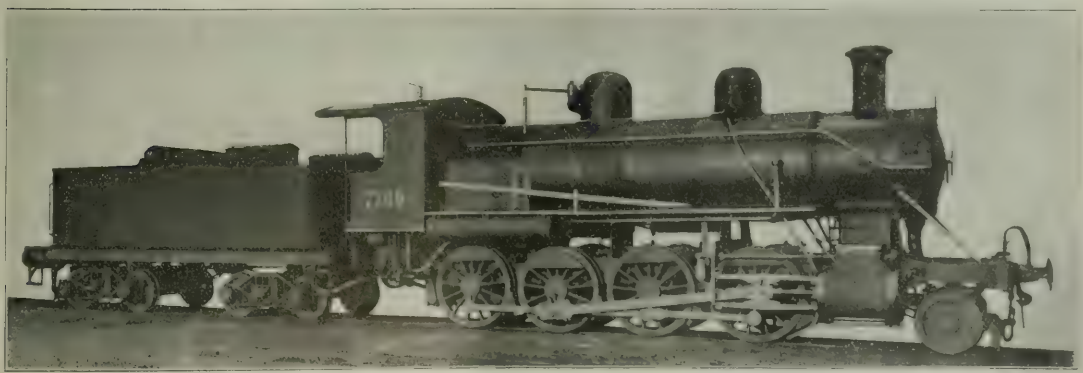
	Consolidation. Simple.	Ten wheel. Compound.
Cylinders, diameter, H. P.	20 in.	15½ in.
Cylinders, diameter, L. P.	...	25 in.
Stroke of piston, H. P.	26 in.	24 in.
Stroke of piston, L. P.	.....	26 in.
Valves	Balanced.	Balanced piston
Boiler, type	Straight top.	
" thickness of sheets.	⅝ in.	
" w'k'g st'm. pressure	200 lbs.	
Fuel	Coal or briquettes.	
Firebox, material	Copper, steel.	
Heating surface, firebox	122 sq. ft.	150 sq. ft.
" " tubes	1,962 "	2,018 "
" " total	2,084 "	2,168 "
Grate area	37.5 "	33.25 "
Tubes, No. and diameter	(260) 2-in.	(250) 2-in.
" length	14 ft. 6 in.	15 ft. 6 in.
Drivers, outside diam.	55⅛ in.	72.83 in.
Main driving jrnls, diam.	8½ in.	9.0 in.
Main driving jrnls, length.	9⅞ in.	10.0 in.
Wheel base, drivers	15 ft. 3 in.	13 ft. 6 in.
" total engine	23 ft. 8 in.	26 ft. 9 in.
" eng. & tender	53 ft. 5 in.	55 ft. 6 in.
Weight, on drivers	132,000 lbs.	99,000 lbs.
" on front truck	15,000 lbs.	47,000 lbs.
" total, engine	147,000 lbs.	146,000 lbs.
" engine and tender	263,000 lbs.	262,000 lbs.
Tank capacity	5,280 gals.	
Tank, coal capacity	6 tons.	

Heating surface	75.57	6[illegible]
Grate area		
Firebox heating surface	0.0529	0.0529
Total heating surface		
Weight on drivers	66.34	15.66
Heating surface		
Total weight	70.53	67.74
Heating surface		
Volume of 2 H. P. cylinders	2.45 cu. ft.	5.24 cu. ft
Heating surface		
Vol. H. P. cylinders	220.53	41.37
Grate area		
Vol. H. P. cylinders	3.97	6.34
Vol. L. P. cylinders		
Vol. H. P. cylinders	2.82	

An account has been given heretofore of the long wire-rope conveyer in northwestern Argentina, from the city of Chilecito, which has a railroad outlet, to the Famatina mines, in the Cordillera. The mines are 22 miles from Chilecito, and about 13,000 ft. higher, which explains why a cable was preferred to a railroad as a grade of 600 ft. per mile is a little too steep. This cable line was built by Adolf Bleichert & Co., of Leipsic, Germany, and was opened for traffic Jan. 1, 1905, having cost about $384,000 per mile. The cost of transportation (by mules) from the mines to the melting works for ten years previous had been on the average $12 per ton; by this cable it has been $1.26 when the shipments are at the rate of 20 tons per hour, and about half as much when they are 40 tons per hour. The ore coming down is so much more in weight than the supplies, etc., going up that it furnishes the motive power, except for a part of the lower end, where the descent is less abrupt.



Boiler with Copper Firebox for Balanced Compound Locomotive; Italian State Railways.



Simple Consolidation Locomotive Built for the Italian State Railways by the Baldwin Locomotive Works.

James McCrea.

After he had been elected president of the Pennsylvania Railroad at last Wednesday's meeting of the directors in Philadelphia, James McCrea held an informal reception for the heads of departments with offices in the Broad street station. One after another the men came in to greet him. All of them, of course, knew about him, had heard stories of his energy and approachability, and all of them felt that a search of the whole country could not have produced a railroader of more experience, more ability, or more genius for organization; but few, if any, of the subordinates were quite prepared for such a complete contrast to the man he had succeeded, Mr. Cassatt.

While Cassatt had been reserved and sparing of his words, McCrea was almost wasteful of his good nature and his cordiality. Where Cassatt had been only studiously urbane and respectfully attentive, McCrea was actively polite and candidly interested.

Mr. McCrea's character was depicted strongly when he said to a friend not long ago:

"From the time I began to have a hand in running the business of a railroad I decided never to buy a newspaper or a politician—and I never have.

"I can forgive an outright thief or a burglar or a safe-breaker," he is quoted as having said, after the recent exposures of some of his railroad associates, "but I hate a grafter, a man who betrays a trust, who leads one life and acts another, who wears a hypocritical smile while he holds out a hand behind him for perquisites. That man is a sneak and a coward, a quitter and a grafter."

Mr. McCrea knows the men. A little while ago he was visiting the office of the president of one of the Pennsylvania's subordinate companies. In the course of the conversation he said:

"By the way, how is young Tommy ——— getting along?"

"Who's he?" responded the subordinate president.

"Why, he's one of the assistant superintendents recently sent down to the ——— division."

"I don't know him."

"Well, I do," said Mr. McCrea. "I know him, and I can tell you that he's a comer, a bright fellow, and one of these days he'll be ready to do big things."

They say that McCrea, whenever any place becomes vacant, always has in mind a good man to fill it. The job may be a despatcher's or an assistant engineer's or something even smaller, but he knows who has had it and whom he wants to have it in future. On the Lines West, over which he has had complete control since 1891, he knows everybody, and everybody knows him.

The new president has worked on every branch of the system between New York and the Mississippi Valley. Born in Philadelphia on May 1, 1848, the son of a physician, he attended the private school of the Rev. John W. Fairies, and then took a course in the Pennsylvania Polytechnic College; but at the age of 17 he was ready to go to work. He became a rodman and assistant engineer on the Connellsville & Southern Pennsylvania Railroad in 1865. After holding that place for two years he went to the Wilmington & Reading, still as a rodman, and on the construction of this road he worked until late in 1868, leaving it to become assistant engineer of construction on the Bennett's branch extension of the Allegheny Valley. It was after three years there that he joined the forces of the Pennsylvania. First, from March 1, 1871, to August 1, 1874, he was assistant engineer in the construction department. It was about this time that he acquired the nickname of "Crosstie Jimmie," which stuck to him for a long time, and still is used occasionally by the men who worked with him in those days.

There was a wreck on his division, where he already had acquired a reputation for energy. Reaching the scene rather late, he rushed to the wrecking foreman and cried, excitedly:

"What can I do? What can I do?"

"Nothing," was the answer.

"Isn't there anything?" exclaimed the young engineer, disappointed.

"Everything has been done except to move some of those crossties out of that ditch over there," said the foreman.

McCrea threw off his coat and began to carry crossties up the embankment. The wrecking crew called him "Crosstie Jimmie" after that.

The fall of 1874 found him serving as assistant engineer in the maintenance of way department on the Philadelphia division, but after a year he was appointed superintendent of the middle division, with headquarters in Harrisburg, where he stayed three years. It was in October, 1878, that he came to New Jersey as superintendent of the New York division for a four-year sojourn.

Over in Jersey City they tell many stories of how "Jimmie" McCrea put life into the local force, reorganized the office, and generally "made things hustle." When he first entered the office, it is related, he saw a group of men, and asked them what were their duties. "We're despatchers," they replied. Going into another room, he saw still other men, and when he asked of them the same question, they said: "We're despatchers." A third group gave the same response.

"Well," exclaimed the new superintendent, "if lightning does not reduce the number of despatchers around this place before I assume my duties, I will." And he did.

From the New York division he was transferred to what is known as the southeast system of the Pennsylvania Lines West. Of these lines he became manager on May 1, 1882, and in that position he remained until October, 1885, when he was made general manager of all the Pennsylvania Lines West of Pittsburg.

About the time he became fourth vice-president of the Lines West, in 1887, although far from an old man himself, Mr. McCrea began to be known in his domain as the patron of young fellows who were seeking to make their way in the railroad world. "Watch the young men!" was his favorite motto.

From fourth vice-president, Mr. McCrea was promoted, in 1890, to second vice-president of the Lines West and in the following year succeeded the late J. N. McCullough as first vice-president. In that position he was almost as much the head of a system as was Mr. Cassatt in the East. Further, he developed into a financier as well as a practical railroader. There was no responsibility with which his chief was afraid to trust him, and so intertwined were their interests in running the many-sided system that it was often hard to tell which was the moving power behind any great improvement in the company. On the day that Mr. Cassatt became president (June 9, 1899) Mr. McCrea was elected a member of the directorate to succeed the former president, Mr. Thomson. Now that he has Mr. Cassatt's place as president of the Pennsylvania Railroad, he will become, as it were automatically, president of half a dozen or more subsidiary concerns.

The change from Pittsburg, where he has been for 25 years, to Philadelphia will be a striking one for the new president. He leaves a splendidly appointed suite in the road's new Pittsburg building and gets in exchange the remarkably plain rooms that Mr. Cassatt liked. But, judging from what one hears about Mr. McCrea and his habits, the plain offices are more appropriate for him. He is a plain man in his manners. Whoever has entered his Pittsburg headquarters will bear witness that he is ready to see all comers, whenever he has the time; that he talks straight from the shoulder, and, although polite, with more of brusqueness than urbanity. He likes no diversion so much as his work.

In his new position Mr. McCrea undoubtedly will adhere to his old methods. The men under him knew he would as soon as they read in the newspapers last Thursday that he had decided to keep the old Cassatt staff in the Philadelphia offices. "Just like him," was their comment. "It wouldn't have been a square deal to make a wholesale shift." That he also intends to maintain his predecessor's general policy is made clear from the statement he issued immediately after his election. The principal change in the conduct of the company's affairs, in fact, seems destined to be the importance of Henry Clay Frick's hand. If there is to be a "power behind the throne," that power will be Mr. Frick. He and Mr. McCrea are old friends. It was Mr. Frick who fought beside him to keep George Gould from obtaining a right of way for the Wabash Railroad into Pittsburg, and they would have won but for the hostility of Frick's enemy, Andrew Carnegie. Yet, nobody who knows Mr. McCrea believes that he will be in any sense under Mr. Frick's thumb. Whatever the "power behind" accomplishes, he will have to accomplish as an ally, not as a boss.—*New York Evening Post.*

Investigation of the Harriman Roads.

The following are extracts from the testimony in New York on January 4 before the Interstate Commerce Commission in its investigation of the Harriman system of railroads.

The by-laws of the Union Pacific provide that:

"The directors shall elect from their number an executive committee of five members. Such committee shall hold office until the next annual election of directors, and shall, when the board of directors is not in session, have all the powers of the board of directors to manage and direct all the business and affairs of the company in such manner as such committee shall deem best for the company's interests in all cases in which specific directions shall not have been given by the board. The chairman of the executive committee [Mr. Harriman] shall be elected by the board of directors, and, subject to the control and approval of the executive committee, shall represent it when it is not in session."

A traffic contract dated June 18, 1903, between the Southern Pacific and the San Pedro, Los Angeles & Salt Lake is as follows:

Article 2.—In partial consideration of the said covenants and agreements of the said Southern Company, contained in Article 1 hereof, said San Pedro Company hereby covenants and agrees with said Southern Company that it will, upon the execution of this agreement, adopt, print, publish, and put in force at all points upon its lease, owned or operated railroad, for the handling of local business thereon, the lawful rates, tariffs, classifications, and charges used by said Southern Company or the handling of any local business which may be the subject of compensation between them.

Article 3.—Each party hereto mutually covenants and agrees to and with the other that after the adoption and putting in force of rates as provided by Article 2 hereof, neither of them shall or will change any such rates without the consent of the other party hereto unless such change may be made necessary in order to meet the rates, charges, classifications, or tariffs of

any other company or competing line of railroad, or to conform to the final decree or judgment of some court of competent jurisdiction or some lawful and valid requirement of State or National law.

The following are minutes of the Board of Directors of the Union Pacific covering the purchase of the Illinois Central stock:

A meeting of the Board of Directors of the Union Pacific Railroad Company, held July 19, 1906. Director Harriman called Vice-President Cornish to the chair, and then stated to the meeting in substance that he believed it to be to the interest of the Union Pacific Railroad Company to purchase stock of the Illinois Central Railroad Company. That while the Union Pacific line served a large grain-producing territory, it had no line from that territory to the Gulf or to Chicago and into the Southeast; that the export of corn by the Gulf ports is likely to increase steadily; that the value and importance of the system of railroads extending from the Missouri River east and south Omaha and as far north as Minnesota and Wisconsin, and from Chicago and St. Louis on a low grade to New Orleans, as does the Illinois Central, will be enhanced by the construction of the Panama Canal, and the importance and value of such connections to the Union Pacific will be very great; that, while the Illinois Central was generally recognized as an important and valuable system of railroads, yet he believes its strategic value and importance were but little understood and appreciated even by some of those most active in its management, and that, while its stock appeared to be a good investment at prevailing prices, he believes it could be made, and in time was bound to become, very much more valuable.

For these and many other legitimate reasons, which might be stated, he believed the Union Pacific ought to purchase stock of the Illinois Central Railroad Company, now to be had at a fair price. He said, however, that he was interested in the ownership of the stock of the Illinois Central, which he thought the Union Pacific should buy, and because of such interest could not act for the Union Pacific. He said he sought to procure the attendance at this meeting of the largest number of directors possible, so that the question might receive of the board the consideration its importance deserves, and that such action should be taken as the board might think the interests of the Union Pacific Railroad Company require.

After extended discussion of the subject, and upon motion duly made and seconded, the following resolution was unanimously adopted:

Resolved, That Directors Frick, Willcox and Valentine be, and they are hereby, appointed a special committee to inquire into and consider the expediency of purchasing stock of the Illinois Central Railroad Company, with power to contract for the purchase, or for the option to purchase such stock, if they deem such purchase advisable, and report their actions or conclusions to the board.

Directors Harriman, Rogers and Stillman announced that they were interested in the subject matter and upon request were excused from voting.

The records of another meeting of the Board on July 31, four days after the meeting of the Illinois Central's board at which Mr. Harriman and Mr. Peabody abandoned their fight on Mr. Fish, showed that the directors present were Messrs. Ames, Earling, H. C. Frick, Robert W. Goelet, also a director of the Illinois Central; Harriman, Marvin, Hughitt, Lovett, Peabody, William Rockefeller, H. H. Rogers, James Stillman and David Willcox. The special committee appointed at the earlier meeting was ready to report in favor of the purchase. It did so, for these reasons:

Messrs. Kuhn, Loeb & Co. hold or control 150 shares, and Mr. E. H. Harriman, Mr. H. H. Rogers and Mr. James Stillman, members of this board, each hold 30,000 shares of the capital stock of the said Illinois Central Railroad Company, and after negotiations with these gentlemen they have offered to sell to this company the said stock so held by them at $175 per share as of Aug. 1, namely, ex-dividend.

The committee regarded this price as fair and reasonable. The committee is satisfied that the stock is so closely held that no considerable amount could be purchased upon the market without materially advancing the present market value. We believe the stock is intrinsically worth more than the price at which it is offered. The Illinois Central Railroad Company during the 54½ years of its existence has paid 101 dividends, and is now paying dividends at the rate of 7 per cent. per annum, and is earning considerably more.

Entertaining these views, your committee recommends the acceptance of the offer above mentioned, provided the purchase be within the corporate powers of this company and is otherwise lawful, and to afford counsel an opportunity to examine into and advise respecting the legality of the purchase and for you to determine what shall be done in the light of such service and of this report, your committee has made an agreement with Messrs. Kuhn, Loeb & Co. and Messrs. E. H. Harriman, H. H. Rogers and James Stillman whereby your company is given an option of 15 days to purchase the above-mentioned stock of the Illinois Central Railroad, held by the said Kuhn, Loeb & Co., and Messrs, E. H. Harriman, H. H. Rogers and James Stillman, at the price above-named, with interest at the rate of 4 per cent. per annum from Aug. 1, 1906, to date of payment.

Your committee has been informed by Mr. Harriman that he owns a majority of the stock of the Railroad Securities Company, which owns (as its only other asset other than cash) 95,000 shares of Illinois Central Railroad Company stock, subject to the pledge of 80,000 shares to secure $8,000,000 par value of 4 per cent. certificates, redeemable at 105 and interest. Mr. Harriman has further stated to the committee that in case the company purchases the Illinois Central Railroad Company stock offered by Messrs. Kuhn, Loeb & Co., Mr. Harriman and the other gentlemen above-named he thought that the company should have an opportunity to purchase his stock in the Railroad Securities Company at a price based upon the price at which Illinois Central Railroad Company stock had been offered to the company by Messrs. Kuhn, Loeb & Co., Mr. Harriman and the other gentlemen, above-named, and we have taken from him an option to that effect for 15 days.

All of which is respectfully submitted.

[illegible]

Later Mr. Harriman bought all the shares of the Railroad Securities Company, paying Mr. Fish for his interest $1,536,349.81 [illegible] stock of the Illinois Central and $1,537,920.19 in cash.

In regard to Mr. Harriman's powers, a resolution adopted [illegible] 26, as amendment to a similar resolution which had been [illegible] since 1902, provides:

That E. H. Harriman, Chairman of the Executive Committee, be, and is hereby, authorized to borrow such sums of money as may be required for the uses of this company, to execute in the name and on behalf of this company demand notes for the amount so borrowed, and to pledge the [illegible] of this company as collateral to such notes. In the absence of the Chairman of the Executive Committee, authority is hereby given to the Treasurer of the company, and to W. D. Cornish, one of the Vice-Presidents of the company, or to the Treasurer and Controller of the company, to sign jointly, on behalf of this company, notes for the amounts so borrowed and to pledge such securities as collateral thereon.

A letter from Mr. Harriman to Mr. Gould, in regard to the building of the Western Pacific, follows:

George J. Gould, Esq., 195 Broadway, New York City.

Dear Mr. Gould: I am in receipt of yours of the 25th inst., as follows:

"You doubtless know that I have determined to support the Western Pacific construction. This I regard as necessary for the protection of the system in which my interests are greatest. If you think this involves reasons why we should reciprocally withdraw from the boards of which we are the respective heads, I would be glad to meet your view. I prefer that you should reach your own conclusion as to whether, remaining as we are or withdrawing as above suggested, would be better for the interests we represent."

It seems to me that you settled the question of your own withdrawal from the Union Pacific and Southern Pacific boards on March 8 last, when, after the Western Union Board meeting, you, Mr. Schiff and myself had a talk regarding your connection with the Western Pacific. You then stated that you had no interest whatever in the construction of the line, and were not committed in any way thereto, but that you did not mean to convey the impression that you might not in the future, but, if you did, you said you did not think it would be right for you to be in the counsels of our allied lines, and also you would give us due notice of intention on your part to promote the construction of the Western Pacific. On March 9 the Union Pacific Executive Committee was elected and you were included therin. I am not conscious of any act on my part which might be considered as detrimental to any of the properties of which I am or have been a director. I have not taken part in any proceedings of the Denver & Rio Grande for a long time, and had presumed that I had not been re-elected to that board. I also declined to qualify as director after my election to the Rio Grande Western, as I did not want to be in any way responsible for the attitude to be assumed by that company toward the Western Pacific.

The era of prosperity through which we are now passing has been marked by less construction or of destructive, competitive and non-producing lines of transportation than any former one, but there has been great expenditure in providing for improvements and additional facilities to the already existing lines, thereby better conserving the interests of the public and the shareholders as well. For myself, I shall regard the loss of your advice, which I have valued in our affairs, as well as the personal pleasure of having you included in them. If there has been any misunderstanding of my directorship in the Denver & Rio Grande and the Rio Grande Western, will you please advise the boards of these companies of my withdrawal from or decline to qualify as one of their body?

Believe me, Yours truly,

(Signed) E. H. HARRIMAN.

In the hearing on January 5 it was brought out that at a meeting of the Executive Committee of the Oregon Short Line of March 31, 1903, the chairman, Mr. Harriman, had stated that, "pursuant to his authority," he had sold 300,000 shares of Southern Pacific at 57½, $6,000,000 to be paid in cash and $11,350,000 to be paid "at the option of the purchaser" before May 1, 1904, collateral to be deposited whose market value should be always in excess of the deferred payments. At a meeting held in November the chairman had informed the committee that pursuant to a letter from William Rockefeller he had closed the transaction with Mr. Rockefeller and had paid the amount involved, and the committee had then resolved "that the action of the chairman in the transaction with Mr. William Rockefeller in connection with the Southern Pacific stock be and hereby is in all things approved." A letter from William Rockefeller to Mr. Harriman as chairman of the Oregon Short Line, dated at 26 Broadway, November 5, 1903, was as follows:

Referring to the agreement entered into between you and me on March 30, 1903, in respect to the 300,000 shares of the capital stock of the Southern Pacific Company, I beg to state that I should be glad to have you take over the stock now instead of waiting until the 1st of May, 1904, as originally contemplated. If you are prepared to do this I am willing to reduce the commission agreed upon to five-eighths of 1 per cent., viz., $187,500, and shall be ready to close the matter upon receipt of your check for the principal amount involved, with interest at 6 per cent., together with the amount of said commission. Yours very truly, WILLIAM ROCKEFELLER.

It was shown that on December 13, 1906, Mr. Harriman had reported that he had organized the Pacific Fruit Express Co. under the law of Utah, the Southern Pacific and the Union Pacific each to take one-half of the stock, the company to be capitalized at $12,000,000. He also reported that he had bought for that company 6,000 refrigerator cars for $10,400,000; also that he had organized an equipment company to buy and lease to the several companies all equipment needed by them.

W. D. Cornish, vice-president of the Harriman lines, testified about the acquirement by Mr. Harriman of the Los Angeles street railway system, or rather 45 per cent. of its stock, the remainder

being in friendly hands. The minutes showed that Mr. Harriman reported that this had been done "to prevent it from falling into other hands." Another purchase was that of the Utah Light & Power Company. Mr. Harriman having reported at a meeting of the Southern Pacific executive committee that he had bought three-fifths of the capital stock. The purchase, Mr. Cornish said, was regarded as advantageous to the Southern Pacific, as it would build up the town.

On January 8, at Chicago, it was developed on testimony of President Ripley, of the Atchison, Topeka & Santa Fe, that two years ago Mr. Harriman, on behalf of himself and several other men, informed him that they had $30,000,000 of Atchison stock and demanded representation on the board. This was given to them, as they could have forced it anyway. The directors elected at Mr. Harriman's request are H. H. Rogers and Henry C. Frick. Both are directors of the Union Pacific, though Mr. Ripley was quite positive in declaring that so far they had to all appearances served the Atchison loyally. He testified, also, that his first knowledge that the Union Pacific as a company held Santa Fe stock was from the press despatches from New York last week.

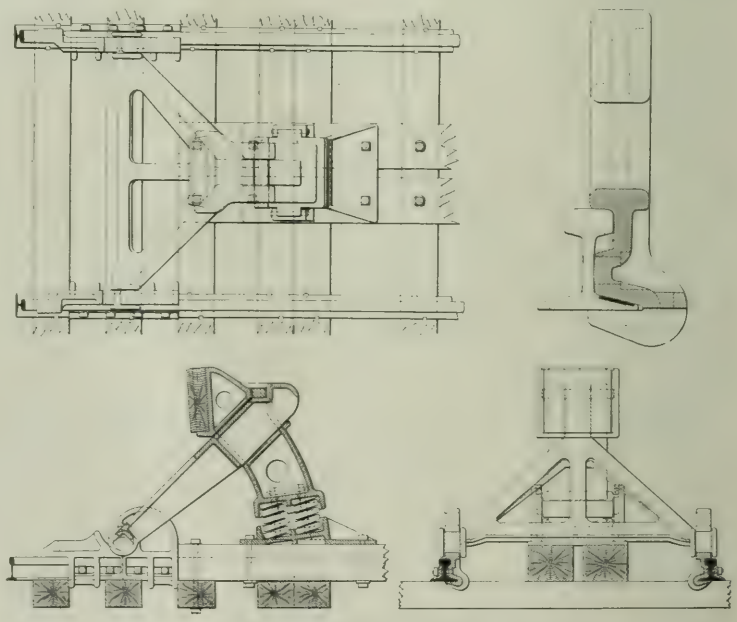
A Cast Steel Bumping Post.

The trunk or body of the bumping post shown in the accompanying drawings is a hollow steel casting of curved form, carrying on its upper or buffing end an oak buffing block; its lower end rests on a nest of four standard M. C. B. 6-in. x 8-in. draft springs. These springs bear on a suitable spring seat bolted to longitudinal timbers secured to the ties. The arms, or tension member, are a single casting of triangular form spanning the track, with a projection at the apex which extends through a rectangular opening in the body casting and is secured to it by a transverse key. At the lower end each arm has a flanged trunnion which bears on and engages a suitable recess in, a bracket bolted to the rail. This bracket is secured by bolts passing through the web of the rail, but the bracket grips the rail base and the bolts are therefore not in shear. To prevent the trunnions from being forced out of the recesses in the brackets by a buffing shock, the opening through which the trunnion must slip to enter the recess is made smaller than the diameter of the trunnion, which is flattened at one point sufficiently to allow the trunnion to slip in when the arm is at right angles to its normal position. The bracket is given a section at point of maximum stress equivalent in strength to an 80-lb. rail section.

Since the bracket, to fit the rail, must conform to the contour of one side of the rail, each weight of rail requires a special bracket. An adjustable bracket has been designed that can be applied to any size of rail between 60 and 95 lbs., a detail of which is shown. The outlines of the two extreme sizes of rails to which it is applicable are indicated, showing its relation to each. For sections under 95 lbs. a shim is placed on top of the base to clamp the bracket tightly against the under side. The holes are made oblong vertically to allow for this. The spacing of the bracket holes is the same as for the standard angle bar and in temporary applications the brackets can be applied by substituting them for the bars. In permanent applications, however, the bracket should abut against the angle bar, requiring special holes to be drilled through the rail web.

The estimated weight of the post is: Body, 450 lbs.; arms, 460 lbs.; brackets, 125 lbs. each; spring seat, 250 lbs.—a total of 1,410 lbs. The spring seat may be made of cast steel, malleable iron or cast iron. This post costs more than a wooden post. Its chief claim to merit lies in its cushioning. It saves damage to the cars and their contents. The application of a friction draft gear in place of the springs to absorb the recoil unavoidable with the latter has been considered. This would made some further increase in the cost. In the event of the complete destruction of this post it has a scrap value.

The parts are so proportioned that the springs of the post and of the car draft gear are fully compressed before the car wheels touch the rail bracket. A metal protecting plate, not shown in the drawings, is provided on the front of the oak buffer block. The post was designed by Mr. W. E. Symons, President of the Pioneer Cast Steel Truck Company, Chicago.



Symons Cast Steel Bumping Post.

The Great Corporations.*

One prevalent cry against the corporations is that they drive out the man who has built up a business for himself and wants to leave it to his son. To the millions of us whose fathers did not build up and leave to us a business the great corporations offer and will continue in widening range to offer a field in which advancement does not depend upon wealth. The ranks of the railroads afford opportunity for the lad of parents rich or poor, who undergoes discipline that obliges him to be punctual and obedient, temperate and courageous. The promotion of the son of his father is in evidence, but not by any means the rule; and the promotion of the unworthy son a rare exception. The shares and securities of the established railroad companies have reached a stability that makes them for investment second in desirability only to the obligations of the staple political governments.

Could this condition which the railroads have attained and maintain, notwithstanding the merciless drubbing which they have received and are receiving, could this condition be attained and maintained by the other industrial organizations would not the material status of this country be vastly improved?

That the discussion of the problems of property which has been incessant during these several years is leading to this end there is abundant evidence. As the people as a whole better understand what the corporate regime means, there will be the less dishonesty on the part or corporation officers; and well balanced action that often through popular ignorance is condemned as dishonest will be appreciated as it deserves.

For the citizen in the ordinary walks of life to invest in the ownership of the industrial and commercial corporations that have been so rapidly multiplying has often been but to venture on the quicksands. This is because he has not known, and in many cases has had no means of knowing, what he has been buying. Here again the older corporations, those of the railroads, afford an example. The bases for railroad accounting are quite generally recognized and established. From the balance sheet, the income account, the statistical tables in the report of nearly every railroad company may be gained fairly exact information as to the status of that company, as to its assets, its liabilities, its earnings, its efficiency. But a very few of the great industrial corporations issue reports similarly explicit and satisfying.

If one were to designate what would constitute the first step toward gaining a general and a popular acceptance of the corporate regime it would doubtless be this, that each corporation should periodically publish a statement that would give to its stockholders and the public in general as complete and explicit information in regard to its status and its performance as may be obtained respectively from the annual reports of the Pennsylvania Railroad Company and the United States Steel Corporation.

*From "The Evolution of Property," a paper by Logan G. McPherson, presented at the annual meeting of the American Association for the Advancement of Science, Dec. 27, 1906.

GENERAL NEWS SECTION

NOTES.

It is given out that the Chicago & North-Western has made 1,625 surprise tests during the past year and has not caught a single engineman in trying to disobey the rules.

The New York State Court of Appeals has decided that the Brooklyn Rapid Transit has the right to charge ten cents as the fare to Coney Island, thus disposing of the issue under dispute in the riots of last summer.

The increase of enginemen's pay on the New York, New Haven & Hartford, announced a few weeks ago, amounting to about 35 or 40 cents per 100 miles, is now followed by a similar announcement of increase on the Boston & Albany and the Boston & Maine; but, according to the reports, the increase is considerably less on the Boston & Albany, and amounts to only 25 cents per 100 miles on the Boston & Maine.

A press despatch from Topeka states that the traffic managers of the principal roads in Kansas have agreed to make general reductions in freight rates, and that, consequently, suits which have been begun by the state officials in the Federal Court to enforce a reduction will be withdrawn. It is said that the reduction in rates on coal will be one mill per ton per mile, and on grain 7 per cent. There will be a reduction of 10 per cent. on paper west bound. Altogether it is calculated that the citizens of Kansas will save from $1,000,000 to $1,500,000 annually by this reduction.

Representative Morrell, of Pennsylvania, has introduced in Congress a resolution to have a special inquiry made by Congress into the safety of railroad operations. The resolution requires the committee to recommend legislation to empower the Interstate Commerce Commission to regulate interstate train movements with a view to prevention of collisions. The resolution evidently covers the same ground as that already covered by the Mann resolution of last June and therefore is superfluous. The Congressional Committee would be doing the same work which the Commission has already begun.

Working along another line, the Interstate Commerce Commission has recommended that automatic stops be tested. This recommendation is noticed in the editorial column.

A press despatch from Houston, January 7, says that the strike of the Southern Pacific firemen has been declared off. An agreement has been signed, providing:

1. A board of arbitrators shall determine whether the Southern Pacific company abrogated its contract with the firemen when it signed the new agreement on May 1, 1906, with the engineers. The company shall name one of the board, the firemen shall name a second, and the two thus chosen shall select a third.

2. All employees who went on strike shall return to their former positions without prejudice to their rights.

3. The seniority of engineers who went on strike shall be determined at a meeting of the general board of adjustment of the Brotherhood of Locomotive Engineers of the Southern Pacific Company, Atlantic system, at a meeting to be held in Houston on January 10.

4. What each organization shall concede will be determined by the board of arbitration.

Nearly all the men on strike have either returned to work or will return at once.

Changes of White Star Line Ports.

Next spring the faster steamers of the White Star Line will not land at Liverpool, Eng., as heretofore, but at Channel ports. The eastbound steamers will land mails at Plymouth, and then go on to Cherbourg and Southampton to land passengers. Westbound, the boats will start from Southampton, call at Cherbourg, and then at Queenstown. This service will begin with the first eastbound voyage of the new steamship "Adriatic," which sails from Liverpool on May 8, and from New York on May 22. The "Oceanic," "Teutonic" and "Majestic" will also carry on the new service, the other boats of the White Star fleet continuing to sail from Liverpool.

Two Cents a Mile in Canada.

A bill has been introduced into the lower house of the Canadian Parliament making two cents a mile the highest legal passenger rate which can be charged on Canadian railroads. This bill is being strongly opposed by the Canadian roads, first on the ground that their passenger receipts per mile operated are much lower than in the United States, particularly than in those parts where a two-cent rate is in force, and second that the enforcement of a two-cent rate would inconvenience a large part of the public, since all low excursion rates would be cut off. Excursion rates in Canada are more frequent and lower than south of the boundary, averaging one and one-half cents a mile. On the government railroads, the Intercolonial and the Prince Edward Island, second-class return tickets are sold at single first-class one-way rates (three cents a mile). The Intercolonial also has Saturday excursions when first-class round trip tickets good going Saturday and returning Monday are sold at the one-way fare.

One Day With a Railroad Magnate.

7.30 a.m.—Reads morning newspapers and learns that he is to be investigated by the Interstate Commerce Commission; that he is likely to be indicted by a grand jury in Kansas; that he is to be investigated by the Missouri Legislature; that he is robbing the farmer, plundering the merchant, and crippling the commerce of a continent.

7.45 a.m.—Receives telegram from leading chamber of commerce stating that business of the nation is being ruined by the combinations he has formed, and asking him to resign from all his presidencies and directorships and retire to oblivion.

8 a.m.—Receives word that business in the states through which his railroads run is so great that existing transportation facilities are utterly inadequate, and asking if he would have any objection to the paralleling of his tracks with canals.

8.30 a.m.—Receives a message to the effect that the shortage of cars on his main lines and branches is killing one branch of trade, while it is booming another. Asked what he is going to do about it.

9 a.m.—Notified that he has been indicted by an Ohio grand jury for exceeding the speed limit in his efforts to relieve the car congestion.

9.30 a.m.—Hears that the President is going to devote a special message to him.

9.45 a.m.—Is informed that shippers along all of his lines are going to bring suits against him for the reason that his employees do not work hours enough daily to clear the side tracks of loaded cars.

10 a.m.—Receives word that 79,865 employees of his consolidated system are about to strike for shorter hours.

10.15 a.m.—Is notified to appear at once before the transportation committee of the Oskaloosa city council, or his right of way through the town will be declared forfeited.

10.30 a.m.—Called to the telephone to receive long distance message from state's attorney of Clark County, Montana, informing him that he is about to be tried for violating 19 different sections of the railroad law of the state.

11.30 a.m.—Hears that he has been indicted for manslaughter in consequence of accident in Iowa.

Noon.—Is cited to appear before the Interstate Commerce Commission to answer questions which it is hoped may send him up for life.

12.30 p.m.—Learns while lunching that all brakemen on all of his lines refuse to brake until he raises their wages 25 per cent.

1 p.m.—Is condemned by National Passenger Association for crowding his rails with merchandise trains, and threatened with 7,000 suits for damages.

2 p.m.—Receives notice from the Secretary of the Western Association of Shippers that unless he suspends the running of passenger trains for a week or ten days, so as to allow the freight to be handled, he will be lynched if caught west of the Mississippi.

3 p.m.—Is informed by a delegation from Batavia, Wis., headed by the Mayor, that unless his lines cease to grant preferential rates to the rival town of Hamburg the matter will be brought to the attention of Congress at the earliest possible moment.

4 p.m.—Is notified that he has been indicted by the grand jury of Douglas County, Nebraska, on 37 distinct counts.

5 p.m.—Closes his desk and goes home, where he cannot pick up a magazine that does not contain a character sketch of him as America's most dangerous and possibly wickedest man.

7 p.m.—Retires for the night, as the only safe way of avoiding hearing comments made by members of his household upon the remarks made about him in the evening papers.—*Chicago Inter-Ocean.*

Lumber Production in United States in 1905.

According to a recent bulletin issued by the Forest Service, Department of Agriculture, 11,666 mills in the United States cut 30,502,961,000 ft. b.m. of lumber of all kinds during 1905. Yellow pine was cut in the largest amounts, 28.8 per cent. of the total production, with white pine, Douglas fir, hemlock and white oak next in order. The soft woods contributed 81.3 per cent. of the total. In the production by states Washington leads with 12.8 per cent. of the total cut, followed by Wisconsin, 8.3 per cent., Louisiana, 7.5

per cent.; Minnesota, 6.3 per cent., and Michigan, 5.6 per cent. Thirty-three states cut over 100,000,000 ft. each, and the remaining states and territories together produced only 292,060,000 ft. The cut of white oak, in which West Virginia leads with 12.9 per cent., was 1,210,216,000 ft., which is a decrease of 43 per cent. in the cut reported by the Census in 1899.

Two Telephone Companies in New York City.

As the result of an investigation of the telephone service in 39 cities where two telephone companies are operating H. P. Nichols, engineer for the Bureau of Franchises of New York City, concludes in a recent report that double service in New York would be both inconvenient and costly should a franchise be granted to the new Atlantic Telephone Co. He finds that independent telephone companies are operating in all the principal cities in the central part of New York state, and in many smaller cities and towns in the vicinity and they claim to have in operation nearly 92,000 telephones. Competition exists in almost every place of any size or importance throughout Pennsylvania, and the independent movement has secured a firm foothold. In some places the service of the independent companies is inefficient and unequal to that of the Bell companies. The cause of this inefficiency seems to be due to lack of management or discipline, and the want of capital more than any other reason.

Generally speaking, there are no independent commercial long distance connections throughout the state, but connections are advertised which it was found could not be made. As a whole, the independent companies are not so strong as in many other localities visited, though the number of telephones is increasing very rapidly, in spite of the efforts on the part of the Bell companies to prevent their growth.

As to the Atlantic Telephone Company, Mr. Nichols believes the company has made its application for a franchise without properly figuring out the rates, and he points out that in the proposals there is nothing to show what the rates will be for private branch exchanges and extension stations, which, he believes, should be specified in the contract. In cities where there are two telephone companies there are cheap rates and good service, but inconvenience has resulted and additional expense to subscribers who, to get full service, must subscribe for both telephones.

Suit Against Gould Roads.

Suits to dissolve the alleged merger of the Wabash, the Missouri Pacific and the St. Louis, Iron Mountain & Southern Railway Companies and the Pacific Express Company, and to revoke the licenses and charters of the Pacific Express Company, American Refrigerator Transit Company, Western Coal & Mining Company, Rich Hill Coal Mining Company, and Kansas-Missouri Elevator Company were filed in the Supreme Court of Missouri by Attorney-General Hadley on Wednesday. The petition alleges that the stocks of the companies named are owned by the same interests, the Goulds, in violation of the provisions of the Constitution and laws of Missouri.

Concerning the suit, Attorney-General Hadley said:

"These suits are brought for the purpose of forcing a discontinuance of the ownership of the stock of the Wabash, Missouri Pacific, and Iron Mountain companies, and the control of these three companies, two of which are paralleling and competing lines, by the same interests, and to force a discontinuance of the ownership of the stock by these companies in the Pacific Express Company, American Refrigerator Transit Company, Rich Hill Coal Mining Company, Western Coal & Mining Company, and the Kansas-Missouri Elevator Company. By this stock ownership these roads have, in fact, been engaging in business not authorized by their charters and prohibited by the constitution and laws of the state."

Short Free Time in France.

It is not in this country alone that freight cars are scarce. On November 5, 1906, the French Minister of Public Works addressed a communication to the railroad managers of that country urging them to take action for the purpose of supplying sufficient equipment for the demands of traffic. In reply the managers have requested to be permitted to shorten the period allowed consignees for unloading the cars. Under the present law a consignee is obliged to unload the shipment during the day when he has received notice of its arrival by 6 o'clock of the evening before. If he does not unload the car during this first day he is charged $2 a day demurrage for the next three days, and $2.40 a day thereafter. The managers desire to change the time of notice to 9 o'clock in the morning with the obligation to unload during the same day, and suggest on the other hand that the demurrage charge between January 1 and August 31, which is a period of slack traffic, should be lowered to one dollar per day per car.

In the correspondence it is claimed by the Minister that the delay in unloading does not generally exceed 24 hours, and he urges a greater daily average movement of cars on the part of the railroad companies. It appears also that formal proceedings would be necessary to change the regulations, which are prescribed by law.—*Official Guide.*

Holding Company for Morse Steamship Lines.

The Consolidated Steamship Lines Company, with an authorized capital of $60,000,000, was organized at Portland, Me., on January 1, 1907, to conduct general steamship business. This is to be a holding company for steamship lines owned by Charles W. Morse.

A Road Crossing Accident.

What happens when a fast passenger train hits a log wagon stalled on a road crossing is shown in the accompanying illustration. The engine left the rails, plowed along the roadbed for about 400 ft., crashed through a flour mill alongside and finally turned over on its side and stopped. The train followed the engine but none of the cars were overturned. The fireman was killed and two of the trainmen died of their injuries, but none of the passengers were hurt. The railroad company is rebuilding the flour mill.

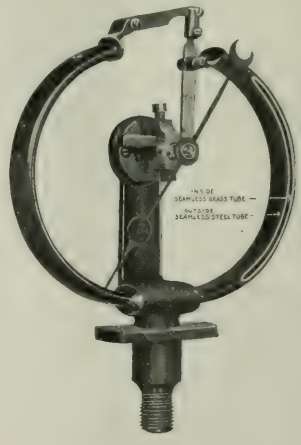


Fallen by the Wayside.

Reduction in New South Wales Railroad Rates.

Late in December it was announced by the Premier of New South Wales that, owing to the general prosperity and the favorable conditions of the railroad finances, reductions would be made in freight rates and passenger fares amounting to about $1,500,000. The New South Wales railroads are owned and operated by the colonial government.

The Golden Locomotive Steam Gage.



Golden Locomotive Steam Gage.

The distinguishing feature of the Golden locomotive steam gage, the mechanism of which is shown in the accompanying illustration, is the construction of the expanding tubes. A flattened seamless brass tube is encased within a seamless steel tube and the two are drawn and treated by a secret process. It is claimed that the tubes so made are non-corrodible and will never take a permanent set, thus destroying the accuracy of the gage. The tubes are tested to 1,000 lbs. pressure before being put in the gages, which are made for pressures up to 400 lbs. They can be fitted to any other form of clock mechanism besides the one shown, which, however, is both simple and efficient. These gages are made by the Golden-Anderson Valve Specialty Co., Pittsburg, Pa.

Report on Dakota Car Shortage.

The Interstate Commerce Commission has made a preliminary report on its investigation of the car shortage in the Northwest, but has given no conclusion. There is little that is new in the report. With regard to the coal famine in North Dakota Commissioners Lane and Harlan (who made the investigation) found "indisputable proof" that there was "an agreement between the coal dealers to maintain prices and to boycott all who do not so agree," but they did not find that this combination is "chargeable with the coal shortage prevailing," or that the railroads were party in any way to such a con-

spiracy. They attribute the coal scarcity to "such an abundance of westbound traffic at the head of the lakes that cars were not available in the congested state of that terminal for the carrying of coal to North Dakota, a comparatively short haul for a low-class commodity." The report indicates that the scarcity, when the cold weather came on, might easily have been avoided by proper foresight and co-operation between the coal dealers and the railroads.

The eastbound grain situation was quite as bad. The country elevators were crammed and grain had to lie on the ground or in exposed bins, while terminal elevators at Duluth, Superior and Minneapolis were waiting for it, empty or partly filled, because the railroads were unable to carry it for lack of cars.

Financial loss to many people is shown to have been caused by the failure of the railroads to prepare for a large movement of grain. The report says:

"Fifty million bushels of grain, as nearly as can be estimated, remain on the farms or in the country elevators of North Dakota. But 38 per cent. of the crop has been shipped." Of the reciprocal demurrage the report says:

"The enactment of a reciprocal demurrage bill will not build railroad track, equipment, enlarge and simplify terminals, nor transform incompetent operating officials into first-class railroad men, but it might stimulate, energize, and in some cases revolutionize the methods of delinquent railroads, so that they would render the service which they were created to render. This is the theory of reciprocal demurrage. But that this of itself will enable the railroad to render adequate service is not demonstrated by experience."

Mahogany Ties in Mexico.

J. M. Neeland, Vice-President of the Pan-American Railroad, now open from a connection with the Tehuantepec National near San Geronimo, Mex., to Pijijiapam, 161 miles, is reported as saying that hardwood is used almost altogether for ties, and that fully 12 per cent. of the ties thus far laid are mahogany. The *chico zaporte*, from which chicle gum is extracted, is also used. The intense hardness of this tree, which increases with time after it is cut down, makes it particularly valuable as a railroad tie.

First Contested Case Under Revised Law.

The Interstate Commerce Commission, in an opinion by Commissioner Clements, has announced its decision in the case of the Frederick Brick Works against the Northern Central Railway Company and the Pennsylvania Railroad Company. The decision is in favor of the complainant. This is the first contested case decided by the Commission under the new law. The complainant shipped from Frederick, Md., to Elberon, N. J., 372,200 lbs. of red brick. The rate charged was a class rate of $3.80 per ton. The complainant alleged this rate to be unreasonable and unjust, and pending the controversy before the Commission the carriers reduced the rate to $2.75 per ton. The Commission holds that the rate of $3.80 per ton was unreasonable and unjust, and awards reparation to the complainant based on the difference between that rate and the rate of $2.75 which was put in effect by the carriers after the complaint was filed.

TRADE CATALOGUES.

The Long-Bell Lumber Co.—It is the custom of the Long-Bell Lumber Co., Kansas City, Mo., each year to give its representatives an outing, the purpose of which is to make them better acquainted with the lumber country, to familiarize them with all details of the business from forest to mill, and to give them a pleasure trip. This year the special train consisted of a baggage car, two diners, six Pullmans and a private car. The trip lasted nine days and covered 3,000 miles. A detailed account of it, with numerous illustrations, has been prepared by the company and is being distributed, forming an interesting souvenir of the occasion. The book is an artistic piece of work, printed on heavy cream-colored plate paper, with suitable cover designs in colors. It is 10 x 14, contains 56 pages, and is complete in all details.

"Do You Know?"—This is the title of a little three-page pamphlet of the Detroit Seamless Steel Tube Co., Detroit, Mich., reminding the reader that "there is nothing new under the sun." It informs him that certain inventions, practices, etc., which are enumerated, popularly supposed to belong only to the present advanced age, were known to such ancient peoples as the Egyptians, or Babylonians. Some facts regarding "Detroit" seamless steel tubes are also included.

Storage Batteries.—Price list "C" of the Willard Storage Battery Co., Cleveland, Ohio, gives prices of elements in rubber jars, cabinet batteries and covered lead-lined tanks; it will be mailed on application.

Track Materials.—A new edition of "Track," the Railroad Supply Co.'s pocket companion for trackmen, is being distributed free of charge. It has been fully revised and much new material added. The number of copies distributed will exceed 75,000, a majority of which are sent on requests from railroads. The general offices of the company are in the Bedford Building, Chicago.

Long Island Railroad.—This company has published an interesting 160-page pamphlet entitled "The Lure of the Land," being a story of the work done by the company at Experimental Station No. 1 on Long Island. The half-tone illustrations, which are plentiful, are unusually good.

Block Signals.—Bulletin No. 29 of the Union Switch & Signal Co. consists of an illustrated article on the automatic electric block signals made by this company for the electrified lines of the Long Island Railroad.

Valves and Packings.—Jenkins Bros., New York, have issued their 1907 catalogue and price list of valves and packings. It illustrates and describes a wide variety of these specialties.

Manufacturing and Business.

C. R. Kearns, who has been on leave of absence for six years on account of illness, has returned to the Nathan Manufacturing Co., New York.

The Bethlehem Steel Company has ordered from the Crocker-Wheeler Co., Ampere, N. J., one 500 h.p. direct-current motor to operate under 240 volts pressure at 450 r.p.m.

The Willard Storage Battery Co., Cleveland, Ohio, making a specialty of train-lighting batteries, has opened an office at 1525 First National Bank building, Chicago, to handle its western trade.

George A. Post, Jr., M.E., Cornell '05, has resigned as a sales engineer of the Westinghouse Machine Company and become engineer representative of the Standard Coupler Company, New York City.

The "Bull-Dog" Anti Rail Creeper, formerly manufactured by the Bryan Manufacturing Co., of Racine, Wis., will be now exclusively manufactured and sold by the Quincy, Manchester, Sargent Co., of Chicago and New York.

The following officers of the Locomotive Appliance Company have been elected: President, Ira C. Hubbell; Consulting Engineer, J. B. Alfree; Vice-Presidents, C. H. Howard, W. J. McBride and F. W. Furry; Secretary and Treasurer, W. H. England.

C. V. Seastone, Associate Professor of Sanitary Engineering, Purdue University, has resigned to take a position with Daniel W. Mead, Consulting Engineer, Chicago. R. L. Sackett, of Earlham College, has been appointed Professor of Municipal and Sanitary Engineering in Purdue University in his place.

The Colorado Gray Iron Foundry Co. has been formed in Denver, Colo., J. M. Herbert, formerly Vice-President of the Colorado & Southern, is President; S. C. Williamson is Secretary and Treasurer, and F. S. McNamara is General Manager. A new plant, said to be the largest of its kind west of Chicago, has been built at Third and Mulberry streets, Denver, and will employ at the start from 150 to 200 men. The main foundry is 110 ft. x 250 ft., and the pattern shop 60 ft. x 130 ft., all buildings being brick. Gray iron castings of all kinds will be made, the capacity being 75 tons a day.

The Hall Signal Company is to be reorganized according to the following plan, which has been approved by the directors and will be submitted to the stockholders. The new company is to have $5,000,000 preferred and $5,000,000 common stock. The $100,000 preferred and $1,900,000 common stock of the present company is to be exchanged for $2,000,000 in preferred stock of the new company, and the holders of the present preferred stock are to receive, in addition, $20 per share. Of the remaining new preferred stock, $1,000,000 is to be issued at par with a bonus of $1,000,000 common, and $2,000,000 preferred is to be held in the treasury. Of the remaining $4,000,000 common stock, $2,500,000 is to be given to the underwriters, J. S. Bache & Co., New York, and $1,500,000 is to be held in the treasury.

Iron and Steel.

The Winona Interurban has ordered 4,000 tons of rails, the Lexington Railway about 2,000 tons of heavy rails, and other electric lines have ordered an additional 3,000 tons.

Inquiries are being made for about 75,000 tons of rails for delivery during the latter half of 1907, and negotiations will soon be under way for rails to be delivered in the early half of 1908.

The general contract for the entire work for the approaches to the Blackwell's Island bridge over the East river at New York has been given to the Buckley Construction Co. It will require 8,300 tons of steel.

The Chicago, Milwaukee & St. Paul is in the market for about

8,000 tons of structural steel for bridges, and the Chicago & North-Western is negotiating for bridge work, requiring 4,000 tons of fabricated steel.

Orders have recently been given for 1,350 tons of bridge material by the New York, New Haven & Hartford to the Pennsylvania Steel Co., and Riter & Connelly. The New York Central has ordered 8,000 tons, and the Louisville & Nashville 1,500 tons of steel for bridges.

The Harriman Lines are in the market for 7,000 additional tons of rails for the Southern Pacific. The San Antonio & Aransas Pass is also in the market for between 7,000 and 8,000 tons. The Lehigh & Hudson River has ordered 6,000 tons, the New Orleans & Great Northern 2,000 tons, and the Johnstown, Ebensburg & Northern 3,700 tons.

OBITUARY NOTICES.

Robert H. Sayre, Chairman of the Board of Trustees of Lehigh University, died at his home in South Bethlehem, Pa., on January 4. Mr. Sayre was born in Pennsylvania in 1824. He worked in an engineering corps on the Morris & Essex Canal in 1840, and later on the Lehigh Canal. After working for some years on railroad construction, he went into the Lehigh Coal & Navigation Company. In 1852 he was elected Vice-President of the Delaware, Lehigh, Schuylkill & Susquehanna, now part of the Lehigh Valley. In 1882 he was made President and Chief Engineer of the Southern Pennsylvania, now the Cumberland Valley, and later was elected Vice-President of the Lehigh Valley in charge of the traffic and engineering departments. In 1886 he was appointed General Manager of the Bethlehem Steel Company, and in 1891, Vice-President.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Engineers' Club of Philadelphia.

At a meeting of this club January 5 a paper, illustrated by lantern slides, on "The Power Plant of the Ontario Power Company at Niagara Falls, Canada," was read by William M. White.

Railway Signal Association.

The January meeting of this association was held in New York City on Tuesday of this week. Vice-President A. H. Rudd occupied the chair, and about 75 members were present. Interesting discussions were had on How to Remedy the Effects of Foreign Currents on Automatic Block Signals; on Electric Locking for Interlocking Signals, and on other subjects which were left unfinished at the annual meeting last October. A report of these discussions will be given in a later issue. The committees for the ensuing year were announced as follows:

No. 1—Automatic Block Signal Systems.—George E. Ellis, Chairman; V. I. Smart, G. N. MacDougald, L. E. Kinch, W. H. Willis, S. N. Wight, A. H. Rice, G. N. Chappel, W. B. Weatherby and W. C. Long.

No. 2—Maintenance of Automatic Block Signals.—W. W. Slater, Chairman; J. G. Young, E. W. Newcomb, C. S. Pflasterer, E. M. Cutting, F. W. Pflegling, A. H. McKeon and W. E. Boland.

No. 3—Circuits for Interlocked Signals.—H. W. Lewis, Chairman; J. Fred Jacobs, W. M. Spangler, E. O. Graham, H. K. Lowry, W. H. Harland, Jr., and H. O. Kline.

No. 4—Storage Battery.—I. S. Raymer, Chairman; J. E. Hackman, W. J. Eck, M. E. Smith, W. H. Fenly and A. H. Yocum.

No. 5—Maintenance Mechanical and Power Operated Signals.—C. E. Denney, Chairman; C. A. Dunham, B. F. Williston, W. S. Workman, Alex. Brown and Chas. L. Hackett.

No. 6—What Shall Constitute Cost in Estimates for Installation?—Frank Rhea, Chairman; W. J. Foale, B. H. Mann and R. E. Trout.

No. 7—Copper and Iron Wire for Pole Line.—W. M. Vandersluis, Chairman; J. R. Decker, D. W. Richards, W. H. Higgins and C. F. Jones.

No. 8—Standard Specifications for Electric Interlocking.—L. R. Clausen, Chairman; E. A. Everett, M. H. Hovey, A. Kelly, F. P. Patenall, G. C. Pflasterer, G. H. Dryden, E. B. Pry and J. J. Cozzens.

No. 9—Signal Definitions.—C. C. Anthony, Chairman; J. C. Mock.

No. 10—Office Records and Accounts.—E. B. Ashby, Chairman; W. A. Peddle and J. M. Fitzgerald.

No. 11—Signal Lamps.—Harry Hobson, Chairman; C. J. Cannon, F. J. Schmeiser, F. E. Wass and Chas. Geary.

No. 12—Rubber Covered Wire.—Azel Ames, Chairman; A. H. Rudd.

No. 13—Maintenance Manual Controlled Signals.—C. H. Morrison, Chairman; M. M. Case, N. E. Baker, A. C. Holden, W. P. Allen and J. I. Vernon.

No. 14—How to Remedy the Effects of Foreign Current on Automatic Block Signals.—W. H. Elliott, Chairman; J. M. Woldron, J. D. Phillips, W. H. Follet, C. A. Christoffersen and W. M. Post.

No. 15—Standard Specifications for Mechanical Interlocking.—T. S. Stephens, Chairman; W. J. McWain, J. B. Latimer and Daniel Cushing.

No. 16—Circuits for Manual Block Signal Systems.—S. P. Hull, Chairman; M. W. Bennett, F. B. Weigand, W. N. Schnure, B. O. Darrow and A. J. Loughren.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Atlanta & West Point.—W. H. Smith, Freight Claim Agent, has been also appointed Acting Auditor, succeeding F. A. Healey, Auditor, resigned.

Augusta Southern.—A. B. Andrews, First Vice-President of the Southern, has been elected also President of the Augusta Southern.

Birmingham & Atlantic.—Y. Vandenburg has been elected President, with office at New York City.

Chicago & Alton.—G. J. Pollock has been appointed Auditor and H. E. R. Wood, Treasurer, has been appointed Assistant Secretary, succeeding to the duties of C. H. Davis, Auditor and Assistant Secretary. The offices of both are at Chicago, Ill.

Chicago, Rock Island & Gulf.—J. W. Robins, Superintendent of the Gulf, Colorado & Santa Fe at Cleburne, Tex., has been elected Vice-President and General Manager of the Chicago, Rock Island & Gulf, with office at Fort Worth, Tex., succeeding S. B. Hovey, resigned.

Cincinnati, New Orleans & Texas Pacific.—C. A. McCormick, Chief of Mechanical Accounts, has been appointed Assistant Auditor.

Mobile & Ohio.—W. W. Finley, President of the Southern, has been elected also President of the Mobile & Ohio, succeeding Samuel Spencer, deceased.

New York, New Haven & Hartford.—E. J. Buckland has been elected Vice-President, with office at Providence, R. I.

Northern Central.—James McCrea, President of the Pennsylvania, has been elected also President of the Northern Central.

Pennsylvania Lines West.—Joseph Wood, Second Vice-President in charge of traffic, has been elected First Vice-President, succeeding James McCrea, promoted. J. J. Turner, Third Vice-President in charge of transportation, has been elected Second Vice-President. E. B. Taylor, Fourth Vice-President in charge of the treasury and accounting departments, has been elected Third Vice-President. D. T. McCabe, Freight Traffic Manager, has been elected a Director and Fourth Vice-President in charge of traffic. These elections apply to the Pennsylvania Company, which operates the Northwest System, and the Pittsburg, Cincinnati, Chicago & St. Louis, which operates the Southwest System of the Pennsylvania Lines West.

Operating Officers.

Atlanta & West Point.—E. W. Sandwich, Acting Car Accountant, has been appointed Car Accountant.

Atlantic Coast Line.—A. P. Connelly, Superintendent of Transportation of the Third division, has been appointed Superintendent of the Jacksonville division, with office at Sanford, Fla. O. H. Page, Superintendent of the Fayetteville district, succeeds Mr. Connelly, with office at Jacksonville, Fla.

See Central of Georgia.

Baltimore & Ohio.—F. C. Batchelder, Superintendent at Chicago, Ill., has been appointed General Superintendent at Baltimore, Md., succeeding C. C. F. Bent, transferred to the B. & O. Southwestern. B. W. Duer, Superintendent at Pittsburg, Pa., succeeds Mr. Batchelder. E. A. Peck, Superintendent at New Castle, Pa., succeeds Mr. Duer. W. W. Temple, Engineer of Maintenance of Way at Pittsburg, Pa., succeeds Mr. Peck.

Baltimore, Chesapeake & Atlantic.—A. H. Seth has been appointed Assistant to the General Manager of this road and of the Maryland, Delaware & Virginia. W. U. Polk, Assistant Engineer, has been appointed Superintendent of both roads, succeeding A. J. Benjamin, deceased.

Canadian Northern Ontario.—F. M. Spaidal, Superintendent of the Canadian Pacific at Montreal, has been appointed Superintendent of the Canadian Northern Ontario, with office at Toronto, Ont.

Canadian Pacific.—See Canadian Northern Ontario.

Central of Georgia.—W. H. Wright, Superintendent of the Savannah district of the Atlantic Coast Line, has been appointed Superintendent of the Central of Georgia, at Savannah, Ga., succeeding J. C. O'Dell.

Chicago, Burlington & Quincy.—E. E. Young, Trainmaster at Denver, Colo., has been appointed Superintendent at McCook, Neb., succeeding C. L. Eaton, resigned.

Coal & Coke.—J. C. Hiltabidle has been appointed Trainmaster, with office at Gassaway, W. Va.

Colorado & Southern.—A. Pardoe has been appointed Car Accountant, with office at Denver, Colo.

Denver & Rio Grande.—W. A. Whitney has been appointed to the new office of Superintendent of Transportation, with office at Denver, Colo. The office of Superintendent of Car Service has been abolished.

Gulf, Colorado & Santa Fe.—See Chicago, Rock Island & Gulf, under Executive, Financial and Legal Officers.

Illinois Central.—C. H. Groce, Superintendent of Telegraph, has been appointed Assistant to the General Manager, succeeding L. C. Fritch, promoted.

Maryland, Delaware & Virginia.—See Baltimore, Chesapeake & Ohio.

Mexican Central.—The office of R. I. Craig, Superintendent of the Torreon division, has been removed from Jimulco to Gomez Palacio.

Midland Valley.—W. J. Weir has been appointed Trainmaster, with office at Muskogee, Ind. T.

Oregon Short Line.—See Union Pacific.

Santa Fe, Prescott & Phoenix.—The office of General Superintendent has been abolished, W. E. Drake, General Superintendent and Chief Engineer, having been promoted. H. C. Storey, Trainmaster, has been appointed Superintendent, with office at Prescott, Ariz. See Santa Fe, Prescott & Phoenix under Engineering and Rolling Stock Officers.

Southern Pacific.—See Union Pacific.

Tehuantepec National.—H. A. Tolle has been appointed Superintendent of Terminals at Salina Cruz, Mexico.

Union Pacific.—J. M. Davis has been appointed Assistant General Superintendent of the Union Pacific, Lines West of Green river, of the Southern Pacific, Lines East of Sparks, and of the Oregon Short Line, with office at Salt Lake City, Utah.

Traffic Officers.

Alabama Great Southern.—E. Schryver, Assistant General Freight Agent of the Cincinnati, New Orleans & Texas Pacific, has been appointed General Freight Agent of the Alabama Great Southern, with office at Birmingham, Ala., succeeding L. Sevier, resigned to go to the Seaboard Air Line. See Cincinnati, New Orleans & Texas Pacific.

Canadian Pacific.—C. E. E. Ussher, General Passenger Agent of the Eastern Lines, has been appointed Assistant Passenger Traffic Manager of the Western Lines, with office at Winnipeg, Man. William Stitt, General Passenger Agent at Sydney, N. S. W., of the Canadian Pacific Steamship Lines, succeeds Mr. Ussher, with office at Montreal, Que.

Chesapeake & Ohio.—The office of F. M. Whitaker, Freight Traffic Manager, has been removed from Richmond, Va., to Cincinnati, Ohio.

Chicago, Milwaukee & St. Paul.—E. S. Keeley, General Freight Agent, has been appointed to the new office of Freight Traffic Manager. H. E. Pierpont, Assistant General Freight Agent at Chicago, Ill., succeeds Mr. Keeley. W. E. Prendergast has been appointed Assistant General Freight Agent at Chicago, Ill., succeeding E. G. Wylie, resigned.

Cincinnati, New Orleans & Texas Pacific.—G. P. Biles, General Freight Agent, has been appointed to the new office of Freight Traffic Manager of this road and of the Alabama Great Southern. H. A. Poveleite succeeds Mr. Biles. See Alabama Great Southern.

Grand Trunk.—W. P. Hinton, General Agent of the Passenger Department at Ottawa, Ont., has been appointed Assistant General Passenger and Ticket Agent at Montreal, Quebec.

Engineering and Rolling Stock Officers.

Atlanta, Birmingham & Atlantic.—J. E. Cameron, Master Mechanic, has been appointed Superintendent of Motive Power, with office at Fitzgerald, Ga.

Baltimore & Ohio.—See Baltimore & Ohio under Operating Officers.

Boston & Maine.—Henry Bartlett, Superintendent of Motive Power, has been appointed to the new office of General Superintendent of the Mechanical Department. C. H. Wiggin, Assistant Superintendent of Motive Power, has been appointed Superintendent of Motive Power. J. W. Marden, Assistant Master Car Builder, has been appointed to the new office of Superintendent of the Car Department, succeeding to the duties of J. T. Chamberlain, Master Car Builder, who has resigned after many years of service.

Boyne City, Gaylord & Alpena.—C. F. Gregory has been appointed Master Mechanic.

Chicago, Cincinnati & Louisville.—J. K. Sroufe, Engineer of Maintenance of Way, has resigned and the office has been abolished.

Chicago, Rock Island & Gulf.—J. S. Peter, Chief Engineer, has resigned to go to the San Antonio & Aransas Pass.

Georgia Southern & Florida.—George B. Herrington has been appointed Chief Engineer, with office at Macon, Ga., succeeding J. J. Gaillard, resigned to go to another company.

Lake Shore & Michigan Southern.—J. T. Carroll, general foreman of the locomotive department at Elkhart, Ind., has been appointed Assistant Superintendent of Shops at Collinwood, Ohio, succeeding R. D. Fildes, resigned. A. R. Sayres, assistant general foreman of locomotive shops at Collinwood, has been appointed Superintendent of Shops at Elkhart, Ind.

Lehigh & Hudson River.—R. F. Jaynes, general shop foreman, has been appointed to the new office of Master Mechanic, with office at Warwick, N. Y.

Louisville & Atlantic.—C. W. Moorman, roadmaster, has been appointed Engineer of Maintenance of Way.

Santa Fe, Prescott & Phoenix.—J. A. Jaeger has been appointed Chief Engineer, with office at Prescott, Ariz., succeeding, as Chief Engineer, W. A. Drake, General Superintendent and Chief Engineer, now Vice-President and Assistant General Manager. S. W. Higley, roadmaster, has been appointed Superintendent of Track, with office at Prescott. George Tisdale, general foreman of bridges, buildings and water service, has been appointed Superintendent of Bridges, Buildings and Water Service, with office at Prescott.

Purchasing Agents.

Atchison, Topeka & Santa Fe.—F. E. Connors has been appointed Assistant General Purchasing Agent, with office at Chicago, Ill.

Beaumont, Sour Lake & Western.—See Colorado Southern, New Orleans & Pacific.

Colorado Southern, New Orleans & Pacific.—J. H. Lauderdale, Chief Clerk to the Vice-President, has been appointed General Purchasing Agent and Treasurer of this road and of the Beaumont, Sour Lake & Western.

Galveston, Harrisburg & San Antonio.—F. C. Stewart, formerly general inspector of signals of the Union Pacific, has been appointed Signal Engineer of the Galveston, Harrisburg & San Antonio and of the other lines of the Atlantic System of the Southern Pacific.

Mexican Central.—H. Putnam, Assistant to the General Manager, has been appointed Assistant Purchasing Agent, with office at Mexico City, Mex., and his former office has been abolished.

LOCOMOTIVE BUILDING.

The National Railroad of Haiti has ordered two locomotives from the Vulcan Iron Works.

The Chicago Mill & Lumber Company has ordered one American (4-4-0) type locomotive from Robert M. Burns & Co.

The Lake Superior Southern will shortly be in the market for locomotives. The order will be placed through D. E. Baxter & Co., New York.

The Spokane International has ordered six simple consolidation (2-8-0) locomotives from the Rogers Works of the American Locomotive Company. The specifications are as follows:

General Dimensions

Type of locomotive	Consolidation
Weight, total	230,000 lbs.
Weight on drivers	185,000
Diameter of drivers	57 in.
Cylinders	20 in. x 28 in.
Working steam pressure	200 lbs.

Special Equipment

Air brakes	Westinghouse

Corrigan, McKinney & Co. have ordered three simple switch-

ing (0-6-0) locomotives from the Lima Locomotive & Machine Company. The specifications are as follows:

General Dimensions.

Type of locomotive	Switching
Weight, total	124,000 lbs.
Diameter of drivers	50 in.
Cylinders	19 in. x 26 in
Boiler, type	Straight top
" working steam pressure	180 lbs.
" number of tubes	272
" material of tubes	Shelby seamless
" diameter of tubes	2 in.
" length of tubes	10 ft. 6in. over sheet
Firebox, length	96 in.
" width	34 "
" grate area	22.66 sq. ft.
Heating surface, total	1,621.51 "
Tank capacity	3,500 gals.
Coal capacity	6½ tons

Special Equipment.

Air brakes	Westinghouse
Axles	Brass Foundry & Machine Co.
Boiler lagging	Magnesia
Brake-beam	National-Hollow
Brake-shoes	Lima Locomotive & Machine Co.
Couplers	Tower
Headlights	United States
Injector	Sellers
Journal bearings	Lima Locomotive & Machine Co.
Piston rod packings	U. S. metallic
Valve rod packings	U. S. metallic
Safety valve	Crosby
Sanding devices	Lima Locomotive & Machine Co.
Sight-feed lubricators	Michigan
Springs	Pittsburg Spring & Steel Co.
Steam gages	Ashcroft
Tires	Latrobe

CAR BUILDING.

The Pittsburg & Lake Erie is reported in the market for cars.

The Baltimore & Ohio, it is reported, will soon order several thousand cars.

The Alfalfa Meal Co. has ordered five tank cars from Robert M. Burns & Co.

The National Railroad of Haiti has placed a contract with the Catawissa Car & Foundry Co.

The Coal & Coke has ordered 300 cars from the South Baltimore Steel Car & Foundry Company.

The Engle Land & Lumber Company has ordered five flat and one box cars from Robert M. Burns & Co.

The Astoria & Columbia River is in the market for three second-hand coaches and one second-hand baggage car.

The New Orleans & Northeastern has ordered 100 box cars and 125 flat cars from the American Car & Foundry Company.

The Chicago, Rock Island & Pacific has ordered 1,000 steel underframe dump cars from the American Car & Foundry Company.

The Buffalo, Rochester & Pittsburg has ordered 500 steel underframe hopper cars from the American Car & Foundry Company.

The Harriman Lines have ordered four coaches and two combination mail and baggage cars from the St. Louis Car Company.

The Lake Superior Southern will shortly be in the market for cars. The order will be placed through D. E. Baxter & Co., New York.

The Great Northern, it is reported, has ordered 500 steel hopper cars of 100,000 lbs. capacity from the American Car & Foundry Company.

The Pennsylvania, as reported in our issue of December 28, has ordered 2,500 steel underframe class XL box cars from the American Car & Foundry Company.

The Intercolonial has ordered from its own shops three motor cars similar to those used by the Great Western of England. These cars will be 65 ft. long and will seat 52 passengers.

The National Lines of Mexico have ordered 800 box cars of 80,000 lbs. capacity and 325 National dump cars of 100,000 lbs. capacity from the American Car & Foundry Company.

The Chicago Great Western has not ordered 300 box cars from the Pullman Company, as reported in our issue of December 21, but intends to build them at its South Park, Minn., shops.

The Delaware & Hudson has ordered from the American Car & Foundry Co. 1,500 steel underframe box cars, 1,500 steel underframe hopper cars, and 1,000 steel underframe flat cars with coal sides.

RAILROAD STRUCTURES.

Cincinnati, Ohio.—The Louisville & Nashville will put up a new freight house at the corner of Pike and Washington streets, to cost between $75,000 and $100,000. Work is to be begun in February.

East Pittsburg, Pa.—The Pennsylvania is planning to build a new freight house to cost $20,000.

Fremont, Neb.—The Chicago & North-Western is putting up a brick freight house and office building 40 ft. x 30 ft.; also a warehouse 40 ft. x 200 ft., at a cost of about $40,000.

London, Ont.—Negotiations are under way between the Pere Marquette and the city officials for rebuilding the Port Stanley railroad bridges.

Los Angeles, Cal.—An officer of the Los Angeles-Pacific Railroad writes that the new passenger station to be built on the site of the Masonic Temple at Fourth and Hill streets, will be built of steel, granite and reinforced concrete with terra cotta facing. It is to be 240 ft. x 330 ft., is to have a frontage of 240 ft. on Hill street and a depth of 340 ft. It is to be 11 stories high, and will cost $1,000,000. The plans provide for 1,700 office rooms, with a floor space of nearly 16 acres. Work is to started within the next few weeks.

Minneapolis, Minn.—The Chicago Great Western is making plans for a new passenger station to cost $250,000 to replace the present one.

New Westminster, B. C.—The Great Northern is planning to put up shops here.

North Bay, Ont.—Bids are wanted February 1 by H. W. Pearson, Toronto, Ont., Secretary of the Temiskaming & Northern Ontario Railway Commission, for putting up an office building.

Omaha, Neb.—The Union Pacific is planning to increase its terminal facilities in Omaha, South Omaha and Council Bluffs. Contracts have been given for a paint and wheel shop to cost $85,000 in Omaha, where the company is putting up shops covering five acres.

Portage la Prairie, Man.—The Canadian Northern has decided to build shops here.

St. Boniface, Man.—The Grand Trunk Pacific has bought a large tract of land here for $200,000 as a site for terminals and shops.

Streator, Ill.—The Santa Fe is to put up a brick eight-stall roundhouse to replace the one recently burned.

Temple, Tex.—The Missouri, Kansas & Texas is rebuilding its freight house and adding a 52-ft. extension.

Wetaskiwin, Alb.—The Canadian Pacific is planning to build a brick passenger station and freight sheds, to cost $20,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

American Railroad of Porto Rico.—An officer writes that this company during 1906 completed 14 miles of road from Isabela to Camney, and is building an extension from Ponce to Coamo, 19 miles, also from Ponce to Barancas, four miles. Address George Servajeau, Isabela, Porto Rico.

Apalachicola Northern.—This company, which last year built 20 miles of road between River Junction, Fla., and Apalachicola, has given contracts to the Morey Engineering & Construction Co., of St. Louis, for building the remaining 59 miles between these points. Grading has been completed from Apalachicola to St. Joseph's Bay, 19 miles. William A. Hunick is Chief Engineer of the Construction Company. (June 29, p. 189.)

Arkansas Valley.—See Atchison, Topeka & Santa Fe.

Astoria & Columbia River.—An officer writes that this company, which last year extended its road from Seaside, Ore., to Cartwright Park, has made surveys for an additional extension from the latter point south to Tillamook, 45 miles.

Atchison, Topeka & Santa Fe.—The Arkansas Villey has given contracts to Thomas Mishon & Co., of Pueblo, Colo., and to William C. Whitescarver, of Trinidad, Colo., for extending its road from its present terminus at Bristol, Colo., to Lays Junction, 17½ miles, and from Bent to Columbine, 41 miles.

Atlantic & Western.—An officer writes that this company has projected a line from Broadway, N. C., east to Lillington, 15 miles. H. P. Edwards, Superintendent, Sanford, N. C.

Beaumont & Saratoga Transportation Company.—An officer writes that this company, which completed eight miles of road last year in Texas, is building with its own forces a 3-mile extension from Sour Lake Junction to Pelt; also a branch from Sour Lake Junction to a connection with the Beaumont, Sour Lake & Western, three miles, and has projected a further extension from Pelt to Saratoga, 11 miles. Address J. H. Broome, Voth, Tex.

BAY SHORE RAILWAY.—See Southern Pacific.

BIRMINGHAM, COLUMBUS & ST. ANDREWS BAY. An officer writes that this company, which has built a road from Chipley, Fla., to Warsaw, 12 miles, has given contracts to Lemuel E. Miller, Philadelphia, for building from Warsaw to St. Andrews Bay, 38 miles. Surveys are also being made for an extension from the northern terminus at Chipley, Fla., to Columbus, Ga., 150 miles. W. M Gordon, President, Columbus, Ga. (See Construction Record.)

BONNERVILLE & SOUTHWESTERN. This Arkansas company has completed surveys for a 3-mile extension of its road. Address J. F. Hinckley, St. Louis, Missouri.

CACHE VALLEY.—An officer writes that this company last year built five miles of road in Arkansas, and has given contracts to the Culver Construction Company of Sedgwick, Ark., for an extension from Walnut Ridge, Ark., east to Paragould, 28 miles. The company has also projected a line from Newport, Ark., southeast to the state line, 80 miles. E. W. Culver, Sedgwick, Ark., is President. (See Construction Record.)

CALIFORNIA NORTHEASTERN.—See Southern Pacific.

CANADIAN PACIFIC.—The following semi-official statement shows the work completed on the western lines (Fort William to Vancouver) at the close of 1906:

Extensions.	Mileage.
Moose Jaw branch	0 to mile 15.0
Wolseley Reston branch	0 " " 97.5
Lauder extension	0 " " 16.0
Yahk branch	0 " " 9.5
Gimli extension	18.2 " " 57.3
Wetaskiwin branch	51.0 " " 98.5
Teulon extension	0 " " 9.5

Double Tracking between Fort William and Winnipeg.

Section	Miles Grading.	Track laid.	Turned over to operating dept.
Fort William	55.0	33.5	22.0
Ignace	42.0	24.8	28.5
Kenora	89.0	29.7	30.0

Ballasting and New Rails.

Division.	Miles Ballasted.	80 lb. rails.
Central	107	55
Western	105	104
Pacific	84	76

New Steel Bridges Built or in Course of Erection.

Division.	Style.
Central	1 200-ft. through span.
	2 70-ft. deck plate girder.
Western	1 125-ft. deck lattice span.
	3 80-ft. through lattice spans.
	1 30-ft. half deck plate girder.
Pacific	1 20-ft. half-d'k plate girder.
	1 60-ft. " " "
	2 40-ft. " " "
	1 50-ft. deck plate girder.
Pacific	1 40 ft. deck plate girder.
	4 130-ft. through lattice trusses.
	1 125-ft. through lattice truss.
	1 80-ft. deck plate girder.
	1 200-ft. through swing span
	1 20 ft. deck plate girder.
	1 30 ft. deck plate girder.
	1 60-ft. half plate girder.
	1 100-ft. through lattice span

During the year the Paliser tunnel on the Pacific division and the Maoyie tunnel on the Sirdar section were finished and put in service.

CANANEA, YAQUI RIVER & PACIFIC.—See Southern Pacific.

CENTRAL RAILWAY OF OREGON.—An officer writes that this company last year built about seven miles of road in Oregon, and has given contracts for building a line from Union, northwest to La Grande, 45 miles. A. B. Brown, Union, Ore., is Chief Engineer. (Sept. 7, p. 62.)

CHARLOTTE HARBOR & NORTHERN.—This company, which built 10 miles of road in Florida last year, is building with its own forces an extension from Gasparilla, Fla., to Peace River, 29 miles, and is making surveys for a line from Arcadia to Plant City, an additional 65 miles. Address L. Fouts, 316 Duval Building, Jacksonville, Fla.

CHESTERFIELD & LANCASTER.—An officer writes that this company, which last year built 15 miles of road to Pageland, S. C., has given contracts to E. H. Page & Son for extending the road from that place to Lynches river, an additional five miles. A. H. Page, Cheraw, S. C., is Secretary and Treasurer.

CHICAGO, ROCK ISLAND & PACIFIC.—Contracts have been given to the Dalhoff Construction Co., of Little Rock, Ark., for extending the Rock Island, Arkansas & Louisiana from Alexandria, La., to Eunice, 55 miles.

CINCINNATI & BIRMINGHAM AIR LINE.—An officer writes that this company is making surveys for a line from Paintsville, Ky., south through Tennessee to Birmingham, Ala., 400 miles. J. H. Connor, President, Nashville, Tenn.

COALINVILLE, ALTON & ST. LOUIS.—This company has projected a line from Alton, Ill., to Coalinville, 32 miles. J. M. Rhoades, Secretary, Jerseyville, Ill.

COAST LINE RAILWAY.—See Southern Pacific.

COLORADO, COLUMBUS & MEXICAN. An officer writes that this company, projected to build from Columbus, N. Mex., to Salt Lake City, Utah, about 500 miles, has finished preliminary surveys and expects to build 100 miles this year. Address A. O. Bailey, Columbus, N. Mex.

COLORADO, TEXAS & MEXICO.—An officer writes that contracts have been given by this company to the Colorado, Texas & Mexico Construction Co., of Mangum, Okla., for building its proposed road from Mangum, Okla., south to Abilene, Tex., 269 miles. Morris R. Locke, President, Mangum, Okla.

CUMBERLAND RIVER & NASHVILLE.—An officer writes that this company is making surveys for a proposed line from Corbin, Ky., to the Tennessee state line at a point southwest to Albany, Ky., 95 miles. The section from Burnside, Ky., to Monticello, has been located and is soon to be under construction. S. Woodward, Carlisle Building, Cincinnati, Ohio, is President. (See Construction Record.)

DONIPHAN, KENSETT & SEARCY.—An officer writes that this company built two miles of road last year in Arkansas, and will build an additional 4½ miles from Kensett west to Searcy. H. R. Kilpatrick, Kensett, is General Manager.

DULUTH & NORTHERN MINNESOTA. This company is building with its own forces a 4-mile extension.

DULUTH, RAINY LAKE & WINNIPEG.—Contracts have been given by this company to the Minnesota Land & Construction Co., for extending its road from milepost 50, to which point the road was extended last year, to Rainier, Minn., 35 miles.

EDDY LAKE & NORTHERN.—This company, which last year built 15 miles of road to Brown Swamp, S. C., has given contracts to R. E. Broty, for extending its line from that place to Marion, 20 miles.

FALLON RAILWAY.—See Southern Pacific.

GEORGIA, FLORIDA & ALABAMA.—Surveys are being made by this company for an extension of its road from Cuthbert, Ga., to Columbus, 63 miles.

GILA VALLEY, GLOBE & NORTHERN.—See Southern Pacific.

GRAND TRUNK PACIFIC.—The Transcontinental Railway Commission is asking for bids, which close February 14, for building five additional sections of the eastern half of the Grand Trunk Pacific as follows: From Moncton, N. B., west 50 miles; from Grand Falls, N. B., to the New Brunswick-Quebec boundary, 62 miles; from Quebec bridge east 150 miles; from a point 150 miles west of Quebec bridge west to Weymontachene, 45 miles; from a point about eight miles west of the Abibibi river east 150 miles, in all 457 miles. When these contracts are let about half the mileage between Moncton and Winnipeg will be under contract.

ILWACO RAILWAY & NAVIGATION.—See Oregon Railroad & Navigation Co.

INTER-CALIFORNIA.—See Southern Pacific.

MCCLOUD RIVER.—An officer writes that this company, on the 15th of the present month, will change the terminus of its line from Upton, Cal., to Sisson, at which point connection will be made with the Southern Pacific. The company now has a road with a total length of 79.63 miles, and is building with its own forces an additional 25 miles.

NIAGARA, ST. CATHARINES & TORONTO.—This company, which last year extended its road to Fonthill, Ont., has given a contract to Joseph Battle, of Thorold, Ont., for extending the line from Fonthill to Welland, five miles. The company is making surveys for a line from St. Catharines, Ont., to Niagara-on-the-Lake, 12 miles.

OREGON RAILROAD & NAVIGATION.—This company has under construction a line from St. Johns, Ore., to Troutdale, 20 miles, and the Ilwaco Railway & Navigation Co. is building a 3-ft. gage line from Ilwaco, Wash., to Knappton, 17 miles.

A line has been located to be built under the name of the Umatillo Central, from Pendleton, Ore., to Pilot Rock, 14 miles.

OREGON WESTERN.—See Southern Pacific.

PORTLAND TERMINAL.—This company has projected a line from Portland, Ore., to the Tualatin river, 20 miles. J. T. Burkhart, Portland, Ore., may be addressed.

PRESCOTT & NORTHWESTERN.—An officer writes that this company is making surveys for a line from the Gurdon & Fort Smith at Rosborough, four miles west of Amity, Ark., to a point near Kirby, eight miles.

ROCK ISLAND, ARKANSAS & LOUISIANA.—See Chicago, Rock Island & Pacific.

Sacramento Southern.—See Southern Pacific.

South Dakota Central.—This company, which last year built six miles of road to Rutland, S. Dak., has projected a line from Rutland to Watertown, 75 miles. J. L. Wagner, Fort Dodge, Iowa, is interested.

Southern Pacific.—An officer of the Cananea, Yaqui River & Pacific writes that this company, which built seven miles of road last year in the state of Sonora, Mex., has given a contract to the Grant Bros. Construction Co., of Los Angeles, Cal., for extending the road from Buena Vista, state of Sonora, Mex., to Tonochi, about 80 miles, and from a point 15 miles from Corral to Alamos, 68 miles.

This company has under construction work as follows:

Fallon Railway, between Hazen, Nev., and Fallon, two miles.

Coast Line Railway, between Santa Cruz, Cal., and Davenport, seven miles.

Sacramento Southern, between Sacramento, Cal., and Antioch, 50 miles.

Bay Shore Railway, between San Francisco, Cal., and San Bruno, six miles.

Oregon Western, between Drain, Ore., and Marshfield, 72 miles.

California Northeastern, between Weed, Cal., and Klamath Falls, Ore., 64 miles.

Inter-California, projected from Calexico, Cal., near international boundary, southeast through Mexico, thence northeast crossing the international boundary line near Colorado river to a connection with the Southern Pacific line near Yuma, Ariz., a total of 54 miles. About four miles in California completed last year.

The Gila Valley, Globe & Northern has given contracts to Robert Scherer & Co., of Los Angeles, Cal., for relocating 13½ miles of its line near Fort Thomas, Ariz., and 12 miles from Rice to Cutter.

Umatilla Central.—See Oregon Railroad & Navigation Co.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—See Union Pacific.

Atlantic Coast Line.—See Seaboard Air Line.

Baltimore & Ohio.—See Union Pacific.

Chateaugay & Lake Placid.—This company has been authorized to increase its 4 per cent. preferred stock from $2,000,000 to $3,000,000 to reimburse the Delaware & Hudson, which controls and leases the road, for standard gaging and other improvements made several years ago. The C. & L. P. runs from Plattsburg, N. Y., to Lake Placid, 80 miles, of which 16 miles is leased from the state of New York, and there is also $450,000 of common stock outstanding.

Chicago & North-Western.—See Union Pacific.

Chicago, Milwaukee & St. Paul.—See Union Pacific.

Chicago, Milwaukee & St. Paul.—There has been much dissatisfaction because the terms of the issue of new preferred and common stock of this company did not provide for the distribution of fractional shares to holders of odd lots of the present stock. The company has, therefore, announced that it will find out the amount of such fractional shares due to shareholders and separate them into lots of preferred and common stock and sell them at public auction. From the amount realized at the sale, the company will deduct $100 per share as being the amount due to its treasury and the balance will be distributed in cash among the fractional shareholders in proportion to their holdings of record on December 19, 1906. (Dec. 21, p. 176.)

Delaware & Hudson.—The United Traction Company of Albany, which is controlled by the Delaware & Hudson, has been given permission to increase its capital stock from $5,000,000 to $12,500,000 in order to take over the $3,000,000 outstanding stock and $6,410,000 outstanding bonds of the Hudson Valley, most of which, it is said, have already been acquired. The Hudson Valley owns 120 miles of electric road from Waterford, N. Y., north.

Erie.—The Erie has sold $1,000,000, six months, 6 per cent. notes to F. S. Moseley & Company, who are offering them at par and interest. Half of the notes are dated December 1, 1906, and half January 2, 1907. They are the last allotment of an issue which J. P. Morgan & Company took some months ago.

Great Northern.—The purposes of the new $60,000,000 issue are as follows: To provide for additional equipment, additional terminal facilities, second track, grade reduction and other improvements; to acquire the bonds or stocks, or both, of the following companies and such others as may be decided on later: The Dakota & Great Northern, a 131-mile subsidiary; the Montana & Great Northern, a 143-mile subsidiary, and the following companies which have built and are building branch lines and extensions of the Great Northern system: the Billings & Northern, the Washington & Great Northern, the Portland & Seattle, the Vancouver, Victoria & Eastern, the Brandon, Saskatchewan & Hudson's Bay and the Midland of Manitoba.

Hocking Valley.—See Kanawha & Michigan.

Hudson Valley (Electric).—See Delaware & Hudson.

Illinois Central.—See Union Pacific.

Kanawha & Michigan.—President Monsarrat, Decatur Axtell, Chairman of the Board, and G. D. Mackay, who has been elected a Director succeeding Chas. G. Hickox, have been appointed a committee to consider the question of funding outstanding equipment obligations and other debts in order that the stockholders may receive a fair proportion of net earnings pending the completion of the merger with the Hocking Valley, which has been deferred until March 1. (Aug. 10, p. 40.)

Macon, Dublin & Savannah.—See Seaboard Air Line.

Nashville, Chattanooga & Louisville.—A semi-annual dividend of 3 per cent. on the $10,000,000 outstanding capital stock has been declared, payable February 1. The annual rate was 5 per cent. in 1905 and 1906, and 4 per cent. in 1904.

New York & Portchester.—Permission has been given this company to make a mortgage for $20,000,000 and to increase the capital stock from $250,000 to $20,000,000. In giving this permission the New York State Railroad Commission announced that at no time may the aggregate outstanding bonds of this company and the New York, Westchester & Boston, which is owned by the same interests, exceed $20,000,000, nor may the aggregate outstanding stock of the two companies exceed that sum. (Nov. 23, p. 146.)

New York, New Haven & Hartford.—A bill is to be introduced in the Connecticut legislature to allow the holders of the $30,000,000 3½ per cent. convertible debenture bonds to share in stockholders' rights in future issues of the New York, New Haven & Hartford. This rule is to apply even though the debentures are not fully paid up.

New York, Westchester & Boston.—See New York & Port Chester.

Philadelphia & Western.—It is proposed to form a syndicate representing about $3,000,000 to fund all the debt of this company, which has built 11 miles of its road now under construction from Philadelphia to Parksburg, Pa., 45 miles. After the road is opened certificates of participation in the syndicate are to be exchanged for stock and bonds of the company. It is planned to make extensions of the road west to Harrisburg and to York to a connection with the Western Maryland.

Oregon Short Line.—See Union Pacific.

St. Joseph & Grand Island.—See Union Pacific.

Seaboard Air Line.—This company has bought, from the Atlantic Coast Line, the Macon, Dublin & Savannah, which owns 92 miles of road from Macon, Ga., to Vidalia, on the S. A. L. The $2,400,000 stock and $1,880,000 mortgage bonds were all owned by the Atlantic Coast Line, which company, it is said, can afford to sell the road because traffic agreements with the Central of Georgia and the Southern take its place. By getting trackage rights from Atlanta to Macon, the Seaboard Air Line can now have a short route from Atlanta to Savannah.

Union Pacific.—In the investigation being made by the Interstate Commerce Commission of the relations of the Harriman Lines with other companies, William Mahl, Comptroller of the Union Pacific, testified that the following purchases had been made by the Union Pacific and the Oregon Short Line since June 30, 1906:

		Per cent. of this issue outstanding.
Union Pacific.		
Illinois Central stock	$28,123,300	30 per cent.
St. Joseph & Grand Island, common	2,900,000	63 "
" " " " 1st pf. (about)	992,200	17 "
" " " " 2d pf.	1,250,000	36 "
Oregon Short Line.		
Atchison, Topeka & Santa Fe pf.	$10,000,000	9 per cent.
Baltimore & Ohio com.	32,334,200	21 "
Baltimore & Ohio pf.	7,260,000	12 "
Chicago, Milwaukee & St. Paul com.	3,690,000	4½ "
Chicago & North-Western com.	2,572,000	3 "
New York Central & Hudson River stock	14,285,745	8 "

United Traction Company of Albany (Electric).—See Delaware & Hudson.

Washington, Alexandria & Mt. Vernon (Electric).—An initial dividend of 1 per cent. has been declared on the $1,500,000 capital stock of this company, which owns 25 miles of electric road in and near Washington, D. C. The above stock was issued in March, 1905.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns OUR OWN opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Excess Cash Fares 63
- The New "Stock Period" 63
- A Training School for Railroad Officers.. 64
- Car Shortage and Industrial Tracks..... 64
- Siberian Railroad Traffic During the War 65
- Responsibility for Trolley Inflation..... 65
- New Publications 66

ILLUSTRATIONS:
- Four-cylinder Compound Locomotive: Austrian State Railways..... 69
- Tests of Bond between Concrete and Steel 70
- Private Car for the Canadian Pacific 72
- The New Union Station at Lexington, Ky. 75
- New Cincinnati Freight Terminal of the C., N. O. & T. P. 76
- The Tonopah & Tidewater Railroad..... 78
- Automatic Block Signals on the B. & O.. 80
- Panama—the Railroad and the Canal... 82

CONTRIBUTIONS:
- Causes of Accidents. 66
- Steam Versus Electric Locomotives 66

MISCELLANEOUS:
- The Interstate Commerce Act as Amended 66
- Engine Failures and Their Report 68
- Plan to Relieve Car Shortage and Congestion 73
- Railroad Refrigeration 74
- Government Investigation of the Terra Cotta Collision 76
- Progress of Electrification in 1906..... 79
- Washington Correspondence 80
- Railway Signal Association 81
- Conduct of Business on the Penn. R. R.. 85
- Mr. Hill on the Railroad Situation..... 86
- Traffic Through the Soo Canal 86
- Enginemen Apprentices in Germany (Note) 85

GENERAL NEWS SECTION:
- Notes 87
- Trade Catalogues 89
- Obituary 90
- Meetings and Announcements 90
- Elections and Appointments 90
- Locomotive Building 92
- Car Building 92
- Railroad Structures 93
- Railroad Construction 93
- Railroad Corporation News 95

VOL. XLII., No. 3. FRIDAY, JANUARY 18, 1907.

A decision was not long ago announced by the Attorney-General of Ohio to the effect that the collection of excess fares from passengers who, having failed to buy transportation at the ticket office, pay their fares in money on the train, is illegal; and this whether or not a refund check is given in return for the extra amount collected. We confess that this does not seem to us a wise ruling even if it can be justified under existing laws; yet while the practice of charging an extra amount in such cases without giving a refund causes irritation far out of proportion to the extra earnings from this source, the endeavor to make it inconvenient for the passenger who fails to buy his ticket before getting on the train to travel as cheaply as he would if he had bought his passage at the ticket window, seems in no way an arbitrary exercise of corporate power. The importance to railroad companies of having the money equivalent for transportation turned in at the ticket office rather than to the conductor is not small. It not only simplifies the work of the accounting department but takes away most of the opportunity for stealing by conductors. When a receipt which is of no value is given to a passenger he frequently pays no attention to it, where in case it were redeemable for even five cents he expects to receive it in return for his higher cash fare, thus forming a more complete check on the conductor's honesty than the valueless receipt. This consideration, however, is from the standpoint of the railroads, and would probably not appeal to the Attorney-General. On the other side, and directly affecting the comfort of travelers, is the possibility that as a result of such a decision, railroad companies may put in force the obnoxious system of requiring examination of tickets by a doorman at all stations. This system always causes a great deal of irritation to the traveling public, particularly in the case which so often happens where friends are not allowed to accompany passengers to the train. It is worth noticing that at all stations along the line on the road with the largest proportionate passenger receipts in the country, station platforms are open to everyone, the whole responsibility for the collection of tickets being thrown on the train conductor, where it finally belongs in any case. In short, at all except the largest terminal stations, freedom of access to station platforms seems clearly the better system. The other probably prevents some unauthorized persons from getting on trains and some heedless or inexperienced travelers from taking wrong trains as they otherwise would do, but these small advantages are by no means compensated for by the annoyances caused to travelers under the locked door policy. Like so many other details of the dealings between the railroads and the public it may be hard to reckon in dollars and cents the advantages to be gained by the open-handed method, to set off against the possibilities of loss through free rides and accidents to passengers on station platforms, but the experience of the New York, New Haven & Hartford, probably the most complete territorial monopoly in the country, would seem to show that it pays to take risks of loss which are really small in proportion to the advantage of gaining good will on the part of the public.

From time to time during the past two or three years we have had occasion to show how the railroads of the country were passing through a "bond period" reaching through several years—that is to say, a period when new issues of bonds were not only large absolutely, but greatly exceeded new issues of stock. This would have been true probably even though bonds convertible into stock had been subtracted. But the records of the present year when fully made up are likely to show a remarkable change, not only for its abruptness, but for the amount of the new stock issues. The 1906 authorizations of the New York Central, the St. Paul, the Great Northern, and the Northern Pacific alone, taken together, mount up to $405,000,000, and stock or convertible bonds have been poured out by other railroad corporations in a flood. A bond period thus seems passing swiftly into a stock period. If analyzed fairly the change does not seem to be due to any particular change in the mental attitude of railroad financiers as to the fundamental merits of stocking as compared with bonding, and a contingent dividend charge as compared with a fixed and invariable interest charge. Views of railroad managers on that point have varied and a good deal has depended on the special railroad case. The change has rather been due (1) to prosperity and net earnings, which, in most cases, not only have justified "rights" as an indirect dividend for shareholders, but made the shareholders expect them, and (2) the low borrowing potentiality of the railroad bond, even of the first class, and the inability of an overloaded market to "digest" new bond issues which would force prices still lower. Moreover, the fiscal managers of a big dividend-paying railroad corporation know that new issues of a stock which has stood well above par will be taken up, while there are apt to be grave uncertainties as to under-

writing on actual sale of new bonds. The interesting question is how long this new "stock period" is to continue. Is it transitory and resting measurably upon the effects of a high money rate, or is it, for two or three years at least, to be normal? If it proves normal with a great increase of the total dividend charge of American railroads, then the far look ahead suggests yet another interesting period, and, perhaps, a long one, during which mutations of railroad prosperity make dividend rates variable and the financial pendulum swings back to bonds.

A TRAINING SCHOOL FOR RAILROAD OFFICERS.

Altoona has been called the railroad university of North America, and with large justice. Not only is it the largest distinctively railroad town on any railroad system in the world, but it is the center of a system of railroad education more advanced and more successful than any other. These facts are, of course, familiar to readers of the *Railroad Gazette*, but it is worth while again to call attention to them, because the system of training there in force is unique in its workings and is an example which should, before this, have been more closely followed by other important roads.

As one of its tremendous classrooms, this railroad university has the largest freight yard in the world, seven miles long and with 221 miles of track. The central receiving point for the thick network of coal mine branches and feeders of the Pennsylvania, Altoona receives an immense tonnage of coal which is there redistributed for eastern points. It is also the headquarters of the Pennsylvania Railroad grand division of the Pennsylvania Lines East and one of the vital operating points for through traffic from the West. An idea of the importance of Altoona as a divisional point can be gained from the fact that the average freight movement through the Altoona yards is about 6,000 cars a day and 2,000,000 cars a year. To handle this traffic requires a force of 25 yardmasters and assistant yardmasters. The yards are operated on the hump system, and the despatch with which trains are broken up and redistributed into other trains, is one of the most remarkable examples of successful American railroading. The greatest railroad shops in the world with a total floor area of 50 acres are another gigantic classroom, an example of the highest types of American railroad shop practice. In all departments, including offices, shops and yards, the Pennsylvania employs at Altoona 15,000 men, who, with their families, make up most of the population of the place.

In this great center of railroad activity, college graduates come to take a post graduate course in railroading as special apprentices. This covers four years work in the shops, during which time a man is given practical experience in all the different shops as well as in shop accounting, drafting and testing. At the end of four years the special apprentice becomes a motive power inspector and works up through the position of shop foreman or assistant master mechanic to the rank of master mechanic. The motive power department at Altoona, including all shops, is in charge of the general superintendent of the Pennsylvania Railroad grand division, who, in managing the shops and in direct charge, is assisted by one of the four superintendents of motive power on the Lines East, who has his headquarters at Altoona. The superintendent of motive power occupies on the staff of the general superintendent a corresponding position for the motive power department that the one of the four principal assistant engineers who has his headquarters at Altoona does for the maintenance of way department. Altoona is also the headquarters of the general superintendent of motive power of the Lines East who, however, is not directly in charge of the Altoona shops, but only in an advisory capacity.

Under the principal assistant engineer are gathered, from all parts of the lines, young civil engineers eligible for promotion to the position of assistant supervisor. These are men who have entered the service of the company either in the construction department or in the offices of the superintendents. As they show fitness for advancement they are sent to Altoona where they become acquainted with the general routine of maintenance of way work and with Pennsylvania methods of operation. From assistant supervisors they become supervisors, assistant engineers and superintendents. The results of the Altoona system of training are shown in the fact that most of the motive power and operating officers on the lines east of Pittsburg received their training at Altoona.

There is one respect in which this system of training for railroad work put in force by the Pennsylvania is particularly worthy of imitation by other railroads. Most other roads which have experimented with this or similar systems have limited their efforts to planning a course of work which will give the necessary experience in one department or another, leaving the young apprentice to shift for himself after working hours. The Pennsylvania has made a point of looking out for the play-time as well as the work-time of its young men in training in both the motive power and maintenance of way departments. Altoona at best is not a garden spot. In summer, particularly, it is hot and disagreeable. Therefore, with the same care that would be used in building a new round house or car shop, the railroad officers have looked after the lighter side of life. They took hold of the Altoona Cricket Club, which had been in existence for many years, and turned it into a club for the officers, the special apprentices, and the rodmen, transitmen and other employees of the maintenance of way department. Altoona itself is on the crest of the Alleghenies and the club is on a high hill that lies far above the valley where the railroad tracks are. Golf links, tennis courts and indoor games, all the appointments of a well regulated country club, are provided, and at a nominal fee. The club is managed and supported by the company and proves a highly profitable investment, not in cash dividends, but in the better ability of men during working hours. In particular by the younger men this feature of the life of Altoona is appreciated, for there is no time when conditions of work usually bear harder than in the first few years. This side of the life at Altoona is an added reason why the place can be compared to a university, for the principle of "all work and no play makes Jack a dull boy," is in both places applied, and at Altoona, surely, with notable success.

CAR SHORTAGE AND INDUSTRIAL TRACKS

The letter of Mr. Russell Harding to the Interstate Commerce Commission, printed elsewhere, in which the writer states his belief as to the chief cause of the present car shortage and congestion of traffic, with a suggested method for determining the extent of this cause, coming as it does from so high an authority, merits most thoughtful consideration. Numbers of high railroad officers, in commenting on the conditions of the past year and the outlook for the coming year, have expressed themselves strongly regarding the relief that would be afforded to the railroads should shippers and consignees provide suitable and adequate facilities for forwarding, receiving and storing goods. President Harahan, of the Illinois Central, for example, pointed out that if such improvements were made as would reduce the time cars were so held only one hour a day on the average, it would mean for his road alone 62,000 hours more of car service each day. Applying this to all of the roads, and for a year's time, and the potential increase in equipment from this source alone—slight as it is in its elements—becomes enormous. Mr. Harding says that despite the tremendous increase in volume of business in the past eight years there has been practically no increase in industrial tracks—meaning, doubtless, no *relative* increase, for of course there has been actual increase, the number of industrial concerns being much greater; and for this reason, he says, fully 90 per cent. of all of the cars that are held in the yards of railroads in the large business centers are for these concerns it being impossible to make prompt delivery because of the lack of industrial and team-track room. The plan which he suggests for verifying the truth of his claims not only would depict actual conditions in the matter of holding tracks and yards of the railroads, and of industrial tracks not owned by the railroads, at the beginning and end of the period over which he makes comparison—1898 to 1906 inclusive—but would form a valuable record of a sort not heretofore existing, and on which action looking to a betterment of these conditions could be intelligently based.

The question raised in the last paragraph of the letter, as to which of the interests should rightly assume the burden of correcting the fault, is novel in the suggestion that it might not be an unfair claim that the railroads should supply the tracks if the industries furnish the rights of way. However this point might be decided, it certainly would be greatly to the interest of all parties concerned to co-operate on the most friendly and unselfish basis in order to secure the facilities so badly needed. Considering the seriousness of the situation, and since a general and permanent improvement of the conditions in question means such a vast potential increase in yard room and in equipment, and failure to better them means the further immediate expenditure of large sums for additional yards, tracks and equipment, would it not be a wise and most profitable procedure on the part of the railroads to inaugurate an active and systematic campaign to induce all industries and business houses on their lines which lack adequate receiving, storage

and despatching facilities, to provide same, the railroads to co-operate to whatever extent their best interests dictate? If generally successful, such a plan would certainly be the cheapest way out of present difficulties and would afford a degree of relief obtainable in no other way.

SIBERIAN RAILROAD TRAFFIC DURING THE WAR.

The Russian official journal has recently published statistics of the traffic of the Siberian Railroad during the Japanese war, concerning which nothing definite had been published heretofore. The railroad had been opened through to the Pacific at Dalny but a short time before the war broke out, and so was only beginning to have a through traffic, which, of course, was then entirely interrupted. It had had, however, an important immigration traffic, and on the western divisions a very considerable grain and dairy traffic.

The whole number of passengers in the three years ending with 1905 were:

	1903.	1904.	1905.
Passengers: First-class	7,000	5,900	4,300
Second-class	62,300	70,100	74,900
Third-class	409,400	448,400	471,000
Fourth-class	455,300	240,500	172,300
Immigrants	142,600	33,300	30,100
Stock attendants	2,300	2,200	1,800
Soldiers—1st, 2d and 3d class	101,700	939,100	1,077,400
Prisoners and their guards	100,100	18,200	13,100
Total	1,280,900	1,757,800	1,846,300

Thus the total number of passengers increased 37 per cent. from 1903 to 1904, and 5 per cent. from 1904 to 1905; but subtracting the military travel, the number of other passengers decreased from 1,180,800 in 1903 to 818,700 in 1904 (30 per cent.) and to 768,400 (7 per cent.) in 1905. The through travel, largely first-class, but always very small, came to an end with the war. Even in 1903 there had been only 19 first-class passengers per day on this line of 4,000 miles. The second and third-class passengers continued to increase, there being a movement of army attendants and surveyors largely exceeding what otherwise would have traveled west of Lake Baikal; but the fourth-class travel fell off 47 per cent. from 1903 to 1904 and 28 per cent. from 1904 to 1905. This travel is chiefly of laborers going from one place where work is to be had to another; in European Russia, chiefly men employed in harvesting, who move north as the crops ripen. Men of this class in Siberia, if able-bodied, belong almost wholly to the army reserves, and the Siberian army reserve was all mobilized during the war. The reduction in the movement of prisoners, which seems frightfully large in 1903, was due largely to the cessation of banishment to the island of Saghalien, opposite the mouth of the Amoor.

The movement of troops naturally is the great feature of this period. No less than 939,000 soldiers were carried in 1904, and 1,178,000 in 1905. It must not be supposed that so great a number of different persons were carried. Aside from transfers from one place to another in Siberia, there is always a large movement from any army back toward the home of the soldiers, and in 1905 the larger movement must have been in carrying the bulk of the army back from Manchuria to Russia, which was chiefly, but not wholly, effected in that year. The movement of freight in this period increased greatly in most of the items which are reported, but these do not enable us to distinguish between what we may call the normal freight of the country and that due to the war. Of that carried by freight trains, the quantities, in tons, average as follows:

	Tons		
	1903.	1904.	1905.
Military freight	4,982	106,179	583,470
Private freight	1,182,581	1,242,270	1,452,740
Service freight	1,751,808	1,988,280	2,593,143

It is probable that in the aggregate the whole of the increase in what is here called "private freight" was due to the shipments of stores to be sold to the army; but the most notable fact in the statement is that the "service freight"—the supplies carried for the use of the railroad itself—exceed in amount the military and paying civil freight put together. Coal alone must have formed a very large part of this service freight, but other very large portions were due to material used in constructions to increase the capacity of the railroad. When the war broke out the railroad through to the mountains around the south end of Lake Baikal was not nearly completed; stations east of the lake were something like 30 miles apart, and the maximum capacity of the line was the movement of 10 trains each way daily. The construction of sidings and passing tracks had progressed so far that, by the end of 1904, 16 trains could pass each way daily, and by November, 1905, 20 trains daily. The requirements of the army made it necessary to limit strictly all shipments of freight which did not conduce to its support. The statistics given show an increase in grain and flour shipments of 22½ per cent. from 1903 to 1904, and a further increase of 8 per cent. the next year. Of course the movement of flour and forage eastward for the supply of the army must have been great. Coal shipments were more than twice as great in 1904 as in 1903, and there was a further increase (37 per cent.) in 1905, when, however, the total coal shipments were only 288,227 tons.

Eloquent testimony as to the interruption of the growth of Siberia is given by the reduction of immigrants' freight from 7,200 tons in 1903 to 212 tons in 1904 and 59 tons in 1905.

RESPONSIBILITY FOR TROLLEY INFLATION.

The public agitation which has sprung up in several states notably New York, New Hampshire and Connecticut, over defects of the state railroad commissions, is commendable and cheering in itself. But the cynical guide must be pardoned when one reflects how long this reformative energy has had to wait, how often warnings have been uttered and exposures made by the so-called "technical" writers but without effect on either the public or the newspapers, and how the sins of omission and commission have gone on until now not a few of them are too late to rectify. These reflections, in the nature of afterthoughts, apply peculiarly to the state of Connecticut where just now there is a sudden and volcanic outburst against stock watering of the street railways. The immediate text is the disclosure of the huge volume of water transmuted into dividend paying stock by the recent absorption of the Connecticut Railway & Lighting Company. The exposure is far from new. But it happens to be accented by a big deal carrying figures of sensational magnitude. Hence the spectacle of Connecticut newspapers which have been silent on the topic for 15 years, now denouncing trolley inflation and the state railroad commission which countenanced it, in scare headlines and double-leaded editorial type. This process of closing the doors after the escape of the animals has its elements of diversion; but, more seriously, it has some historical hints on trolley inflation in Connecticut which are not the less instructive because typical of other commonwealths.

The first trolley wave struck Connecticut in the year 1888, though as a mild surge; a dead-locked legislature two years later created a law-making *hiatus* of four years during which no statutory business of any kind was done. It blocked and in a sense dammed up trolley projects until 1892, when they burst on the legislature in a flood. The state was thus measurably the victim of somewhat exceptional conditions. The trolley craze grew to wildfire. Cities and suburbs, farms and the backwoods hailed the new motive force as a mighty local and economic helper. The steam companies at first resisted electric parallels successfully, later in vain. Fiscal aspects and ratios of capitalization were ignored and the state railroad commission continued to be the voluntary cipher that it had been before. Outside capital quick to see the profits of course rushed in, constructing street railways by bonds—often marketed below par—and "bonusing" the stock. It was a veritable trolley saturnalia that lasted almost a decade, during which new charters—if not paralleling steam lines—could be had for the asking, and the first speculators in old horse railroad territory got rich quick.

Now too late has come the disillusion. The economic mill, even in so exceptional a thing as the rise of electric street railways, grinds slow but it grinds sure and fine. Connecticut has awakened to a solid economic condition as contrasted with rash and thoughtless enthusiasm. The situation has been forced further by the threatened development of long distance electric rivalry. This has compelled the steam interests to buy up the dropsical trolley systems one by one until they are now unified under one control, similar conditions existing in Rhode Island and lower Massachusetts. Water original, secondary and in some cases tertiary, is solidified into shares that carry their fixed charge on the purchaser, and, next, on the public. Honest capitalization that might in many cases have connoted a three cent fare has become diluted capital exacting a five cent fare. And who is to blame? Obviously the Connecticut citizen who blinded himself both to existing facts and to easy forecast; next a legislature equally negligent but in which the current of intelligence could hardly be expected to rise above its source; and last, and, on the whole worst, a railroad commission supple, languid and inefficient always, only just now more vividly exposed as such. In other words, all three of the civic elements charged with the prevention of a public evil were inert when they should have been active.

Where is the redress? Plainly nowhere as regards the past. Connecticut wakes up too late. She has forced her steam interests to self-protection, she has legalized under the signet of her own state officers securities bought by innocent investors, by trustees and savings banks, and she stands committed to a condition which she has herself created and for which she must endure the logical penalty. She has, however, one or two minor offsets. For example, she will gain some tens of thousands in dollars by taxation based on watered stocks enhanced in market value by the new merger, and she probably has a few operated trolley lines that would be non-existent had speculative street railway building been at lower terms. For the rest she must "take it out" of a railroad commission made up of two politicians and an antique engineer now in his eighth decade. In the attacks now centering on that body in the Connecticut press one can find retributive justice and a measurable promise of future betterment. As to the general lesson its teachings reach far beyond the bounds of a small New England state which is far from unique in its experience of initial error and belated repentance.

NEW PUBLICATIONS.

The Crisis at Panama. By Lindon W. Bates. New York: Lindon W. Bates. 8½ in. x 11¼ in.: 57 pages; five illustrations.

In this interesting pamphlet the author calls attention to the experience of the French at Panama as it applies to the present plans for the canal. He points out that so far the Americans have gone ahead, particularly in the matter of labor, through exactly the same phases as their predecessors. Mr. Bates criticizes the estimates made of the time necessary for the completion of the canal and of the work necessary for the various locks. His own plan is to build but two locks, raising the water level to such a height as to create artificial lakes in the present most unhealthy regions.

Proceedings of the Fourteenth Annual Convention of the National Railroad Blacksmiths' Association. Edited by A. L. Woodworth, Lima, Ohio. 6 in. x 9 in.; 203 pages; 9 illustrations. Cloth.

A number of the papers included in this volume of proceedings have already been published in abstract in the *Railroad Gazette*. The complete list of the subjects discussed is as follows: Frogs and Crossings; Formulæ for Rings; Flue Welding; Classification of Work in Shop; Tools and Formers for Bulldozers; Discipline; Best Method of Annealing High-Speed Steel, Also of Tempering Same; Case Hardening; Best Coal for Use in Smith Shop and Kind of Fires Used; Piece Work; Making of Locomotive Frames; Thermite; Furnaces; Proper Material for and Best Methods of Making Side Rods, Crank Pins and Motion Work in General; Designs of Furnaces and Economy in Fuel; Flue Welding; The Foreman and His Shop; Springs; The Apprenticeship System and the Utilization of Scrap Material. These subjects are usually treated quite briefly and the discussion upon them is equally brief. It is a practical presentation of a topic that frequently contains new ideas worthy of consideration and imitation, but which sometimes, also, is merely a recapitulation of current and established practice without suggestions for a betterment. The papers, as a whole, are, however, marked by an intensely practical consideration of the subject in hand.

CONTRIBUTIONS

Causes of Accidents.

New York, Dec. 31, 1906.

To the Editor of the Railroad Gazette:

There has been a great deal said and written lately regarding accidents on railroads and very little publicity has been given to the real cause of these accidents. An analysis of the causes of wrecks on a certain portion of a certain railroad for a year showed that, out of an approximately one thousand accidents, involving the interruption of traffic, about 48 per cent. were due to defective operation, 36 per cent. to defective equipment, and the remaining 16 per cent. to defective track. The statement attached gives the details.

The remedy for the first is certainly more rigid discipline and larger expenditures for supervision. The remedy for the second is a more intelligent expenditure for repairs to running gear and draft gear. The quality of the inspection given to freight equipment as ordinarily witnessed is apparently very inferior, and it would seem that greater attention, with possibly greater expenditures, to the repairs of cars would result in fewer interruptions to traffic.

As to the safety of a car, the word of a $45 car inspector, who landed from Poland three weeks ago, is often accepted in preference to the opinion of the conductor who has been in the service for many years. Hundreds of times, long, heavy freights have been delayed and train service demoralized because of the draft timber pulling out, which might have been avoided by the application of 10 cents' worth of bolts and 7 cents' worth of labor. A stitch in time saves nine. The remedy for the defective track is more intelligent supervision and insistence upon improved conditions. The occasions of spread track were all on side tracks, seldom used, and most of the other derailments due to defective track were on side tracks or yard tracks. I have no doubt that, if all accidents were analyzed in this way, in detail, it would give to the supervising officer most valuable information as to the lines on which to look for improvements in the service. L.

Summary of Analysis of Wrecks.

Defective Operation.		Application of brakes	5
Collision	48	Something dragging	14
Sidewipe	48	Miscellaneous	110
Break in two	30		—344
Disregard signals	22	*Defective Track.*	
Disregard orders	0	Broken rail	19
No flag out	1	Spread track	17
Misplaced switch	68	Switch	14
Run through switch	125	Frog	2
Misplaced lading	9	Guard rail	1
Miscellaneous	110	Stub switch	7
	—461	Crossing plank	0
Defective Equipment.		Obstruction	44
Dragging brake-beams	38	Hand-car struck	6
Burst air hose	13	Bad flagging	0
Broken truck	76	Miscellaneous	13
" draft rigging	17		—123
" wheels	52	Unknown	41
" axles	14		——
Burnt journals	5	Grand total	969

Steam Versus Electric Locomotives.

New York, Nov. 27, 1906.

To the Editor of the Railroad Gazette:

Referring to the article by Mr. Joseph Mayer in your issue of November 16th it would appear that the author has based his calculations of the horse-power developed by the locomotive upon the resistance per ton upon the level, as he has made no allowance for grades which form the most important part of the train resistance. Allowance is not made either for fuel consumed during stops or for acceleration. As such important matters are neglected in so well-known a matter as the locomotive, what confidence can be placed in the balance of the article, which deals with less known matters and are consecutively based upon one assumption or another? Is it not preferable to depend upon statements derived from actual working, as given by Mr. J. A. F. Aspinall and quoted in your issue of October 12th, where he distinctly says: "The cost per ton-mile for coal, for instance, is greater"? Roger Atkinson.

The Interstate Commerce Act as Amended.

By Frank Haigh Dixon.*

The new law widens materially the scope of the Commission's authority, and includes agencies of transportation that have heretofore been free from governmental control. The term "common carrier," as used in the act, now includes express companies, sleeping-car companies, and persons or corporations engaged in the transportation by pipe-lines of oil or other commodity except water or gas. Express companies have long been held to be common carriers in law, but they have been exempt heretofore from any attempt at control. In the first year of its existence the Commission decided that the original Interstate Commerce law was not sufficiently clear to warrant it in taking jurisdiction of any such companies except those conducted by the railroads as a part of their business. Consequently, it declined to exercise any authority over express companies at all. As a result, express companies have published no rates or traffic statistics and no financial reports. So far has this policy of secrecy been carried that, in the case of one company, it has recently caused a revolt among minority stockholders.

The act extends the meaning of the word "railroad" to include switches, spurs, tracks and terminal facilities of every kind, and all freight depots, yards and grounds. "Transportation," which, in its indefinite form under the old law, included "all instrumentalities of shipment or carriage," now includes cars and all other vehicles, and all instrumentalities of shipment or carriage irrespective of ownership or contract, and all services in connection with the receipt, delivery, elevation, transfer, ventilation, refrigeration, storage and handling of property transported. Every carrier is obliged to provide such facilities upon reasonable request, and to establish reasonable rates applicable thereto.

Rebates and Discriminations.—The Elkins Act of 1903 has doubtless done away with many of the common forms of rebating. Yet the Commission in its last published report, that for 1905, finds itself compelled to admit that the giving of rebates has been resumed. New and elaborate devices have been employed on a large scale for the purpose of evading the statute. Among these the most important are the private car and the industrial railroad. The practical monopolization of refrigerator equipment by one corporation,

*Abstract of a paper in the *Quarterly Journal of Economics.*

and the identity of car-owner and shipper, are responsible for the evils, and the testimony given before the Senate Committee which held hearings in the spring of 1905 is filled with allegations of exorbitant rates for refrigeration, icing and special forms of packing, and with the difficulties that shippers encounter in the settlement of damage claims because of the divided responsibility of railroad and car-owner. The new law gives the Commission authority over all services performed by private-car lines, and expressly requires the publication separately of all terminal, storage and icing charges, or those for any other facilities or privileges granted. The complaint of divided responsibility between railroad and car-owner has been met by holding the railroad responsible for the provision of such special equipment upon reasonable request.

The terminal railroad, variously known as the "tap-line," or industrial railroad, has been, in the judgment of the Commission, one of the most dangerous and effective means of evading the law. Such a road built by an industry to connect with a main line, instead of securing from the road to which it delivers its freight merely a reasonable switching charge, obtains an undue proportion of a through rate which amounts to a rebate. The new law extends the jurisdiction of the Commission over such connecting lines, and gives it power to determine a proper switching charge or a proper proportion of a through rate. At the same time a railroad is required, on application of a branch line or shipper, to build and operate on reasonable terms a switch connection, where such connection is reasonably practicable and where business warrants it, and to furnish without discrimination cars for the movement of traffic.

Another serious and elusive form of discrimination has been practised with special success by the coal roads. By virtue of being owners of coal mines and transporters of their own product, as well as that of independent operators, they have been enabled so to manipulate their books that it has been impossible for either the Commission or the courts to decide whether the advantage which they enjoyed over independent shippers should be regarded as a discrimination granted to themselves as carriers or a loss suffered by them as producers. The extraordinary situation revealed in the affairs of the Pennsylvania Railroad by the investigation of the Interstate Commerce Commission while the rate bill was under discussion in the Senate, combined with the sentiment fostered by long-continued troubles in the coal fields, resulted in the incorporation of a radical clause, which provides that after May 1, 1908, no railroad will be allowed to transport in interstate commerce any commodity, other than timber or its manufactured products, produced by it or under its authority, or which it may own in whole or in part, or in which it may have any interest direct or indirect, except such as may be necessary and is intended for its use as a common carrier.* Inasmuch as the term "railroad" includes switches, spurs, terminal facilities and yards, it will compel all owners of terminal elevators and of businesses connected by taplines to give up one business or the other. A railroad can now be engaged in no other business than that of transportation. Of course, most of the terminal facilities are intrastate in their ownership, but the jurisdiction of the Commission will extend to all their interstate shipments. That the financial problem involved in this clause was appreciated is shown by the fact that nearly two years are to elapse before it becomes effective.

The Act of 1887 contained no *express* prohibition of the granting of passes. The new law leaves no doubt as to its intention in this matter. Common carriers are forbidden to give directly or indirectly, and persons are forbidden to use, any interstate free ticket or pass. Two general classes of exceptions are made. The first includes railroad employees and their families, officials, railroad surgeons and attorneys, and employees of agencies associated with the railroad business, such as those of the sleeping-car, express, telegraph, postoffice, customs and immigration service, caretakers of live stock, and newsboys and baggagemen on trains. The second class comprises the poor and unfortunate classes and those engaged in religious and charitable work.

The Elkins Act of 1903 has been strengthened by making both giver and receiver of a rebate liable to imprisonment as well as fine, and by compelling the recipient of the favor, in addition to these penalties, to forfeit three times the value of the consideration received. It is perfectly obvious that a vigorous enforcement of the imprisonment penalty would dispose of the rebate question once for all. Whether we have reached the point in our criminal procedure when we have the courage to put our financiers and our railroad presidents behind the bars for an offence of this character is another question.

Rates.—The question of conferring specifically upon the Commission the rate-making power has been the topic about which all discussion concerning the amendment of the Interstate Commerce law has centered. It was the main suggestion of President Roosevelt in his presentation of the subject in the messages of 1904 and 1905. It was the topic of greatest interest and most general discussion in the hearings before the Senate Committee. It formed the main theme of the speeches in both Houses of Congress. Such a power is designed to reach the published rates, not secret rates, which are covered by the sections forbidding rebates and discriminations. Excessive rates, those unreasonable in and of themselves, if they exist at all, are of comparatively small importance, but relatively unreasonable rates have been the subject of long-continued and bitter complaint. A shipper is not so much interested in the rate he pays as he is in seeing to it that his competitor pays the same rate. The Supreme Court's decision that the Commission could not prescribe a rate for the future left to the shipper merely the privilege of suing for excessive charges when a rate had been held by the Commission to be unreasonable. This the individual shipper usually failed to do, the amount in controversy in any individual case being usually too small to warrant it. Moreover, the one who paid the freight rate was frequently a middleman, and the individual who actually suffered from the excessive rate, the consumer or the producer, had no standing in court and could not recover. The only adequate relief from such a situation was to clothe the Commission with power to prevent such occurrences in the future. The rate section of the amended act provides that the Commission shall have power, on complaint, whenever the rates or charges or any regulations or practices are unjust or unreasonable, to prescribe, after full hearing, the reasonable regulation or the maximum rate, and to make an order that the carrier shall cease from violation of the statute. All orders except those for the payment of money are to go into effect in not less than 30 days, and to remain in effect for not more than two years, unless suspended, modified or set aside by the Commission or suspended or set aside by a court of competent jurisdiction. Express jurisdiction is conferred on the Circuit Courts in suits to enjoin, set aside or suspend orders of the Commission. It required, however, that no injunction or interlocutory degree, suspending the order of the Commission, should be granted except after not less than five days' notice to the Commission.

Under the old law the Commission had no power to compel the making of a joint rate, and the railroads could nullify any order of the Commission which declared any such rate unreasonable by refusing to agree upon divisions of the through rate. The Commission is now given power, after hearing, to establish maximum joint rates, to prescribe their division among the carriers concerned, and to establish through routes and the terms and conditions under which they shall be operated whenever the carriers have refused or neglected to do so voluntarily. This provision also applies when one of the connecting carriers is a water line. The old law, in the case of both local and joint rates, required a 10 days' notice of any advance and a three days' notice of any reduction. By various devices, the most objectionable of which was the so-called "midnight tariff," which gave favored shippers advance information of a contemplated reduction of rate, and immediately restored the old rate when these shippers had profited by it, the provisions of the section were rendered of little value to the public. Under the new law, schedules of both local and joint rates must be filed with the Commission and publicly posted, and, where no joint rates have been established, each carrier must file the rates applied to through transportation. The schedules must also state separately all terminal, storage and icing charges, and all privileges and regulations which in any way affect the service rendered. Thirty days' notice is required of any change in these rates unless the Commission for good cause modifies the requirement.

Accounting.—The importance of the section of the act relating to annual reports has been little appreciated. The new section grants to the Commission all that the most ardent advocate of publicity of accounting could desire. It requires that annual reports shall be made out under oath, and imposes penalties for failure to file them with the Commission within the prescribed time. It empowers the Commission to call for monthly or special reports. It gives the Commission authority, in its discretion, to prescribe the bookkeeping methods of the carriers, gives it access at all times to the books of the railroads, and authorizes it to employ special examiners for the purpose. Fine or imprisonment, or both, are imposed upon persons who wilfully falsify or mutilate records or neglect to make the proper entries, and jurisdiction is given to the United States courts to issue writs of mandamus in the enforcement of the provisions of the section.

Among the minor changes may be noticed the so-called Carmack amendment, which provides that carriers receiving interstate shipments must issue a through receipt of bill of lading therefor, and become liable for the shipment, no matter on what road the loss or damage occurs; but the initial carrier is entitled to recover from the carrier on whose line the loss takes place. The Commission is enlarged from five to seven members, only four of whom shall be of the same political party. Their term of office is extended from six to seven years, and their salary is increased from $7,500 to $10,000 per year. These changes mean an increase in the dignity and influence of the Commission.

*The decision of the Supreme Court on Feb. 19, 1906, in the case of the Chesapeake & Ohio Railway (see Railroad Gazette, Feb. 23 and March 2, 1906), probably had much influence in the enactment of this clause.

The omission which will be most keenly felt in the enforcement of the new statute concerns the relation of long and short haul rates. Section 4 of the old act, which made it unlawful for a carrier to charge any greater compensation in the aggregate for transportation under substantially similar circumstances and conditions for a shorter than for a longer distance over the same line in the same direction, the shorter being included in the longer distance, robbed of all its vitality by Supreme Court decision,[1] stands unamended. It is evident that a large breeding place of discrimination and undue preference has been left undisturbed, and that the arbitrary basing point system of the southern roads may continue its existence unmolested.

There are two other regrettable omissions in the statute. The one is the failure to bring under the jurisdiction of the Commission carriers engaged in inland transportation by water.[2] Of more importance is the failure to repeal Section 5 of the old law which prohibits pooling. Such a result was hardly to be hoped for in the present temper of public opinion, and in view of the fact that rates have been advanced since the era of railroad consolidation. But it is the widespread conviction of students of the problem that the pooling of traffic by competitive lines, under close supervision of the Commission, would materially improve the railroad situation by securing uniform and stable rates, and by eliminating a great part of the place discriminations. The theory clung to so tenaciously by the people at large, and given weighty sanction by the decisions of our highest court, that competition can be relied upon to give shippers reasonable rates, is utterly impracticable when applied to the railroad industry. The conversion of the informal and secret agreements between carriers which now prevail, and which in the nature of things must prevail, into open legal contracts sanctioned and regulated by the Commission, must be effected sooner or later if this railroad problem is to be solved by other means than by government ownership.

Engine Failures and Their Report.*

Failures of engines in service interest so many departments of a railroad directly or indirectly, as well as the traveling or shipping public, that every energy is bent toward avoiding them. Shortage of power at times may compel the use of engines on the road which, under ordinary circumstances, would be held for back-shop repairs. These engines, then, should not be expected to handle full tonnage, but should be favored to a degree decided upon by the master mechanic in charge. But, on the other hand, no engine should be permitted to start on a trip unless the roundhouse foreman is sure, to the best of his knowledge, that the engine will make the trip successfully if it is handled properly and is not delayed unreasonably. Particularly is this latter condition true in what are known as bad water districts, as has been definitely demonstrated. And, too, an engine crew should be given as much consideration as the engines. They cannot work perpetually on short hours of rest unless their working hours are made short.

It is naturally during a rush period, whether of short or long duration, that engine failures increase in number and often also in proportion to the total miles run in a given period of time. However, there is a practice which, if once tried under such conditions, is usually adopted—*i. e.*, reduced tonnage. There is the consequent increased speed over the road, more frequent attention to engines in roundhouse, shorter rest hours required by engine crews, and more cars handled in the same time. This is very pronounced on single track roads where a great deal of time is consumed in waiting at meeting points. The train despatcher can make better meeting points and the petty annoyances on the engine which make trouble and delays on tonnage trains have no effect. It may be that the cost per ton mile of freight per train is slightly increased, but the cost per ton mile of freight handled in the given period of time is not, for one or two engine failures will quickly wipe out the figured profits of full tonnage trains.

An engine failure, when charged, should be fair and just. The plain fact that an engine has died on the main line, or has given up its entire train and has come to the terminal caboose "bounce," is not in itself a cause for the recording of an engine failure. Very often the circumstances are such that a credit mark should be given instead of a demerit. Many of us know of instances on outlying divisions, where up-to-date roundhouse equipment is not very extensive and roundhouses themselves are not elaborate or frequent, when an engine has been worked back and forth between outlying points and the despatcher wants to make one more trip before sending it in as requested. In an endeavor to help the despatcher, the engine crew will attempt to do what is asked of them. The consequence is that a train is left on the main line, or some important movement is delayed. Is that properly an engine failure, or is it a man failure? Such a case surely is one for investigation first before reporting.

The failure report should be accurate as to facts. These reports originate usually in the train despatcher's office. Too often the compilation is left until the last moment when every one is in a rush and when the easiest way is to take the notes from the train sheets. As a consequence, any occurrence which has annoyed the despatcher during his trick is charged as an engine failure if there is half a chance. The result is that the division superintendent and the master mechanic, as well as other division officers, are bothered with useless letters and memoranda sustaining charges and making explanations of a petty incident that should have been thoroughly sifted on the spot. This not only wastes valuable time of responsible men, but creates an undercurrent of feeling that often in the end causes bitter enmity. On the other hand, imagine what would have been the result if the despatcher had stopped for a moment before making the record, had obtained all the required information and had considered as to whether the service had been delayed or not, forgetting his own personal annoyance. Every one would have been happy, all had smiling faces and been ready for a dig into the work of the division instead of a dig into the other fellow.

The failure report should be definite as to details; that is, it should not say "leaking" when there are no flues that can leak, staybolts that can leak, mud ring that can leak, etc. It should not say "not steaming" when flues stopped up, honey-combed flue-sheet, poor coal, green firemen, leaky steam pipes, etc., can be selected as the definite cause.

And finally the record should stay when once made. If the proper care, as roughly outlined above, is taken, there will be no such thing as having "failures" canceled.

But what constitutes an engine failure? Is it not a train failure or delay for which the engine or its crew are alone responsible? With this thought in view, the Chicago & North-Western has adopted the following rules for guidance in making engine failure records.

DEFINITION OF WHAT CONSTITUTES AN ENGINE FAILURE.

1. All delays waiting for an engine at an initial terminal, except in cases where an engine must be turned and does not arrive in time to be despatched and cared for before leaving time.

2. All delays on account of engines breaking down, running hot, not steaming well, or having to reduce tonnage on account of defective engine making a delay at a terminal, a meeting point, a junction connection or delaying other traffic.

DELAYS THAT SHOULD NOT BE CONSIDERED AN ENGINE FAILURE.

1. Do not report cases where engines lose time and afterward regain it without delay to connections or other traffic.

2. Cases where a passenger or scheduled freight train is delayed from other causes and an engine (having a defect) makes up more time than she loses on her own account, should not be called an engine failure.

3. Do not report delays to passenger trains when they are less than five minutes late at terminals or junction points.

4. Do not report delays to scheduled freight trains when they are less than twenty minutes late at terminals or junction points.

5. Do not report delays when an engine is given excess of tonnage and stalls on a hill, providing the engine is working and steaming well.

6. Do not report delays on extra dead freight trains if the run is made in less hours than the miles divided by ten.

7. Do not report engine failures on account of engines steaming poorly, or flues leaking, on any run where the engine has been delayed on side tracks other than by defects of engine, or on the road an unreasonable length of time—say fifteen hours or more per 100 miles.

8. Do not report an engine failure for reasonable delays in cleaning fires and ash-pans on the road.

9. Do not report failures against engines that are coming from outside points to the shops for repairs.

10. Do not report cases where an engine is held in the roundhouse for needed repairs, and called for by the operating department, they being informed that the engine will not be ready until a stated time. Failure to provide that engine before that stated time should not be called an engine failure.

11. Do not report broken draft rigging on engines and tenders caused by air being set on train, account of bursted hose or breaking in two.

12. Do not report delays to fast schedule train when the weather conditions are such that it is impossible to make the time, providing the engine is working and steaming well.

13. Do not report delays when an engine gets out of coal and water, caused by being held between coal and water stations an unreasonable length of time.

In collecting the information for the failure the engineman and the despatcher are the first ones concerned. The engineman advises the despatcher just what is the trouble with the engine and says what must be done to get the engine to the terminal or place of tie-up. His statement shows whether the boiler, the machinery, or

[1] Alabama Midland Case, 168 U. S., 144, 173.

[2] This refers only to all-water lines, water carriage that forms with rail transportation a through route, being now under the jurisdiction of the Commission.

* A paper presented at the January meeting of the Western Railway Club by W. E. Dunham, Master Mechanic, Chicago & North-Western Ry.

special attachment are troubling, and gives a brief detail of what is wrong. The despatcher then advises the master mechanic or the division foreman and also the local foreman of the terminal to which the engine is going. As soon as the engine arrives the roundhouse foreman makes a close examination and prepares a statement which he sends to the master mechanic along with the engineman's written explanation. These various statements give the master mechanic full knowledge of the case, and he should have these papers within twenty-four hours after the failure occurred. In this prompt action rests a large part of the value of an engine failure report for the division officers. It convinces everybody concerned that things are being watched, and that indifference to the service will be treated accordingly.

The final ten-day or monthly statement of failures for the division is of value to both the operating and the mechanical departments. To the former it should show the result of long hours on the road on both engine and engine crew as well as train crew, the result of inferior coal, poorly designed and operated coal stations, scanty and bad water supply, overloading of engines, indifferent train despatching, lack of harmony in action on the part of the men in charge of a train. To the mechanical department the report gives not only all this same information, but it also shows up poor design, weak parts, inferior material, bad shop practices, careless handling, indifferent inspection and poor workmanship. In order to fully indicate these defects the roundhouse foreman sends in with his personal examination report a marked sketch of the defective part.

With a view to having uniformity in these reports and save time, blank breakage report forms, printed in copying ink, are used. The local master mechanic and shop foreman first make use of these reports by inspecting the broken part, if necessary, investigating the matter of its preparation and application. They are then forwarded to the assistant superintendent of motive power and machinery, where they are again checked up and where, by the frequency of similar reports, attention is drawn to some particular defect. It may be some one design of cylinder head, rod strap, eccentric or strap, or any such part of the machinery of a certain class of engine is regularly giving trouble. These reports quickly show it up to those who have such matter in charge, and the detail is quietly and efficiently remedied without the necessity of any further investigation. Such would be the case if the shops are at all careless in preparing the detail and are passing as good enough parts that are not true as to dimensions, etc.

After the assistant superintendent of motive power and machinery is through with the reports they are sent to the mechanical engineer, who checks the dimensions of the broken pieces and makes use of the data obtained in designing new parts for old engines or preparing plans for new ones. If he finds that some old style of detail designed several years ago is not holding up under the present-day methods of operation, he takes steps to have it discarded as fast as possible and substitutes a modern design. He also strengthens a pattern here and rearranges the metal there with a view to overcome external and internal defects that have been brought out by these reports.

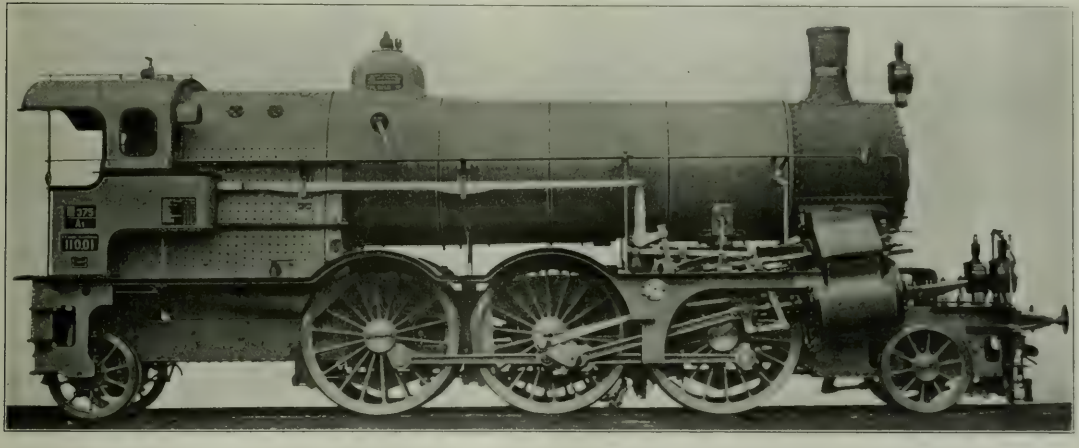
As a further record and for the purpose of comparison, a monthly statement is prepared in the office of the superintendent of motive power and machinery, which classifies and details the failures and also shows totals for each division of the railroad.

Four Cylinder Compound Locomotive; Austrian State Railways.

BY REGINALD GORDON.

London *Engineering* of November 16th last published a description of a 2-6-2 four-cylinder balanced compound locomotive one of a number now building at the Floridsdorf Works, Vienna, for the State Railways of Austria. An examination of the illustration of this locomotive, reproduced from *Engineering*, shows what has been growing more and more noticeable during the last five or six years, the closeness with which American and European locomotive practice approach each other. Naturally the kind of service and the requirements of traffic modify the designs in each country, but the development of certain definite types and the incorporation in the design of certain features is so plain to anyone who carefully observes locomotive practice on both sides of the ocean, that the distinction between this country and Europe in this respect is no longer so marked as it used to be. For instance, by way of comparison, note the adoption of the 4-4-2 type of locomotive in Great Britain and Europe, and the increasing use of the Walschaerts valve gear in the United States; the increasing size and power of British and European locomotives, and the use of outside connected cylinders thereon, while we in this country are developing the four-cylinder compound along European lines, and beginning to use superheaters. In short, each country has to a certain extent been making use of ideas developed in the other, so that the locomotives of either one resemble those of the other closely.

These remarks are suggested by the subject of this sketch, a four-cylinder compound 2-6-2 engine, with extended wagon top boiler and wide firebox. The cylinders are all four on the same transverse line under the smokebox, but set at an inclination to the horizontal. The low-pressure cylinders are outside and the high-pressure inside, and all four drive the second axle, an arrangement rendered possible by the height and inclination of the cylinders, the high-pressure guides being above the forward driving axle far enough to allow the high-pressure main rods to clear it. All four cylinders have slide valves, operated by Walschaerts gear, and the high-pressure valves are driven by a connection at the back end of the low-pressure valve stems through a rocker attached to each. The boiler is of the extended wagon top radial stayed type, with its center 9 ft. 5 in. above the rails. It is 61 in. inside diameter and has a wide firebox with 43 sq. ft. of grate area. The trailing truck has inside bearings. Altogether, the locomotive has a decidedly American look and is worthy of notice by engineers both here and abroad.



Four-Cylinder Compound Six-Coupled Locomotive for the Austrian State Railways.

The weights and principal dimensions follow:

Boiler pressure, per sq. in.	220 lbs.
Cylinders, diameter high-pressure	17 " in.
Cylinders, diameter low-pressure	24 " "
Stroke of cylinders	28 " "
Diameter of driving wheels	5 ft. 11⅝ "
Diameter of leading and trailing wheels	3 " 4¾ "
Rigid wheel base	12 " 10 "
Total wheel base	31 " 2 "
Boiler, inside diameter	61 "
" tubes,	282
" diameter, 2 in.; length	17 " 1 in.
Grate area	43 sq. ft.
Total heating surface	2,775.3 "
Weight on driving wheels	96,100 lbs.
Total weight in working order	154,340 "
Tender capacity, water	5,500 gals.
Tender capacity, coal	7½ tons

Tests of Bond Between Concrete and Steel.*

The results of tests that have been reported on the strength of bond or adhesion between concrete and steel for plain, round and square bars are remarkable because of the lack of uniformity and wide variation, and indicate that there are so many conditions effecting this value even in laboratory experiments that engineers may well question if any dependence at all can be placed upon the adhesion of plain bars to concrete. The writer has studied all the results of bond or adhesion tests that have come to his attention. He finds from these reports that the strength of bond or adhesion obtained for plain bars embedded in Portland cement mortar and Portland cement concrete ranges from less than 100 lbs. to over 800 lbs. per square inch of embedded surface of plain bars.

The reports studied by the writer include the following, the figures accompanying the names indicating the minimum and maximum results reported in each case in pounds per square inch of embedded surface of plain round and square bars.

Zeitschrift des Vereins Deutscher Engenieure (Vol. 49, '05) *Cement Age*, October, 1905	83 to 592
E. Morsh (from *Beton und Eisen*, 1903)	100 " 696
E. S. Wheeler, U. S. Assistant Engineer	111 " 556
Prof. A. N. Talbot, University of Illinois	174 " 386
Prof. C. E. DePuy, Lewis Institute	188 " 341
Prof. C. W. Spofford, Massachusetts Institute of Technology	219 " 374
S. W. Emerson, Case School of Applied Science	278 " 587
Prof. F. H. Constant, University of Minnesota	316 " 854
Prof. W. K. Hatt, Purdue University	470 " 756
Professor Bauschinger (from Buel & Hill)	570 " 640

This strength of bond or adhesion depends upon the following factors, any or all of which may vary: Quality of cement; character of sand or stone rust used in the mortar; ratio of cement to sand or stone dust; sizes of gravel or broken stone used in concrete; ratio of mortar to gravel or broken stone; degree of plasticity or percentage of water used in mixing mortar and concrete; thoroughness of mixing process; car with which mortar or concrete is placed; amount of leakage of mortar from concrete because of defective forms; possible disturbance of concrete during time of setting, breaking the initial adhesion to bars (this may easily result from tamping on or near concrete that has taken its initial set); the condition of the surface of the bars, and the age of the concrete.

M. Breuille reports in the Annals des Ponts et Chassees, 1902, the results of tests made to ascertain the action of water and moisture on reinforced concrete. He reports that by soaking in water for nine months the adhesion between iron and concrete is reduced from one-half to two-thirds, and in time the adhesion is entirely destroyed. This is of vast importance in connection with tunnel, foundation and bridge or culvert work.

It is evident that some positive mechanical bond between steel bars and concrete must be used in reinforced concrete structures to insure their permanence and reliability. In order to investigate the relative strength of bond developed by different forms of bars in the same kind of concrete and under otherwise identical conditions, the writer arranged with C. E. DuPuy, Professor of Mechanical Engineering in Lewis Institute, Chicago, to make a series of bond tests, in which not only the stresses necessary to pull out the bars would be recorded, but also the amount the bars moved or slipped under increments of stress would be recorded. He submits herewith Prof. DePuy's report of these tests. In doing so, the writer desires to call attention to the fact that so far as he is aware these are the first tests, the results of which have been published, in which any record of the amount of the slip of the bars as well as the stresses on the bars have been recorded.

A series of tests were made at the U. S. Testing Laboratory at the Watertown Arsenal recently to determine the "adhesion resistance of steel bars in cement and mortar prisms." In these tests both twisted and corrugated bars were tested. In the report it is stated, that the "concrete prisms were secured in the jaws of the testing machine between V-shaped wooden cushions, against which a sufficient compressive force was applied to hold the specimens in place against the tensile pull on the bars." The report goes on to say, "this lateral pressure in the sides of the prisms prevented their splitting lengthwise during the tests and in some degree probably resulted in applying pressure against the sides of the embedded bars." In the writer's opinion this was an unscientific way in which to make such tests, as the lateral pressure of the jaws enormously increased the friction bond between the bars and the concrete and vitiated the results as a consequence. The effect would be most marked upon the adhesion or bond of the twisted bars as they depend for bond entirely upon the wedging action of the inclined planes which the sides form because of the twisting. As a consequence, these results are entirely at variance with the results obtained by Prof. Spofford at the Massachusetts Institute of Technology, Prof. Constant at the University of Minnesota, and Prof. C. E. DePuy at Lewis Institute. Moreover, none of these reports except Prof. DePuy's brings out the fact of how much the bars slip before the maximum load is reached, and this is a most important feature to consider in bond tests. In Prof. DePuy's report, Table IV shows the relative strengths and efficiencies of bond of the different bars tested by him at the point where the slip did not exceed $^1/_{100}$ in.

The writer desires to express his appreciation of the very careful and scientific manner in which Prof. DePuy conducted this series of tests.

*A paper presented to the Western Society of Engineers, Dec. 5, 1906.

REPORT OF TESTS.

Object.—The object in making these tests was to determine the relative strength of bond between concrete and steel for different shaped bars, when the quality of concrete was uniform and the lengths of embedment the same for each of the several different kinds of bars. Also to measure the amount of slip, as well as the loads of stresses causing the slips.

Scope.—In order to make the results comparable, bars were secured for the tests having as nearly as possible the same average area of cross section and weight per foot as shown in Table I.

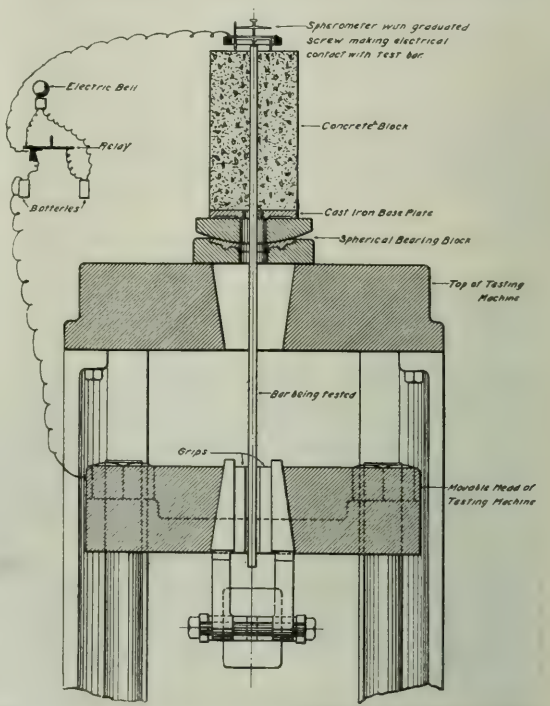


Fig. 1—Apparatus or Testing Bond Between Concrete and Steel.

There were seven kinds of bars tested and five lengths of embedment of each kind. The lengths of embedment were 8, 12, 16, 20 and 24 in. for each kind of bar.

TABLE I.
Description of Bars Used in Tests.

Bars.	Size.	Average Weight, per ft., lbs.	Average Area, sq. in.	Average Perimeter, ins.
Round	$^{11}/_{16}$-in.	1.284	0.378	2.17
Square	$^{5}/_{8}$-in.	1.322	.390	2.50
Twisted (B)*	$^{5}/_{8}$-in.	1.343	.395	2.51
Twisted (R)†	$^{5}/_{8}$-in.	1.345	.395	2.51
Thacher	$^{3}/_{4}$-in.	1.310	.385	....
Corrugated (N)‡	$^{5}/_{8}$-in.	1.250	.368	2.43
Corrugated (O)§	$^{5}/_{8}$-in.	1.443	.424	2.60

*Buffalo Steel Company, 2.3 twists per foot.
†Ransome, 2.8 twists per foot.
‡New style.
§Old style.

Apparatus.—The apparatus used is clearly indicated in Fig. 1. The concrete blocks were cylindrical, 6 in. in diameter, and 8, 12, 16, 20 and 24 in. long respectively. Each concrete block had a cast iron base plate, turned to a true face. These blocks were supported upon a spherical bearing block on the top of an Olsen testing machine, so that the specimen could be properly adjusted for a direct pull on the bars. The lower projecting end of the bar was gripped into the movable head of the testing machine. The upper end of the bar projected ¾ in. above the top of the block, while upon the concrete block rested a spherometer with the graduated screw brought into contact with the upper end of the bar being tested, thus closing an electric circuit. As the load came on, the slightest slipping of the bar in the concrete would break the electric circuit, causing a bell to ring until the graduated screw was turned down and the circuit closed. By this means it was possible to measure very accurately the movement of the bars and the load causing the same.

Materials.—Table I gives the general description of the bars

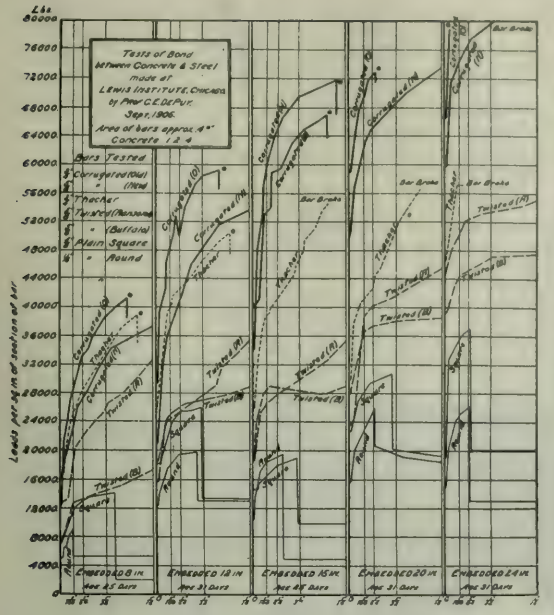


Fig. 2.

used. The round and square bars were of steel furnished by Jos. T. Ryerson & Sons, Chicago, and taken from their regular stock of structural steel bars. The twisted bars (B) were furnished by the Buffalo Steel Company. The twisted bars (R) were furnished by Messrs. Hough & Company, Chicago, representatives of the Ransome Concrete Machinery Company. The Thacher bars were furnished by The Schofield Company, Philadelphia, and the Johnson corrugated bars were furnished by Condron & Sinks Company, Chicago, representatives of the Expanded Metal & Corrugated Bar Company. The Ransome twisted and the old-style corrugated bars were covered with a thin coat of rust but free from scales of rust. The other bars were all fresh from the rolls and free from rust.

The concrete was hand-mixed with great care after the proportions had been accurately measured. The mixture was one part Atlas Portland cement, two of coarse sand and four of broken limestone, of ½ in. and under, without dust. This was mixed to a fairly wet concrete, one that would easily enter the moulds and

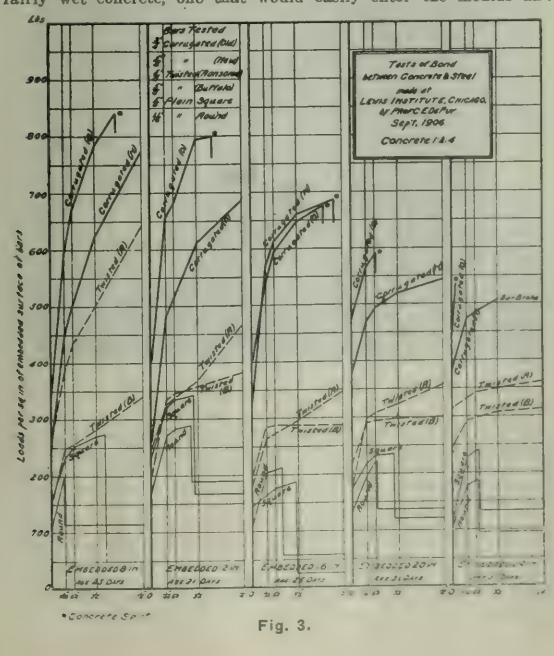


Fig. 3.

could be churned readily with a small iron rod. All the concrete used was mixed in one batch. The sheet iron forms in which the blocks were moulded were removed about one week before testing. The tests were made when the concrete was 25 days old for the 8 and 16 in. embedments, and when the concrete was 31 days old for the 12, 20 and 24 in. embedments.

Results of Tests.— The results obtained are graphically shown in Figs. 2 and 3 and are tabulated in Tables II and III. The diagrams show the results of all of the tests, with a maximum slip of $^1/_{16}$ in. Where the maximum load or stress on the bar was not reached within a slip of $^1/_{16}$ in., the curves would extend beyond the limits of these diagrams. In Fig. 2 the stresses or pulls on the bars are reduced to pounds per square inch of the cross-sections of the bars, while in Fig. 3 these stresses or pulls on the bars are reduced to pounds per square inch of the embedded surface of the bars. In Tables II and III the actual stresses on the bars with the corresponding slips are given, first in pounds per square inch of section of the bars, and second in pounds per square inch of the embedded surface of the bars. As there was no way of readily determining the surface areas of the Thacher bars, these are not included in Fig. 3 and Table III.

TABLE II. RESULTS OF BOND TESTS.

Stresses on bars in pounds per square inch of cross section

Embedment	8 in.	12 in.	16 in.	20 in.	24 in.
Slip not more than $^1/_{100}$ in.					
Round	9,200	18,700	18,900	23,000	24,800
Square	11,900	24,300	16,800	28,000	35,200
Twisted (B)	12,700	25,400	28,800	36,500	44,300
Twisted (R)	19,400	24,600	26,000	38,300	50,600
Thacher	25,300	40,800	38,900	41,200	57,100
Corrugated (N)	23,800	37,500	60,000	61,500	74,500
Corrugated (O)	29,200	48,000	53,500	69,400	79,000
Slip not more than $^1/_{32}$ in.					
Round	*9,200	*20,100	*19,800	*26,000	*26,500
Square	13,500	*26,200	*19,300	*20,800	*37,300
Twisted (B)	14,400	27,100	29,100	37,000	46,700
Twisted (R)	25,400	27,800	30,000	41,700	53,400
Thacher	33,800	46,600	46,400	50,600	*57,100
Corrugated (N)	33,000	48,400	69,600	68,400	*80,000
Corrugated (O)	38,500	58,000	64,100	*73,000	*79,000
Slip not more than $^1/_{16}$ in.					
Twisted (B)	17,300	29,000	29,200	38,400	47,600
Twisted (R)	32,600	35,400	35,500	45,300	55,100
Thacher	†39,000	†50,200	†56,700	†57,000	*57,100
Corrugated (N)	†40,700	54,200	†72,300	72,500	*80,000
Corrugated (O)	†41,300	†58,800	†67,500	*73,000	*79,000
Slip not more than $^3/_{32}$ in.					
Twisted (B)	21,000	32,700	31,500	39,900	48,300
Twisted (R)	38,000	42,800	42,400	51,300	59,500
Corrugated (N)	40,700	‡55,800	‡72,300	‡73,300	*80,000
Maximum stresses on twisted bars with corresponding slips.					
Twisted (B)	43,000	57,000	52,000	64,500	71,000
	$^3/_{16}$ in.	$2^1/_2$ in.	$1^1/_2$ in.	$3^1/_4$ in.	$1^3/_4$ in.
Twisted (R)	41,800	58,200	56,900	81,000	68,500
	$^1/_8$ in.	$^3/_{16}$ in.	$^3/_{16}$ in.	$^3/_4$ in.	$^3/_{16}$ in.

*Developed full strength of bond before slipping $^1/_{32}$ in.
†Developed full strength of bond before slipping $^1/_{16}$ in.
‡Developed full strength of bond before slipping $^3/_{32}$ in.

TABLE III.—RESULTS OF BOND TESTS.

Stresses on bars in lbs. per sq. in. of embedded surface of bars.

Embedment	8 in.	12 in.	16 in.	20 in.	24 in.	Av'ge.
Slip not more than $^1/_{100}$ in.						
Round	198	269	203	198	178	209
Square	252	346	164	218	229	232
Twisted (B)	250	334	283	288	291	289
Twisted (R)	382	324	256	312	332	321
Corrugated (N)	452	474	569	467	471	487
Corrugated (O)	594	651	545	565	535	578
Slip not more than $^1/_{32}$ in.						
Round	*198	*289	*214	*224	*190	223
Square	271	*341	*188	*240	*242	256
Twisted (B)	283	357	287	299	306	306
Twisted (R)	500	366	295	329	350	368
Corrugated (N)	626	612	660	519	506	585
Corrugated (O)	784	786	653	593	535	670
Slip not more than $^1/_{16}$ in.						
Twisted (B)	340	382	287	311	313	327
Twisted (R)	642	466	349	358	362	435
Corrugated (N)	†775	785	†687	550	*506	640
Corrugated (O)	*840	*800	†687	†593	*535	691
Slip not more than $^3/_{32}$ in.						
Twisted (B)	415	430	310	315	317	357
Twisted (R)	766	562	425	405	390	509
Corrugated (N)	†775	†706	†687	‡556	*506	646
Maximum stresses for twisted bars with corresponding slips.						
Twisted (B)	846	750	512	510	466	...
	$^3/_{16}$ in.	$2^1/_2$ in.	$1^1/_2$ in.	$3^1/_4$ in.	$1^3/_4$ in.	
Twisted (R)	825	765	560	640	449	...
	$^1/_8$ in.	$^3/_{16}$ in.	$^3/_{16}$ in.	$^3/_4$ in.	$^3/_{16}$ in.	

*Developed full strength of bond before slipping $^1/_{32}$ in.
†Developed full strength of bond before slipping $^1/_{16}$ in.
‡Developed full strength of bond before slipping $^3/_{32}$ in.

TABLE IV. RELATIVE STRENGTHS OF BOND

Relative efficiencies of the bars tested. From Table II slip not over $^1/_{100}$ in. Strength of bond of plain round bars taken as unity in each case.

Embedment	8 in.	12 in.	16 in.	20 in.	24 in.	Av'ge.
Round	1.00	1.00	1.00	1.00	1.00	1.00
Square	1.30	1.30	0.90	1.22	1.42	1.23
Twisted (B)	1.38	1.36	1.55	1.59	1.79	1.53
Twisted (R)	2.11	1.32	1.38	1.67	2.04	1.70
Thacher	2.75	2.18	2.06	1.79	2.30	2.22
Corrugated (N)	2.59	2.00	3.18	2.68	3.01	2.70
Corrugated (O)	3.18	2.56	2.85	3.00	3.18	2.95

Relative Efficiencies of Different Bars.—In Table IV are given the ratios expressing the relative strength of bond, or efficiencies of the different kinds of bars as determined by these tests at the point where the slip did not exceed $^1/_{100}$ in., the strength of bond of the plain round bar being taken as unity in each case. From the results of these tests the greater efficiency of the bond of corrugated bars is very apparent.

Private Car for the Canadian Pacific.

The Canadian Pacific has just turned out of its Angus shops a handsome private car, the "Killarney," for the use of the President, Sir Thomas Shaughnessy. The interior of the car is marked by the entire absence of ornamentation and the studied plainness of the finish. The exterior is finished entirely in mahogany, Canadian Pacific standard ornamentation being used.

The car is very long, being 74 ft. over the frame, and 84 ft. 3¼ in. over the buffers. At the rear end is a large observation platform, recessed into the body of the car for 2 ft., and surrounded by a heavy railing slightly relieved by polished brass ornamentation. The observation room is 14 ft. long by 9 ft. 8 in. wide. The walls are finished in selected Circassian walnut. The Empire ceiling is finished in stained birch, to suit the lighter tones of the walnut. The decklights are in art glass to harmonize with the woods and appointments. The observation windows are unusually large, those at the rear being 5 ft. by 2 ft. 3 in., and those at the sides 5 ft. wide and 2 ft. 6 in. high. One of the features of this room is an ingenious spring roller map rack which is placed in the upper part of the bulkhead of the car and runs transversely. By the release of a lever the map rack moves out from the bulkhead so that any one of the maps may be pulled down for examination. By means of the same lever, the map rack moves back into the bulkhead flush with the other woodwork. The room is furnished with two heavy wire backed armchairs, and two sofas which at night may be turned into beds, all upholstered in dark green leather. There is also a small writing table and chair at the forward end of the room, both of which are walnut. The carpet is a heavy Wilton, of a rich green shade with a small artistic design.



Private Car "Killarney" for the President of the Canadian Pacific.

A corridor, paneled in mahogany veneer, extends from the observation room to the dining room at the opposite end of the car, and runs past the intervening rooms. This corridor is roofed over flat, the space between the roof of the corridor and the ordinary roof of the car being used for lockers, which are reached from the various rooms. This arrangement adds to the storage accommodation of the car and to the appearance of the passage itself.

A general lavatory comes next to the observation room. This is finished in ivory white with mosaic tiled floor, the appointments being in white porcelain with nickel plated fittings. Next to the lavatory is a small room for heavy coats and small hand baggage. Next to this comes the president's bedroom, 8 ft. 6 in. long by 6 ft. 9 in. wide. The woodwork is finished in ivory white, the walls being paneled in red silk, with curtains at the window of silk to match the panels. The room contains a plain brass bedstead, at the head of which is a small table with drawers. On the opposite side of the room is a wardrobe and a dressing table with drawers underneath. The carpet is a heavy Wilton of a shade harmonizing with the curtains and panels.

Opening off this room is the bathroom, which also communicates with the passage and the next bedroom. This room has porcelain bath and washstand with nickel plated fittings, the floor being covered with small mosaic blocks. The walls from the floor to the cornice are covered with white enameled tiles, and all exposed woodwork is finished in ivory white.

The second bedroom is finished practically the same as the president's room, except that the panels, curtains and carpet are blue.

Next to this bedroom is the secretary's office and bedroom. This is intended for the president's secretary, but it can also be used as an additional stateroom if required. It has a sofa, which at night can be turned into two berths, upper and lower, porcelain washing conveniences, cupboards overhead both at the front and rear ends of the room, and a handsome desk, having a bookcase above, the doors of which are fitted with leaded glass windows. The finish of this room is entirely mahogany.

The porter's room is immediately next to this, but the section of the car just described is divided from the remainder by a swinging door in the passage to prevent draughts. This room contains two berths, folding washstand and water closet, and is plainly finished in mahogany and green leather. All the rooms are amply supplied with basket racks, coat hooks, etc., of a finish to match the rooms.



Interior of Observation Room.



President's Room With Bath Connecting.

The kitchen car, which also serves the purpose of a pantry, is completely fitted up with cupboards for the silver, glass and chinaware, drawers for the knives, forks, spoons, etc., refrigerator, working table and sink, a steel range of the latest design, and a coal bin. The walls of the kitchen are finished in white enamel tiling, while the woodwork is of mahogany.

Next comes the dining room, 12 ft. 8 in. by 10 ft., finished in mahogany veneer, and decorated with a simple marquetry design. The mahogany dining table will seat eight people comfortable, and ten at a pinch. The upholstering of the sofa and chairs is of dark green leather, and the floor is covered with a heavy Wilton carpet of a rich green color.

The car is lighted with electricity and also the Canadian Pacific standard system of acetylene gas. The fixtures, however, are so arranged that the gas can only be turned on by a special key in the hands of the porter, so as to prevent the gas from being unnecessarily wasted.

A Plan to Relieve Car Shortage and Congestion.

The following letter, giving what the writer believes to be the chief causes of the present car shortage and congestion, and suggesting a method for determining the truth of his assertions, was addressed to the Interstate Commerce Commission by Mr. Russell Harding, to whom we are indebted for this copy.

New York City, Jan. 7, 1907.

INTERSTATE COMMERCE COMMISSION, WASHINGTON, D. C.

Gentlemen.—Herewith I hand you an analysis specifically for the relief of car shortage and congestion. In various mediums during the past 30 days interesting articles have appeared appertaining to the question of car shortage as experienced throughout the United States. The question appears to be discussed from two viewpoints, one side claiming that the car supply is ample, but that track facilities are wanting. The seeming want of additional track facilities is susceptible of much discussion and consideration. It would seem, from long experience in the transportation business, that there is a point which has not been given the proper consideration by either the public or the transportation companies; and to the writer it is the true cause, if not wholly, at least to a very large extent, of the present congestion, and the inability to handle freight promptly to destination.

We will consider the question from the situation, say, in 1898, when business conditions began to change by the volume of business increasing steadily each year in all branches, up to the present time. At that time (1898) shortage of equipment was unknown to any degree for the reason that the volume of business from the various industries throughout the country was only equal to the facilities as provided by such industries themselves, or otherwise.

With the immense increase in business that has developed there has been practically no increase in industrial tracks; consequently the transportation companies have been forced, in order to care for such increase in business, to expand, and expend enormous sums of money increasing their yards at all important points in order to hold the cars awaiting delivery to industrial concerns; and there seems to be no end to the expansion in this direction, until further facilities are provided by individuals or industries.

Let us see how this works out: Dating from the time mentioned (1898) it was possible to satisfy the industries by switching to their plants cars for unloading, and taking therefrom cars as loaded; say one, two or three times each 24 hours. By the increase in business gradually each year the same plants require switching service three, six and eight times daily, in order to keep up, or to attempt to keep up, with the increase; and it is the exception rather than the rule that additional or enlarged facilities have been provided by such industries, thus requiring the transportation companies to perform many times the service in switching, and to increase their terminal yards to permit the large accumulation of cars to be stored therein, caused by the failure of the industrial plants to handle their materials without continuous service of the switch engines, occasioned wholly by inadequate industrial switching tracks.

Further delays are caused by the necessity of transportation companies being compelled to work, or switch out of their enormous holding yards certain specified cars that may be wanted by the industries in preference to others containing, say, certain kinds of material: when the same concern may have large numbers of other cars being held for unloading in said yards and which are more conveniently placed for switching.

From information gathered, the assertion is here made that in all large business centers 90 per cent. of all the cars that are held—and I do not believe that there is an important point but will show the yards of the transportation companies filled to their utmost capacity—are for delivery to industries and business interests at such points, and the transportation companies are unable to quickly or properly deliver such freight on account of inadequate industrial and team track room. By being "unable" is meant a physical impossibility to perform the work owing to crowded conditions in the holding yards. Therefore, instead of transportation companies being able to get from the total cars in their service from 28 to 40 miles per day movement—such results being obtained eight years ago by prompt loading and unloading of cars—they are now showing a movement of only 15 to 22 miles per day for the total number of cars in service, thus requiring the addition of a larger number of cars to perform the same business in tons handled.

At division points of the transportation companies enormous expansion and expenditures of money have been made yearly during the period in question, the necessity being wholly for the purpose of storage yards resulting from the congested condition of terminal yards at destination of freight. This accounts for the fact that movement from originating station to destination. Originating centers must be cleared daily, or practically so; hence freight is moved out and cut off at intermediate points owing to the fact that the final destination points are blocked with freight awaiting delivery as set forth above.

Since the question has become so serious as to attract the attention of the Interstate Commerce Commission and the different state commissions, would it not seem wise to consider the question by dissecting the whole situation so that the true cause may be shown that is responsible for the present conditions?

I have stated that much of the trouble comes from insufficient industrial tracks—meaning such tracks as are not owned, or controlled, by the transportation companies. I think fully 75 per cent. of the trouble is chargeable to this cause. It would not be difficult to determine this, if I might offer a suggestion, which would be as follows: Cause each system of railroads of any magnitude to prepare blueprints of all tracks as owned by them and over which they exercise control, including all large centers and division points; in fact, tracks of every nature outside of main tracks, say as of January 1, 1898, and the same on January 1, 1907. This information can be produced by all roads, as such records are generally kept up very closely. From such blueprints can be determined what tracks the railroads had on January 1, 1898, with which to handle their business; and also what additional tracks have been put in up to January 1, 1907; also the car capacity of such tracks at each date. And from said blueprints the industry tracks will also be shown and their car capacity. In this manner an accuracy of condition will be shown.

If the industrial tracks that are not owned by the transportation companies do not show an increase in proportion to the increase in holding tracks and yards put in by the transportation companies, then it would seem that the transportation companies have been forced to add track facilities for individuals and industries, and also forced to stand the very heavy expense of additional switching and handling of cars.

After the above conditions have been shown, a further proof of the true conditions may be had by the work of the auditing departments of the various selected systems. Cause to be shown by carefully compiled statements the tonnage handled in and out for the various industries during the year 1897, and the tonnage handled during the year 1906, by the same lines and for account of the same industries. The per cent. of increase shown can be compared with the per cent. increase of tracks put in by the railroad companies and by the industries.

Further, as the records of the transportation companies are kept, each 24 hours a report is made showing the total number of loads and empties to move, east, west, north and south; the number of loads and empties in trains in transit, and the number of loads waiting to unload at each and every station on the road. A glance at such reports for a few consecutive days will clearly show the conditions and give an accurate idea of the situation and what causes congestion and slow movement of freight.

So far as the ability of any of the great systems for handling the business over their main lines is concerned, this can be shown beyond doubt, if the freight so handled can be taken care of at destination promptly; but under present conditions slow movement is experienced by the very crowded conditions in all yards, and the blocking of passing tracks with cars held out.

Railroad companies, in order to prevent charges of discrimination by failure to move freight, are compelled to change the consist of their trains at almost every division point for the purpose of showing their endeavor to move the vast accumulation bodily daily if only for the distance between division points, which causes an expense of switching at each point, as well as taking up the time of locomotives that would otherwise be used in moving cars on the main line towards the destination of the freight.

Touching on the subject of insufficient equipment, the explanation first mentioned shows where it is necessary to provide 75 per cent. more cars to move the same volume of freight, less the increased capacity of the modern car.

After the conclusions have been reached locating the fault for slow movement, or more properly non-delivery, it becomes a very serious question to determine which of the two interests should shoulder the burden. It may be claimed that the railroad company should provide tracks for industries, or business interests, as they do for local freight houses and what are termed team delivery tracks. It has not been the custom so to do, but it may be that such might be the ruling, providing that individual interests furnish the right of way.

RUSSELL HARDING.

Railroad Refrigeration.

BY JOS. H. HART, PH.D.,
Randal Morgan Laboratory of Physics, University of Pennsylvania.

The problem of refrigeration is daily becoming of increasing importance in railroad management. The amount of perishable freight which is transported in this country is increasing by leaps and bounds, and the end is not yet in sight. The problem of protecting this freight by suitable refrigeration while in transit has not yet been satisfactorily solved. The advent of mechanical refrigeration as a practical process into the engineering world has developed hopes of its utilization in this field which have not yet been realized, but it is not evident that this is the fault of mechanical refrigeration. Artificial refrigeration is able to produce to-day ice in large quantities at less than 50 cents a ton, and to produce refrigeration equivalent to the melting of ice at a much less rate. In spite of these facts, the good old-fashioned method of icing cars is still commonly in vogue, and although there exist a number of other methods more or less adequate and satisfactory in their work, they have not found general use. Daily, almost, new patents are taken out for refrigerator cars and refrigerator car apparatus, but none of these seem to be entirely satisfactory. The fact of the matter is that railroad refrigeration has not been approached in any sense as a broad engineering problem. The field is open and a large amount of individual work in small details has been accomplished, with very unsatisfactory results.

The problem of satisfactorily cooling cars while in transit is no more difficult than that involved in cooling any similar space for equal intervals of time. In spite of this, the whole situation is undeveloped and extremely unsatisfactory. We have to-day the ordinary method of dumping natural ice into cars, and this ice is collected along the railroad at regular intervals in houses provided for storing the same. The variation of this method consists in artificial production of ice at stated intervals by refrigerating plants, and its storage and installation in refrigerator cars. The development of individual refrigerating machines for single car units has been attempted without appreciable success. The number and variety of the devices with this object in view are innumerable. A majority of such devices depend upon the motion of the car to produce the operation of the refrigerating plant, and are therefore subject to considerable disadvantage. The same problem applies to the electrical lighting of passenger coaches by dynamos attached to the axles of the cars, a method which has been found very unsatisfactory in practice. When the car stops, light stops, unless a large and expensive storage battery is installed, and the system of switches required for automatically changing the current is no inconsiderable item. The same difficulties apply in the unit refrigeration by mechanical means. When the car stops refrigeration stops, and this is often sufficient to prove a great danger to perishable goods in transit. The difficulty can be obviated, of course, by the use of brine storage tanks to store the refrigeration and use when the car is not in motion, but this is unsatisfactory for the same reasons that storage batteries are undesirable in lighting systems.

The problem of cooling the car by direct refrigeration instead of the utilization of ice has been solved in one or two minor instances where the refrigeration required is not extreme. As an illustration, bananas are now carried in bulk for several days with cooled air injected into the cars at suitable cooling stations along the route. This involves the use of large mechanical refrigerating plants and the cooling of large quantities of air. This air is blown into the cars under slight air pressure and rapidly cools them and their contents. The fruit is cooled sufficiently to be carried for several days without re-cooling, the amount of heating which takes place depending upon the temperature and moisture in the atmosphere. The chief difficulty in this method of refrigeration is the production of sufficient ventilation to keep the goods in good condition without large losses in refrigeration. In the banana trade this seems to be satisfactorily solved. The temperature of the bananas need not be lowered very much, and can rise quite high without causing deterioration. Thus the range is considerable and the quantity of heat taken out of the car, which is returned by radiation and ventilation, is large in proportion to the bulk of the cargo.

This process, however, cannot be extended to any great extent by the air process without tremendous losses from an efficiency point of view and without the ever present possibility of considerable damage resulting from overheating. It can be stated at the outset that refrigeration of cars by unit refrigerating machines installed in the cars and operated either by the motion of the car itself or by power received from the engine, is impracticable not only from a first cost point of view but also on account of its very small efficiency. Thus all the attempts to produce refrigerator cars complete in themselves is necessarily an uneconomic process, and one that almost invites failure from its very nature. The problem of utilizing cold air is acceptable and satisfactory with certain limitations necessarily involved in the nature of the process and the nature of the cargo, from the standpoint of amount of ventilation required, quantity of the refrigeration involved in the cargo and temperatures desired. As an illustration of this latter point, meat cold storage requires considerably lower temperature than that of many fruits. It would be almost impossible to maintain a temperature of 35 or 40 degrees in a refrigerator car with cold air for any appreciable length of time owing to the very small quantity of refrigeration held in the air itself and the fact that the low temperature would promote rapid radiation.

The only method in which this problem can be attacked satisfactorily is from a broad engineering point of view, paying attention not only to the needs of the railroad but also to the limitations of the various refrigerator processes. Apparently the only limitations of the railroad are: first cost, convenience of operation and minimum space. From a refrigerating point of view the limitations involved are necessarily small units with small quantities of heat used in the process, fairly low temperatures occasionally, and necessary ventilation with its accompanying losses in refrigeration. Now mechanical refrigeration is able to exist economically under some circumstances in stationary units smaller than that of a refrigerator car. Small one and two-ton refrigerating machines exist and operate at a distinct economic advantage both from an efficiency and convenience point of view in considerably smaller units than that required for refrigerator cars, so that this latter statement explains to a certain extent the large amount of work done at present in attempts to instal single automatic refrigerating machines in separate cars. The process of air cooling as now used in the banana trade, with refrigerating stations instead of ice houses at stated intervals along the route, is thoroughly practical and very efficient and is capable of considerable expansion. The entire problem, however, of railroad refrigeration can only be approached satisfactorily with a complete knowledge of mechanical refrigeration and its limitations. Mechanical refrigeration is an economic process to-day with two different processes. Both of these, however, involve the boiling of liquid ammonia. They are known respectively as the compression machine and the absorption machine. For extremely large units the absorption machine is much more efficient than the compression machine, although in small units the compressor holds its own fairly well on account of smaller first cost and ease of operation. However, it should be borne in mind in railroad work that refrigeration can be produced much cheaper in large quantities and that the absorption machine is much superior in efficiency to the compression machine. But the absorption machine is so complex in its operation and requires so many different units and so much care in its maintenance that no automatic absorption machines have ever been built. This eliminates the possibility of utilizing small units of mechanical refrigeration in cars if any consideration at all is given to the production of refrigeration and the efficiency of this process.

Refrigeration when it is produced—and, as we have stated, it can be best produced in large plants by the absorption machine—can be utilized in a number of different ways, each of which offers special different advantages depending on the immediate application of the refrigeration. Thus, in ship refrigeration, which is somewhat analogous to railroad practice, air refrigeration has been used. The reason for this, however, is largely the possibility of ammonia gas escaping and injuring the product as well as rendering the ship uninhabitable. Direct air refrigeration by balanced expansion has a prime cost factor three times as great as that of ammonia expansion and from an efficiency point of view in operation is scarcely half as high as that of an ammonia plant. Air cooled by contact with ammonia pipes, however, is often used in both cases and presents one of the possibilities of railroad refrigeration but has a number of limitations.

Now refrigeration produced in ammonia machines can be utilized in a number of ways. There exist what is known as direct refrigeration and indirect refrigeration. The indirect refrigeration requires the use of brine as an intermediary in the utilization of the cold. The reason for this is purely mechanical. Ammonia pipes carry the ammonia under pressure and are sometimes subject to chemical action and leaks of the ammonia gas are not only undesirable but often injurious to the goods in the refrigerator. In practice, brine is ordinarily used, and the pipes carrying the ammonia occupy a small space and cool the brine, which is made to circulate wherever wanted. The advantage of the brine system is that brine can be used as a storage reservoir; that is, a large quantity of brine can be cooled off by the machine, the machine can then be stopped and the cold brine can be circulated through the system, producing refrigeration just as if the machine were in operation, and the cold brine, which has a large heat capacity, becomes hot very slowly, so that in some cases the machine may be stopped for several days without a very appreciable rise in the temperature of the refrigerating coils.

Thus, when we consider mechanical refrigeration from a general point of view, the development of its application to railroad refrigeration is at once almost self-evident. The production of ice in individual plants by the use of the brine is not only wasteful

and inefficient but is absolutely unnecessary. The brine itself can be used and possesses large heat capacity. Injected into refrigerator cars it could be used in pipes or in a narrow tank about the walls or at one end of the refrigerator car, and the system could be arranged so that less space would be taken up. The possibility of having single tank cars carrying nothing but cold brine connected with pipes through the various cars and operated from the locomotive very much as the modern air-brake system is utilized presents a possibility which from an efficiency point of view is far superior to the methods now in vogue. Brine tanks could be installed under the cars and filled at stated intervals, and automatic devices constructed readily to show when the temperature rises above the danger point. The brine could then be renewed at suitable stations in exactly the same manner as the Pintsch gas tanks are refilled. This process would involve a saving not only from a refrigerating point of view in the operation of the refrigerating machine and the elimination of the production of ice as at present used, but the refrigeration could be produced in extremely large units and the brine transported either in cars or by pipes to other suitable distributing stations.

This plan is so sensible and involves such a large saving in almost every department extending from the production of the refrigeration to its handling and the saving of space and its transportation, that it seems remarkable that this process has not been developed before. There is no doubt that it will be developed as soon as capable engineering experts take charge of the problem, although such men must be capable not only from a refrigerating standpoint but from a railroad standpoint as well.

In conclusion it can be stated that the present methods are absolutely inadequate and extremely inefficient, and the developments that are now going on in the line of individual refrigeration is an attempt to solve the problem along wrong lines.

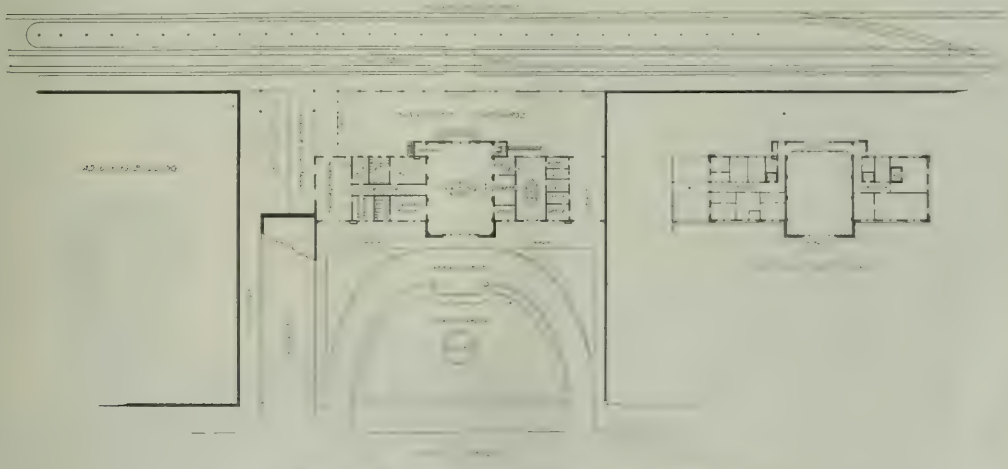
The New Union Station at Lexington, Kentucky.

A new Union station is now being built at Lexington, Kentucky. It is to be ready for use within two or three months. The accompanying illustrations are made from the original sketches for the building; for them we are indebted to Richards, McCarty & Bulford, Columbus, Ohio, the architects. This station is to be used for the Chesapeake & Ohio, the Louisville & Nashville, and the Lexington & Eastern railroads, the latter a 93-mile line from Lexington east to Jackson, Kentucky. It is being built by the Union Station Company, in whose ownership and management each of the railroad companies have representation.



Architects' Sketch of New Union Station at Lexington, Kentucky.

The site is a central and convenient one about two blocks from the business center of the city, fronting 265 ft. on Main street and extending back 240 ft. from Main street to Water street, on which are the tracks of these three railroads. The station fronts on Main street, which is toward the north. On the east is an alley 16 ft. wide marked "Service Drive" on the drawing. Between this alley and the station 40 ft. has been reserved for a viaduct from Main street, running past the east end of the station, over the railroad tracks, and connecting with High street, the first street south of Water street. The grade of this viaduct is such that there is entrance to the second floor of the station from the viaduct level; this for the benefit of the offices which are to be on that floor. The space next to the station under the viaduct is to be used for service wagons; no baggage, mail or express wagons are to be allowed to enter the court in front of the building, which is reserved for carriages.



Plan of New Union Station at Lexington, Kentucky.

The station building itself stands about 150 ft. back from Main street, leaving a large court in front enclosed on three sides by the station, the viaduct wall, and on the west an ornamental wall built against an adjoining building. From each corner of the front court

to the main entrance of the grand waiting room, the space between this carriage drive and the street is to be a sunken garden with fountains, flower beds and shrubbery. The entrance to trains will be either through the main waiting room or through the waiting room for colored people. Passengers arriving on trains need not pass through these waiting rooms, but can go out to the street through an open passage at the west end of the station. In this way passengers are entirely separated from the baggage, express and mail end of the station.

The passenger concourse between the station and the tracks is 50 ft. x 220 ft. It is roofed in and protected from the weather, and lighted and ventilated by skylights. In order to handle crowds effectively the passenger concourse is enclosed with a high iron fence which allows entrance to the train platform only through the gates, where shown. The inside track platform, next to the passenger concourse, is 14 ft. wide. There are three tracks, two for local service, and the outside one for through service. The platform between the through service track and the local service tracks is 20 ft. wide. It has been attempted to avoid columns in these platforms as much as possible. These two platforms are together 700 ft. long. Butterfly roofs are used instead of the umbrella shed, thus throwing all the water from these roofs toward the center from which it is carried down each of the columns to the sewer connection instead of throwing the water to the outside next to the cars.

On the ground floor of the station in the center is the grand waiting room, which is 50 ft. x 72 ft., and has a barrel arch ceiling 55 ft. high at the center. This room is lighted, not only by the two large arches at each end, but by art glass ceiling lights. The waiting room for colored people is 22 ft. x 48 ft. The ticket office is between the two main waiting rooms, thus serving both white and colored passengers, but keeping them entirely separate. On the opposite side of the grand waiting room from the ticket office there is a smoking room for men and ladies' waiting room. Between these two rooms a 10 ft. corridor leads from the grand waiting room to the baggage room, so that it is not necessary for passengers to go outside to check baggage. As the Phoenix Hotel adjoins the property no provision was made for a restaurant or eating room in the station.

The second story of the building is used for the general offices of the Lexington & Eastern. This space is, of course, only in the two wings which are connected above the main waiting room by a balcony at the south end. The building is made of fireproof construction. The material for the exterior is a rough orange mottled brick, trimmed with terra cotta. The roof is Spanish tile. On the first story all floors are marble and tile. The wainscoting is of white marble, the wood finish, doors and windows throughout are of quarter-sawed oak.

The New Cincinnati Freight Terminal of the C., N. O. & T. P.

The proposed new freight terminal of the Cincinnati, New Orleans & Texas Pacific at Cincinnati, Ohio, to be built by the lessor company, the Cincinnati Southern Railway, was described and illustrated in detail in this journal something over a year ago (*Railroad Gazette*, September 29, 1905). The plans provided for a thoroughly up-to-date large-city terminal on an entirely new site much nearer the business district of the city than the terminal then in use, and which was acquired at considerable cost, the sum exceeding $1,300,000. The work suffered considerable delay and was not finished until the fall of 1906. A photograph of the terminal taken from the corner of Vine and Front streets is presented herewith. It shows the office portion and the inbound freight house, the great length of the latter—1,142½ ft., almost a quarter of a mile, from Vine street to the west end—causing the farther end to dwindle to indistinctness in the view.

The office part is 130 ft. front by 45 ft. deep and the two freight houses are each 1,000 ft. long. The outbound house is 42 ft. wide and the inbound house 25 ft. wide. Each has a two-story portion 135 ft. long adjoining the office building for record rooms for the general offices of the railroad company. The entire structure is built principally of reinforced concrete. The office portion has steel roof trusses and tile roof and the concrete walls are faced with pressed brick with stone trimmings. The freight houses have wooden roof trusses and tile roofs, and the walls are without the brick veneering, having instead a plaster finish on the concrete surface.

The freight house tracks have room for 81 cars. The capacity of the new outbound house is double that of the former quarters, while the inbound house capacity was increased six times. The work was begun under the late Col. G. B. Nicholson, who was Chief Engineer of the C., N. O. & T. P. and Chief Engineer and Superintendent of the terminal work for the Trustees of the Cincinnati Southern. It was completed under Mr. H. E. Warrington, the present Chief Engineer, who as Principal Assistant Engineer, took charge of the department when Colonel Nicholson was relieved from active duty on account of failing health.

Government Investigation of the Terra Cotta Collision.

On Monday of this week the Interstate Commerce Commission resumed its hearings on the rear collision at Terra Cotta, D. C., December 30, in which over 40 passengers were killed. We continue from our last issue the report of the evidence.

W. N. Dutrow, block signalman at Silver Spring.—I am spare signalman for the Baltimore & Ohio. My home is at Boyds, Md. Am 22 years old, and Boyds has been my home for the past five years. In 1905-06 I was agent and operator for the Atlantic Coast Line in North Carolina, mostly at Oak City. My wages there averaged $46 a month, including commissions on the express business. I learned telegraphy in 1903 under the agent at Boyds. Was in the office with him every night for six months. On the Atlantic Coast Line I was examined by the despatcher at Tarboro. After a year on that road I returned voluntarily to Maryland so as to be near home and to get an eight-hour job. I was examined very briefly by the division operator. He told me to post up on the block-signal rules. I did so, and after ten days went to work at Rockville. This was in October last. I worked there and at other stations five days in October, 12 days in November and 16 in December. I was at Silver Spring three nights before the collision. The pay there is $48 a month. The hours of operators in Maryland are eight hours, but some agents perform other duties before or after the eight-hour period, so that they are on duty altogether 10 or 12 hours. The only special instructions I received at Silver Spring were from Miss Harrington, the regular operator from 4 p. m. to midnight, who



New Cincinnati Freight Terminal of the C., N. O. & T. P.

took a vacation for the holidays, that the "double green" meaning the green lantern to be used in connection with the green semaphore light to give a permissive signal—was to be hung out every night and kept there from 7:00 p. m. to 6:30 a. m. The helper at Silver Spring is 70 years old and receives $20 a month.

The double green is shown to every eastbound train at Silver Spring during the night, so that the cross-overs at Terra Cotta and at University may be used by westbound trains at any time. I know of no printed rule covering this matter. (It appears that certain eastbound night passenger trains are scheduled to run from Silver Spring to University and beyond at 60 miles an hour and faster. As the road has a number of curves, the caution signal would apparently make it impossible for these trains to make their schedule time.) Asked whether there was a distant signal at Silver Spring, witness apparently had never heard of such thing as a distant signal.

Train No. 6, eastbound, passed my station December 30 at 4:43 p. m.; No. 66 at 6:21 p. m., and extra 2120 at 6:28. I gave white (all-clear) to both 66 and 2120. The latter was running at about 20 to 30 miles an hour. I saw the white signals on the engine. About 6:33 p. m. Takoma informed me that 2120 had passed his station at 6:31.

Engines have run by my red signal perhaps 50 yards. I know of no inspection as a check against this irregularity. The first I heard of the collision was through the messages passing over the wire ordering out relief trains. I spoke with nobody about the signal at my station, except that the agent at Boyds, an old acquaintance of mine, asked me what signal I had given to 2120 and I told him white.

Asked if he had had any controversy with the despatcher that night, witness said he had not. About seven or eight o'clock the despatcher wanted him to call Day Operator Burns. After a second notification, Burns came to the office but refused to work. The despatcher seemed to think that I had not properly handled his orders, but I had done nothing wrong. Operator Feeney was in my office about 8:00 p. m. and, being near the blanks, received a message for me.

Q. Were you excited about the collision? A. I was perfectly calm. I stayed on duty until midnight. Q. The men on trains 66 and 2120 say that you gave them the double green signal; is that true? A. It is not. Q. If you had given double green and it was wrong to do so, would you tell the truth about it? A. Yes, for even if I had given such a signal the engineman would be at fault for accepting it, because it would be his duty to stop and inquire the reason for the display of an improper signal at that time (before 6:30). Q. Why should the men of trains 66 and 2120 declare that they received double green at your station if the signal was really white and they knew it to be so? A. To support their untruthful story that the responsibility rested on me. (Taking the witness' assertion as true, that the signal showed white, his opinion here rests on the assumption that Vermilion, the engineman of No. 66, testifies "double green" so as to support Hildebrand, the engineman of 2120; that Hildebrand either did not see the signal, or saw it white; and that each fireman corroborated the testimony of his engineman as a matter of course.)

C. E. Remsburg.—I am signalman at University. Am 35 years old and have been a telegraph operator 15 years. I learned during two years that I acted as mail carrier. Have been at University as block signal operator 7½ years. My examination for that position was by Mr. Little, division operator. It took about 20 minutes. My pay is $55 a month, about five dollars more than it was two years ago. I learned of the collision at 6:45, the conductor of No. 66 reaching my office on foot at that time. For all eastbound trains I display a green signal, my station being near the terminal yards at Washington. A double green would mean substantially the same as my signal, as it requires a train to run under control the whole length of the block section. (It appears that though green is given for every train, passenger trains are not allowed to follow other trains under green signals until the last preceding train has reached the next block station, except on an order from the despatcher.)

Miss Marguerite Harrington.—I have been block-signal operator at Silver Spring since last October. Before that I worked two years on the Illinois Central. I was examined by the division operator; was tested as to my proficiency as a telegraph operator and also on the rules. I work from 4:00 p. m. to midnight and do nothing but block-signal work, there being a station agent who attends to the ordinary station work. Operator Dutrow, who was taking my place on December 30, had been there once before. At that time I had told him that the double green was the signal given to all trains from 7:00 p. m. to 6:30 a. m.

Takoma sometimes closes as early as 6:20. Q. Suppose No. 66 received a double green at Silver Spring at 6:21, what should the engineman do? A. On either a single green or double green, he would run under control to Takoma. I understand that single green and double green mean virtually the same thing. Q. Do you give permissive signals to passenger trains frequently? A. Perhaps twice a week. No. 66 would have no right to assume from seeing a double green before 6:30 that Takoma was closed.

Engines have passed my red signal a few times, but [illegible] farther than that. In case of sickness, block-signal operators have in one or two cases worked 16 hours continuously. I have worked 17 hours on one occasion. On the Illinois Central I worked controlled manual, single track. I feel safer here, under the "telegraph block," as we use the telegraph, while on the I. C. we used the telephone, which was confusing. Asked whether the telegraph block system would be better than the controlled manual on the Illinois Central, witness was not prepared to compare [illegible] working.

J. W. Kelly, Jr., trainmaster, was recalled and testified at length concerning the hours of freight trainmen, as shown by the records for the months of October and November. Certain night crews worked 14 hours, 22 hours, and in one case 36 hours; the crews' work was more night than day. Another crew worked 20, 19, 19, 21, 19 and 21 hours daily; another, 22 hours, 21½ hours, 19 hours, etc. The worst case was one of a crew that worked an average of 21 hours daily for five consecutive days. It appeared, however, that these crews were all on short and irregular runs, and that they had to wait at branch termini for boats or were otherwise delayed. Asked if the men could reasonably endure these hours, witness said that they could not, unless they slept some during the time they were on duty. It is against the rules to sleep on duty. After a good deal of questioning, it appeared that witness would mildly censure the men for sleeping on duty, if he knew of it; but if an engineman slept while on the road, suspension would be the penalty. Asked why the company did not put on two crews, so as to divide these long periods of service, witness replied that the men preferred the long hours; if there were two crews, the earnings of each would be reduced so that they would be dissatisfied. In another case a pick-up crew worked regularly from about 2 a.m. to 4, 6 and 8 p.m., but there was opportunity nearly every day for the men to sleep some; and a good deal of the work was switching, not road work. Asked why this run was not changed, witness said that "everybody was after it"; the men make large wages on account of the extra hours for which they are paid each day.

Q. Are these long hours safe? A. On these runs they are. Q. Was it safe for Hildebrand to run as he did on December 28, 29 and 30? A. This was not excessive, considering that he had had a long rest on Thursday.

Asked about the schedules of night passenger trains at 60, 70 and 80 miles an hour from Silver Spring to University, where they have to run regularly under the double green signal, witness said that enginemen were always freely excused for not making time whenever caution signals necessitated slackening of speed. Q. Would it not be better for No. 66 to have a separate schedule for Sunday, when it makes extra stops? A. No, for this would make one more schedule on the time table and perhaps thereby confuse trainmen.

Answering Commissioner Clark, witness said that the double green was not only a signal indicating that a train might be expected at a cross-over, but also indicated caution throughout the block section (the same as a single green). Double green at Silver Spring at 6:28 for a regular passenger train would be wrong and the train should stop. Q. Why should the engineman of No. 66 say that he received double green at Silver Spring on December 30 if he actually received white? A. I cannot answer. Q. Has this engineman been disciplined? A. We have as yet received no conclusions in his case.

Thomas Fitzgerald.—I have been general manager of the Baltimore & Ohio two years. Before that was general superintendent and superintendent. The block system has been in use on this section of the line about 15 years. We have about 700 miles telegraph block and 100 miles automatic. There have been cases of enginemen disregarding both distant and home automatic signals, and in one case there was a collision from this cause. We have had false clear automatic signals, but not to any extent. Under the telegraph block system on our road this is the first accident of any consequence that I can recall. The telegraph block system, properly operated, is probably as safe as the automatic, but the automatic is a great relief to the railroad officer, because with it he can say that he has adopted the best protection known. Except for this point the telegraph block system is probably just as good.

Q. What is the weakest point of the telegraph block system? A. The human family. Q. Then the thing that needs attention in it is the personnel, is it not? A. Yes. Q. What inspection have you, to maintain the integrity of the block signal? A. We have the usual number of officers for looking after the men. We have not yet had any surprise checking. We have thought that we could get better service from the men by trusting them. Our men, as a rule, are a good set. Excessive checking may impair a man's individuality. Still, said the witness, we shall probably have to adopt surprise checking. Q. Have you had complaints of unreliability of signalmen? A. Yes, sometimes. A man, perhaps, becomes addicted to intoxicating liquors; a fellow operator or some other observer may report him. Q. Should it not be the duty of some one on the part of the road to keep a check on these men? A. I do not know how you could keep a constant check on all the operators. I find that an

efficient train despatcher seldom has a bad operator. The minimum salary of block signal operators now is $52, and for 12-hour men $55. At interlocking towers the pay is from $70 to $75. Q. Will $47 to $60 a month furnish you with capable operators? A. The service is easy, and for competent men there is a good chance for advancement. Of natives, we keep all we educate, but the floaters make some trouble. I find that other roads are in the same situation. The trouble is that there is not a sufficient supply of operators. Q. Have you tested devices for automatically stopping trains? A. We test everything that has merit, and we are constantly looking for everything new that is good. The only device that I remember as being tested by us recently is one for shutting the throttle valve of the locomotive, which was tried by our signal department at or near Pittsburg some time since.

Asked as to the relative cost of the automatic and the telegraph block system, witness said that, taking everything into account—the interest on cost and expenses of operation—the automatic was but little cheaper than the manual. (In this comparison, however, the fact that the block sections under the automatic were much shorter than under the telegraph block system was not taken into account, apparently.) Q. Is the automatic superior in point of safety? A. I cannot say; that is a matter of opinion. Q. Are you going to extend the use of the automatic? A. We are. Q. Does any officer keep watch to see that trainmen do not work excessive hours? A. Some six months ago train despatchers were instructed to check the trainmen and take them off if found to be working too long. Q. Is it safe to let enginemen decide for themselves when they ought to take a rest? A. I am not sure that we should do otherwise than leave the men to judge this matter for themselves; though, of course, there will be exceptional cases of men who will deliberately stay out too long.

Asked about the agreement of the company with brotherhoods of employees, witness replied that there was one to the effect that after working 15 hours a man should be entitled to 10 hours' rest. Asked about enginemen disregarding signals and the punishment therefor, witness could give no exact information. Men are censured and, at times, suspended. Q. Should not there be distant signals all along the line? A. Possibly it would be a good thing; but I do not recall an accident due to the lack of a distant signal. It is not unusual for trains to come in 30 minutes late on a foggy night and report that the delay was due to the necessity of slackening speed on account of fog. Very few of our enginemen have passed stop signals. In case a man of 20 years' experience and a good record commits this error, it is a question whether it is to the interest of the company to dismiss him. Of course, we suspend him, perhaps 60 days. Witness could not recollect cases of signalmen giving false clear signals, or what punishment had been imposed, though he thought there had been several cases.

Concerning a daily record of the watches of all conductors and enginemen, which is required by the rules, witness could not say that it had been regularly enforced, but in general he knew that conductors and enginemen took pride in having their watches run accurately. Asked why the former five-minute allowance for variation of watches, in the case of trains of the same class meeting, had been abandoned, witness said it was because the American Railway Association had so changed the standard rules. It was found that trainmen would use the five minutes. Asked about the propriety of extinguishing the semaphore light at a block station which is closed for the night, witness said that this practice also was in accordance with the general standard practice.

Asked about the effect of the Maryland eight-hour law and about cases of signalmen working outside after the eight-hour period, witness said there had been a number of such cases. It was difficult, if not impossible, to regulate men's conduct when off duty. In one case an eight-hour signalman was found to be running a saloon. He was dismissed; then he married the saloonkeeper.

Asked concerning the discrepancy in the testimony of the different witnesses as to the times that engine 2120 passed the several stations, witness said that from the records made by the block signalmen at stations west of Silver Spring, and from the views of men familiar with the line as to what the speed of the train would be, one would readily conclude that the record of the signalman at Silver Spring was right. (This would indicate either that Hildebrand's watch was three minutes fast, or else that he misstated the time.)

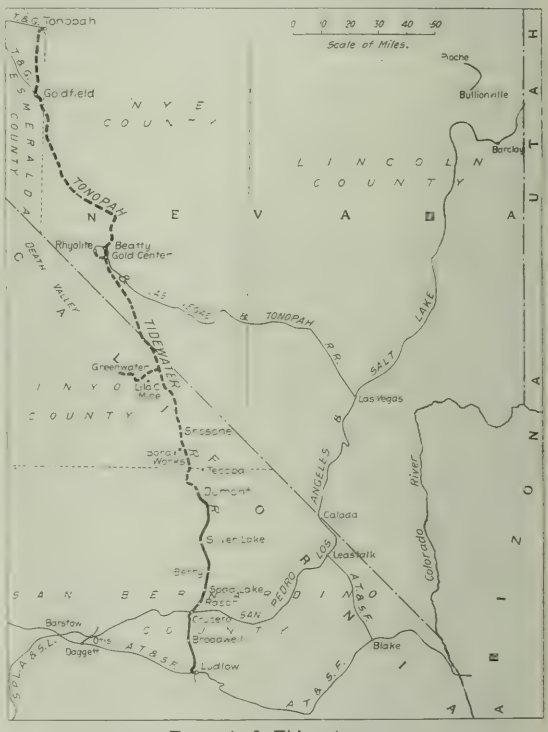
Referring to criticisms of the clocks in the block signal stations, and at other places on the road, as being poor timekeepers and requiring to be set nearly every day by the standard time received over the telegraph wire, Mr. Fitzgerald, and also Miss Harrington, testified that every operator receiving train orders, comes by force of habit to keep his clock pretty nearly right, because in every order received the despatcher gives the time, and the operator automatically glances at his own clock to see if the time given by the despatcher corresponds with his own.

The coroner's jury which investigated the collision on the Baltimore & Ohio at Terra Cotta, D. C., December 30, held eight railroad officers and employees responsible for the disaster: William E. McCauley, assistant division operator; T. F. Dent, train despatcher; J. W. Kelly, Jr., division trainmaster; Harry H. Hildebrand, engineer of No. 2120; Frank F. Hoffmeier, conductor of No. 2120; R. L. Vermillion, engineer of train No. 66; George W. Nagle, conductor of train No. 66, and William Dutrow, operator at Silver Springs. The verdict charges Dutrow with the chief criminal responsibility, and the rest with a lesser degree of negligence. It directs that Dutrow be held for the action of the grand jury. The block system on the Baltimore & Ohio is declared not to afford satisfactory protection, and the rates of wages paid the operators and signal men are declared insufficient. It is also recommended that all block signal stations be kept open throughout the day [and night] and no additional duties given to the operators aside from working the signals and attending to the telegraph.

The Tonopah & Tidewater Railroad.

The projected route of the Tonopah & Tidewater Railroad and the line already built are shown on the accompanying map. The road is to extend from Ludlow, Cal., on the Atchison, Topeka & Santa Fe to Tonopah, Nev., 250 miles. It is already in operation from Ludlow to Dumont, 75 miles, and is being rushed to completion as fast as heavy rock work will permit. As soon as the grade is built through the Amargosa canyon, north of Dumont, track can be laid at the rate of a mile a day on the rest of the road.

After leaving Ludlow the road enters a highly mineralized re-



Tonopah & Tidewater.

gion in which are a number of old lake pits rich in borax. About 20 miles north of Dumont are extensive borax deposits which have been developed by F. M. Smith, who is the principal owner of the road. A borax plant will be started as soon as the track reaches this region this spring.

The company will soon put in service an automobile line from the main line about 10 miles east to Tecopa, which is the center of a group of rich mines, as a feeder to the main line. From a point about 120 miles north of Ludlow a branch will be built westward into the Greenwater district, whose copper and gold mines are now being rapidly developed. An automobile service will be established to the "Lila C" mine. There will be branches to Rhyolite and Bullfrog, while the main line will run north via Goldfield Center and Beatty. Bullfrog will be 168 miles from Ludlow by this road.

While the Greenwater district is a recently opened one, it is believed that its copper belt extending along the Tonopah & Tidewater will rival Butte as a copper producing region. Copper is in the main a recent discovery; the development of gold and silver mines in Tonopah, Goldfield, Bullfrog, Rhyolite and many smaller centers of western Nevada has been going on for several years.

Progress of Electrification in 1906.

The Western Society of Engineers, Chicago, held their annual meeting and dinner on January 8. The present membership of the society is 925, the increase for the past year being 96. The officers elected for the ensuing year are: President, W. M. Abbott; Vice-Presidents, Andrew Allen, E. N. Layfield and A. M. Talbot; Treasurer, Albert Reichman; Trustee for three years, Willard A. Smith. Mr. B. J. Arnold, the retiring President, delivered the principal address of the evening, his subject being "The Progress of Electricity on Steam Roads in 1906." The address was illustrated with lantern slides. Much of the ground covered by Mr. Arnold is already familiar to readers of the *Railroad Gazette*, dealing as it did, briefly, with the acquirement of paralleling electric roads by steam roads, and with the electrification of the New York Central terminal at New York City, the Pennsylvania Railroad tunnel work at New York and also the Hudson & Manhattan and the New York and Jersey Co.'s tunnels, the New York, New Haven & Hartford electrification work, the West Jersey & Seashore line of the Pennsylvania, and the Southern Pacific's plans for electrifying about 20 miles of its suburban steam lines at Oakland, Cal. He also said: "The equipment of the Cascade division of the Great Northern Railway, over the Cascade mountains, a distance of about 100 miles, although not yet definitely decided, is contemplated. Its equipment would eliminate the use of steam locomotives now operating over a tortuous piece of road, and through a long and difficult tunnel. Electrification is also contemplated upon a division of the Southern Pacific Railway, through the Sierra Nevada mountains, for the purpose of eliminating the difficulties due to tunnel operation, and of increasing the capacity of the road, which is now limited by the size of the present steam locomotives."

Regarding the St. Clair tunnel of the Grand Trunk, he said: "In order to eliminate the present objections regarding the use of steam locomotives in the St. Clair tunnel of the Grand Trunk Railway, lying between Port Huron, Mich., and Sarnia, Ont., the officials of that company decided a little over a year ago to adopt electrical propulsion. After due consideration it was decided to adopt the single-phase method. This system was adopted for several reasons, the principal one being the objection to the use of the third rail in the yard at each end of the tunnel, which was quite extensive, and in which much switching had to be done in making up trains before entering the tunnel. The equipment will consist of six electric locomotives, weighing 120 tons each, having a normal capacity of 1,500 h.p., capable of exerting a drawbar pull of 25,000 lbs. at a speed of 10 miles per hour, and a maximum speed for passenger train service of 35 miles per hour. The power station, which is now well under way, will contain two 1,250 k.w. turbo-generators, either one of which will be capable of operating the tunnel up to its full capacity, the other being held in reserve. The decision to adopt single-phase for this installation was made by the speaker some time prior to the decision of the New York, New Haven & Hartford Company, and, like it, the working of this system in this class of service will be carefully watched.

"The Erie Railroad has a commission organized for the purpose of electrically equipping its lines, now running out of Jersey City, a total of about 250 miles, although it is contemplated that but 35 miles will be immediately equipped, comprising the division extending from Jersey City to Greenwood Lake. In addition to its suburban lines in the vicinity of Jersey City and its terminal, the road now has under construction 34 miles of single track, known as the Rochester division. This division lies between Rochester and Avon, N. Y., with a branch between Avon and Mt. Morris. The single-phase alternating current system will be used, having a working pressure of 11,000 volts on the overhead conductor. The energy will be secured from Niagara Falls at a pressure of 60,000 volts. Six passenger coaches, 54 ft. long, and seating 56 people, will be placed in service, each car weighing about 50 tons and equipped with four 100-h.p. motors. These cars will be capable of a maximum speed of from 45 to 50 m.p.h. and of hauling one trailer. While this extension of the Erie is short, the company has under contemplation the electrical equipment of its entire suburban service surrounding Jersey City, which will involve an expenditure of some $15,000,000. Plans are now being formulated for this expenditure.

"An important piece of equipment for electrical operation is now under construction by the West Shore Railroad between Utica and Syracuse, N. Y. The work in hand covers a distance of 44 miles, and the passenger schedule provides for limited trains in each direction, making the distance from terminal to terminal in 1 hour and 22 minutes.

"In deciding upon the plans, the relative merits of alternating current overhead equipment and third-rail direct-current equipment were carefully considered, and the decision to install the direct-current system was largely determined by the general flexibility of a third-rail equipment should it become desirable to make lateral extensions, install additions, side tracks, etc. Over certain sections of the line traffic conditions require that two additional tracks be built. These tracks will enable the passenger trains operated electrically at 55 and 45 miles an hour to avoid interference with freight trains operated by steam—fast freight trains with a schedule of about 25 miles an hour, and local freights with a schedule of about 15 miles an hour.

"Construction work was started on May 15, and is well under way at the present time. Electric power will be furnished by the Hudson River Electric Power Company, which will deliver three-phase, 60,000-volt current at the railway company's sub-station seven miles west of Utica. The Hudson River Company will for the present generate this current at its auxiliary steam plant in Utica, but upon the completion of its contemplated transmission lines current will very likely be taken from the hydro-electric plants owned by the company in the eastern part of the state. There will be four sub-stations located about 10½ miles apart. These will be identical in construction and each will be equipped with two 300-k.w. rotaries and the necessary apparatus for transforming 60,000-volt three-phase current to direct current for distribution to the rails at 600 volts.

"The transmission line towers will be of steel and similar in design to those built for the Syracuse Rapid Transit Railroad. There will be 391 of these towers, with normal spacing of 480 ft. Most of the towers are 39 ft. high, the highest being 63 ft. The line conductors will be located at the vertices of an equilateral triangle 7 ft. on a side.

"The third-rail construction is the Wilgus under-running protected type, this being the standard adopted by the New York Central. The third rail is located between the parallel tracks except where curves, or other special conditions, require it to be transferred to other sides of the track. The company will operate 15 closed cars, 49 ft. over the bumpers, each equipped with four 75-h.p. motors per car, and multiple unit control.

"The Spokane & Inland is a single-phase line between Spokane, Wash., and neighboring cities, having a total of 114 miles. The capital invested in the project is, approximately, $3,500,000. The service includes passenger, mail, express and carload freight. The power is purchased from the Washington Water Power Company and is delivered to the railway company, as three-phase, 60-cycle current, at a frequency changing station 10 miles south of Spokane. This station has four frequency changers, each of nominal 1,000 h.p. capacity, which convert the current to 25-cycle, 2,200-volt, single-phase current. For transmission to the sub-station this 2,200-volt current is stepped up to 45,000 volts and transmitted to 15 sub-stations, where it is stepped down to 6,600 volts for direct connection to the trolley circuits.

"The cars and locomotives operate on three different voltages at different parts of the line. In the country 6,600-volt alternating current is used and in the smaller towns 700-volt alternating current, while within the limits of Spokane 600-volt, direct current is used. In the country and through the small towns a pantagraph under-running trolley is utilized, while in Spokane the ordinary under-running trolley wheel is used. The passage from the alternating current to the direct current system is done by operating a commutating switch, which makes all necessary connections, and by changing the trolley from the pantagraph to the wheel type.

"The cars are equipped with four 100-h.p. alternating current motors. The locomotives use the same type of motors, but have a capacity of 150 h.p. each. Both the locomotives and coaches may be operated on the multiple unit system. The locomotives are capable of handling seven standard freight cars, fully loaded, at 30 m.p.h. on level track. A locomotive weighs 49 tons and has a length over the bumpers of 29 ft."

Referring to European work, he said: "Some recent installations may be of interest. Progress is being made on the tunnel work under the Seine for additional lines to the Paris Metropolitan Railway. The project for the tunnel under the English channel between Calais and Dover has acquired a new interest and is a subject under much discussion. The proposed tunnels would be 18 ft. in diameter, the submarine portion being 24 miles in length, with approaches six miles in length, and, of course, would be operated electrically. This tunnel is designed to carry the rolling stock of the principal European railroad companies. * * *

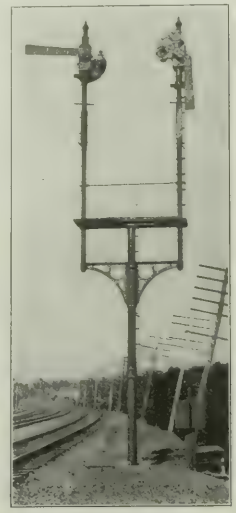
"From an examination of the map of the business district of Chicago, bounded by 16th street, Halsted, Chicago avenue and the lake, it will be seen that 23 per cent. of this area is occupied by the tracks of the steam railway companies. In view of the present state of the art of electric railroading the right to vitiate the air of our congested districts by the emission of large quantities of carbon dioxide from the stacks of the numerous locomotives is as questionable as the right to foul the air by the stenches from our stock yards. As there is now a possibility of the removal of these yards from our midst, is it unreasonable to hope that all of the steam railroad companies, through the wise foresight of their officers, may help to purify and beautify the city by assisting the general movement now under way by our progressive, civic bodies for this purpose? In my judgment, at least one, and probably three, of the companies now operating in the city of Chicago can afford to and would profit by the electrical operation of their suburban trains."

Automatic Block Signals on the Baltimore & Ohio.

The Baltimore & Ohio has recently installed a number of the top mast direct-connected type of electric motor signals made by the General Electric Co. This signal, formerly known as the Herman signal, was illustrated and described in the *Railroad Gazette* July 1, 1904, but since it has been taken over by the General Electric Co. it has been redesigned and improved in many respects. The entire mechanism is contained in a metal box or case at the top of the post and the signal blade is attached direct to the main shaft without the interposition of rods or levers; the relays are mounted in a box at the base of the post for convenience in inspection and maintenance. The signals on the B. & O. are of the three-position type, the downward inclination of the arm indicating proceed.



Independent Home and Distant Signals, New York Central.



Three-Position Signals on the B. & O.

The motor, while being of standard design, embodies some special features. The field coils are wound with a special flexible enamel covered wire which possesses high insulation resistance and withstands an abnormal puncture test. The pole pieces are built of a special grade of laminations. The armature coils are wound in slots in a laminated core, and after being baked at a high temperature are subjected to the vacuum insulating process, which thoroughly impregnates the armature with a compound of high insulating properties. The commutator is composed of copper bars of uniform hardness, mica insulated. Brush-holders and brushes are easy of access, the springs exerting a uniform pressure between the brushes and the commutator, and an easily removable commutator cover is provided.

The motor transmits movement to the signal clutch wheel by a train of gears. The clutch magnets, when energized, engage a toggle arm with bosses on the clutch wheel, transmitting the motion to the signal blade. The lock magnets, when energized, hold the signal blade in the desired position until these lock coils are de-energized, when the blade returns freely to stop position by gravity. The clutch and lock coils are wound with enamel-covered wire possessing the same characteristics as that used for the field winding of the motor. A dash-pot is provided for retarding the return motion of the blade to any desired degree. This dash-pot is filled with a special grade of Russian oil, the viscosity of which is not affected by temperature. The absence of reciprocating motion in operating the signal blade and the avoidance of vertical rods, guides and jaws and all outside connections to the spectacle casting, is a feature of considerable advantage, tending toward simplicity and reliability of operation.

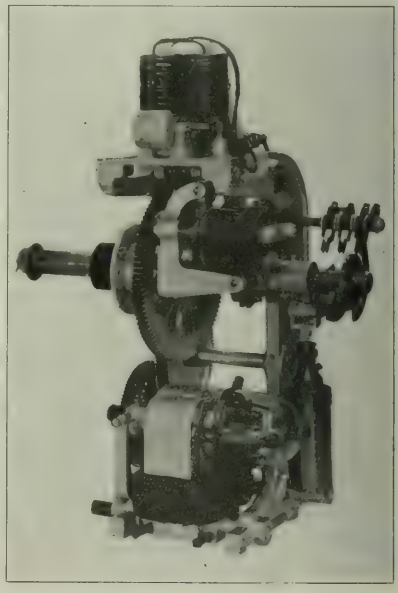
All parts of the signal mechanism are interchangeable. The toggle levers are composed of a non-corrosive nickel alloy and the gears and clutch wheel are of good cast-iron; the pinions are of steel. Bearings are of bronze and are provided with convenient means for lubrication. The contact fingers are firmly fixed on square insulated studs, and are non-adjustable. The contact sectors are firmly fastened to the main shaft, an extra adjustable circuit control being provided. The contact sectors and fingers are composed of a special non-corrosive alloy. The side frames are of high grade cast-iron, with solid webs. The entire mechanism, when assembled, is strong and rigid, susceptible of but little wear, and, apart from the brushes, requiring no adjustment. This non-adjustable feature of the mechanism makes it adapted for location at the top of the mast, as maintenance is reduced to a minimum, the only attention required being that for lubrication and inspection of the commutator and brushes. A seat is provided at the top of the post for the maintainer. While top mast signals have occasionally been objected to on the score of difficulty of maintenance, it has been found by practical experience in service on the Baltimore & Ohio that this signal is not open to this objection. The elevated location of the signal places the mechanism at the point where the work is to be done and the signal is above the influence of surface fogs and moisture. The motor is free from the action of frost, which has frequently caused trouble with signals of the ordinary type, where the mechanism is located at the bottom of the mast. The direct-connection of the mechanism to the signal shaft insures economy of current consumption and reliable operation at low voltage.

About 150 signals are in operation on the Baltimore & Ohio. Most of these are used as distant interlocking signals, but 25 have been installed for automatic service on the main line between Baltimore and Relay. These signals were put in operation in July, and during the months of August, September, October and November they have indicated 368,712 movements without a failure.

This signal is also adapted to two-position operation, and the design of the mechanism case is such that a signal may be inserted in the mast at any desired point, thus two or more signals, with independent mechanisms, may be operated on the same signal mast. This arrangement is shown in one of the illustrations of an electric top mast home and distant motor signal with independent mechanism on the New York Central.



Top Mast Signal Mechanism in Case.



Signal Mechanism Removed.

Washington Correspondence.

Washington, Jan. 15.—The hearings in progress before the House Committee on Interstate and Foreign Commerce on the Sherman bill proposing to require all railroads engaged in interstate passenger traffic to issue interchangeable mileage books at the rate of two cents a mile, and several other bills proposing two-cent fares in various forms have attracted comparatively little attention. Although the Sherman bill was introduced at the instance of organizations of commercial travelers, and although they were notified that the hearings would take place and were requested to send

representatives no one has yet appeared in favor of the bills. Representatives of several important railroad systems have submitted arguments in opposition. They have contended that either one of these bills would have the effect of reducing all interstate rates and most state rates to a maximum of two cents per mile. The unreasonableness of a proposition to enforce such rates on many of the roads of the country has been pointed out and it has been argued that the reasonableness of a passenger rate depends very largely upon the density of traffic on the line of a road and the cost of conducting its passenger service. Representatives of some of the western and southern roads introduced statistics of population and of passenger movement to show that a rate that might be reasonable on an eastern road running through a densely populated part of the country, having a heavy suburban passenger business and well-filled through trains, would be ruinous to a road in the west or south serving sparsely settled communities and hauling passenger trains with very few passengers. It is contended that any of the bills would be unconstitutional on the ground that the rate prescribed would amount to taking the property of many of the roads without due process of law, and that it is beyond the power of Congress to enact a law like that proposed by the Sherman bill which would compel each road in the country to enter into contractual relations with every other road, to honor its tickets, and to become responsible for their redemption without regard to the responsibility of the issuing road. The hearings have not yet been concluded, but the questions and comments of members of the Committee seem to indicate that there is little prospect of favorable action on any bill that has thus far been presented.

J. C. W.

Railway Signal Association.

The January meeting of this Association was noticed, with a list of the new committees, in the *Railroad Gazette* of January 11, page 58. The first discussion was on how to remedy the effects of foreign current on automatic block signals. The committee report on this subject was presented at the October meeting, but not discussed. The principal recommendations of the committee were printed in the *Railroad Gazette*, October 19, page 333. The Secretary read a letter from Mr. Henry Bezer describing an arrangement of track relays which he had lately put in use on the Central of New Jersey at Bethlehem, Pa., to make automatic block signals proof against disturbances from foreign currents.

The paper described that with rails intact the foreign current via the track relay would be limited, but with broken bond wires, or a rail broken, the current would be considerable, increasing the nearer the exit end of the block was to the broken rail.

Protection is given by low wound auxiliary coils in the track relay, which must complete a circuit before coils of higher resistance can complete the signal circuit. The auxiliary coils are then out of circuit.

A shiftable weight adjustment renders the auxiliary coils inoperative at anything below a predetermined current. They could safely be adjusted to be inoperative at any current less than the maximum foreign current ascertained by artificially setting up with equivalent of a rail broken at the exit end of the block being measured, abnormal traffic conditions ahead, which should be a steel car train bridging the insulated joints dividing one section from the other, for a distance of four miles. Then track battery with a pressure one-eighth of the foreign pressure would operate the system in the worst weather, but any higher current could be determined upon, with a corresponding increase in track battery and weight in the armature for the auxiliary coils.

A relay between the track battery and the rails interposes resistance of only one-fourth of an ohm when the track relay has to be operated, but with a train in the block this resistance is increased to 5 ohms. There is therefore practically the same track battery output whether there is a train in the block or not.

Potash batteries can be used. Polarization is prevented because there is no long-continued overdraft. Their life can be accurately calculated. Storage batteries can also be used.

Mr. Bezer's arrangement has been in use about three weeks and no satisfactory report of the results in service can yet be made. The large amount of battery power needed makes the expense of this arrangement much heavier than for the ordinary simple track circuit. The letter was referred to the committee.

In the discussion the first speaker was Mr. Waldron. The recommendation of the committee that State Legislatures should be asked to pass laws protecting steam railroads against electric lines was injudicious, he declared. The electric railroad has a right to exist, and there is no use in trying to secure the passage of one-sided laws.

On the Philadelphia & Reading the most prominent characteristic of foreign currents felt in the signal instrument is the variableness. Changes in the loads on the electric lines make wide variations in the disturbances at different hours of the day. These currents have, at times, been strong enough to burn out track relays. On 45 blocks the Reading has at the battery end a one-tenth ohm relay, connected in series with the battery. The signal battery is at that end and the signal circuit goes through the back point of the low resistance relay. This arrangement has worked pretty well so far, though in wet weather the low resistance relay sometimes picks up and stops a train.

On the Union Pacific some track circuits, at an electric interlocking, were demoralized by a 15-ampere current, and alternating current track circuits were installed for the whole plant. On the third-rail line of the West Jersey & Seashore, where alternating currents are used for the track circuits for 35 miles of line, there were in the first month only two failures due to anything wrong in the track circuit.

The meeting next took up the report of the committee on interlocking of block signals, which was the subject of the chief discussion at Washington last autumn. It was in this report that the new and comprehensive scheme of signaling was proposed, including upward inclination of arms and two lights at every signal.

The Secretary read a letter from Mr. I. S. Rayner protesting against the use of a red light (as recommended by the committee) as "the common property of three signals." Rather than have so many red lights, to be treated as signals, the writer would have a light to be of the nature of a marker and nothing else.

A letter was also read from Mr. Buckelew, Superintendent of the Central Division of the Philadelphia, Baltimore & Washington, where are located the signals, giving indications by upward inclinations, described in the *Railroad Gazette* of October 19 last. Mr. Buckelew says that the enginemen and firemen, after running under these signals for three months, like them better than the standard signals, under which they run on the Philadelphia terminal division. They commend specifically the three novelties—namely, putting the arm "up in the air," using a single blade in three positions, and staggering the lights at night. The great beauty of the scheme is found in its relief to the engineman. He is required to remember nothing. Under this scheme an engineman could run anywhere with no special instruction. The two-light feature is especially valuable where there are many confusing lights, and the cost of the dummy light is well repaid.

It is proposed to use upwardly inclined signals at the new union passenger terminal of the P., B. & W. and the B. & O. at Washington, and a proposal is being considered to arrange the lower or smallest blade (see *Railroad Gazette*, October 26, 1906, page 369, diagram No. 2, signal No. 6) so as to give indications by it for all routes when necessary or desirable. At a facing point this signal is primarily designed to indicate only for the diverging route (as a crossover), and unless such route leads to another clear signal the arm would be set at 45 degrees. But this same indication is at times desirable for a movement along the main line, as for example, in case a train is stopped some distance beyond the signal, and it is desired to have a switching engine attach a car to the rear of the standing train.

At this point there was a lengthy discussion as to whether it is necessary thus to provide fixed signals to give all the indications which may be necessary in switching. Finally it was moved by Mr. Sperry (General Railway Signal Company) that "track layouts and signals should be so arranged as to provide fixed signals for all necessary movements," and this resolution was adopted. In this connection it should be observed that decisions made at a January meeting of the Association have only the effect of declaring the sense of the meeting; all decisions which affect anything of the nature of standard practice must be approved by an annual meeting before they can be regarded as the authoritative declarations of the Association.

There was general agreement with the rule, formulated by Mr. Ames and printed in the code of the Lake Shore & Michigan Southern, that where a signal is out of order hand motions may be used for switching movements, but movements from station to station should be made only on authority of a written card; but no vote was taken. After a brief discussion the following recommendations of the committee were unanimously rejected:

(e) That the stop indication shall be given by red lights in a vertical line.

(f) That the stop and proceed indication shall be given by red lights in an oblique line.

(g) That lights in a horizontal line shall be used for information signals.

The paragraph describing the arrangement of arms (three on a post) was left for future discussion. The use of a purple light for stop in dwarf signals was approved, as also that providing that a stop signal in the 45-degree position should be used to give a distant indication that the next signal would be found at stop; but the use of two arms on interlocking distant signals was not approved.

The discussion on circuits for interlocked signals was marked chiefly by a strong protest, voiced by Mr. Cade and supported by others, against the excessive use of costly electric locking to provide against dangers which, if the discipline of the signalman and the engineman is good, are not dangers at all, or at least are so greatly reduced that the wise railroad manager had better use his available money for the promotion of safety on his railroad in other direc-

tions, or on other parts of his lines. It was set forth with great vigor that we have been using more and more elaborate appliances year by year, and yet have not secured an arrangement which is satisfactory to the majority.

The report of the committee on standard specifications for all-electric interlocking was taken up and a few of the paragraphs discussed, beginning at the point where the discussion was broken off at the October meeting, but the members soon came to the sensible conclusion that details of this kind had better be perfected in committee.

Panama: The Railroad and the Canal.

BY FULLERTON L. WALDO.

From December 28 to January 2 the writer visited the Isthmus with a party of Congressmen who were investigating the canal work. In the five and a half days at our disposal we crossed the Isthmus four times on a special train which stopped at various points to allow of detailed investigation of specific engineering problems. We devoted half a day each to Culebra, Gatun, Cristobal, La Boca, and the Ancon Hospital; we also visited Gorgona, Bas Obispo and the cities of Colon and Panama (old and new), making our headquarters at the Tivoli Hotel on Ancon Hill in the canal zone, just outside the city limits of Panama. During our visit it did not rain, with the exception of one or two brief showers, the temperature in the daytime averaging 86 deg. The 24-hour average temperature in January (the nights being comparatively cool) is 74 deg., while the temperature of the hottest month, July, is 76 deg. January is considered the most agreeable month of the year. A curious fact about the rainfall is its rapid decrease in quantity as one goes southward across the zone. At Colon the rainfall is about 160 inches annually, at Panama 75 inches, and at the Island of Taboga, in the Gulf of Panama (selected as the site of the I. C. C. Sanitarium) the rainfall is only 30 inches. The writer saw but one mosquito and heard two others while on the zone. The Tivoli Hotel, where we stayed, which opened for general business on January 1, 1907, is a large, substantial building (315 x 170 ft.), of Oregon fir and Georgia pine, with accommodations for several hundred guests and all the appointments of a first class seaside hotel in the United States: mission furniture, electric lights, shower-baths in tiled bathrooms, a telephone in every room, and screened doorways opening on ample verandas. The hotel was built by the Isthmian Canal Commission as the last (and the best) link in the chain of hotels that begins with the inferior Washington Hotel by the water's edge at Colon.

The railroad between Colon and Panama at present is what railroad men would call "a red-hot track." As the writer rode in the cab of the locomotive of our special, he was impressed by the amount of traffic held up on the sidings to let us pass. It is as busy a 47-mile length of single track as I ever saw. According to the annual report of the commission (issued December 20, 1906) 20 of the 35 miles of additional track planned for have been completed, and three-fourths of the work has been done for the remaining 15 miles. There is still, however, a great deal of tracklaying to be done to join together the double-track portions. The cypress ties brought from the States are lying along the embankment in readiness. Many of the old lignum vitæ ties, which wear out but do not rot, have been in use almost ever since the road was opened for traffic half a century ago. I saw a great many carloads of new ribbed tie plates of the Glendon and Wolhaupter types which are being put in to supplant the old service plates. These new plates are the types used extensively in our northwestern states, the Northern Pacific having purchased a million in the past year. The short-length French rails (19 to 24 ft.) have been replaced by the 33-ft. 70-lb. American rail, the track being 5-ft. gage. Wood-burning engines are no longer used. The locomotives generally employed are from the American Locomotive Company, but 40 new Baldwins are about to be put in service. The commission requires, for all purposes, about 685 tons of coal per day, which all has to be brought from the States.

All through freight is handled at night. The trains bearing spoil from the Culebra cut and the special trains have made it necessary to cut down the passenger traffic from four trains per day each way to three, each consisting of ten heavily loaded cars. The negroes from Jamaica and Barbados, Trinidad and Martinique have developed a passion for short-haul visiting from station to station whenever they get the chance. The first class fare across the Isthmus has been recently reduced to $2.40, or five cents a mile; the second class fare (usually taken advantage of by the negroes) is $1.20. The employees of the road travel for half fare, but it is safe to assume that nine-tenths of the white men of the canal working force have passes. The old terminal at Colon, so far as freight traffic is concerned, has been abandoned in favor of the new site at Pier 11, Cristobal, in the suburbs of Colon. The roundhouses, turntables and machine shops have been removed to this point, but the docks of the Panama Railroad and the Royal Mail steamships remain at the original location. There has been no congestion of freight at the canal termini since the middle of December, 1905. We saw the ships being expeditiously unloaded by the stevedores at Colon, and noted that at La Boca (the Pacific terminus) four Wellman-Seaver electric cranes (capacity 3,500 lbs. each) are employed to facilitate unloading. The crying need at the Colon terminus is for breakwaters, to create a safe and commodious harbor. The "Panama" (5,700 tons), which left New York four days ahead of our boat, was unable to dock any earlier, having lost her four days' advantage by having to stand out to sea in a "norther" which beset the shipping in the harbor just before our arrival. No boat can remain at the wharves during these storms, which fortunately occur not more than once or twice a year. The Pacific terminus (La Boca) is almost invariably as placid as a millpond. There were six large steam vessels in the Colon roadstead as we came in, and six more unloading at the wharves, all of which had suffered more or less delay in consequence of the storm.



Culebra Cut. French Level (Top of Bank) and American Level.

We went up the Atlantic end of the French canal a mile or so in a tug to Pier 11, just beyond the new and attractive Cristobal buildings of the commission on the point where the de Lesseps houses stand. This pier has been extended 400 ft. since April and roofed (with corrugated iron), and it is here that the reception to Mr. Roosevelt was held when he made his memorable speech to the canal builders. We saw a bakery, started up the day before our visit, turning out splendid bread at the rate of 24,000 5-cent, 1-lb. loaves per 10-hour day. A laundry (capacity 10,000 pieces a week) is being built to furnish a little healthy competition for the Panaman washerwomen with their Klondike tariff of $3 per dozen pieces. A cold storage plant, in part designed by visiting experts from the Swift and Armour companies, is also building. Not half enough ice is made at present to supply the needs of the zone, though the railroad owns two plants at Colon, and the only conspicuous factory chimney in Panama is that of another plant, likewise railroad property; and there are several private plants.

The car shops at Cristobal accommodate 110 cars. The entire terminal had to be filled in to 4 ft. above sea level, where there formerly existed a morass chockfull of old French derelict machinery. There is a machine shop, with up-to-date equipment from

the Niles-Bement-Pond works. The one thing lacking to bring the plant fully abreast of the most modern practice is the electric installation which will come with the provision of water power. The equipment would be worth fully $85,000 in the States and cost $91,000 here. In connection with the purchase of machine tools and steam shovels, at the prices which were named to me, I could not see where any "graft" came in beyond the manufacturer's reasonable profit. It is felt by the engineers generally that so much of the old French stuff has been found available or convertible that (when the vast amount of digging they did is reckoned in) $40,000,000 was a bargain price for the canal and accessories. A visit to the Culebra cut and other canal excavations, and my observation of the conversion of old French iron by drop-forging and other processes, convinced me that we got the value of our money. No one, who has not been on the spot, can realize the extent of our indebtedness to the French—an indebtedness which the men on the Isthmus are the first to recognize. Of course the French excavators appear small beside our Bucyrus 70 and 95-ton shovels, and the Belgian locomotives cannot measure up to our 72-ton engines; the French dump cars look like children's express wagons alongside our western dump cars and vestibuled flat cars with their Lidgerwood drum and cable plow unloaders. But the French in their day did splendid work with the best excavating machinery then available, and it behooves us generously to recognize the dimensions of their achievement.

An 80-ft. roadway is being built across the valley [illegible] land, parallel to the railroad track between Colon and the Monkey Hill Cemetery, to relieve the congestion in the yards. Of course the local population make much of every funeral, and the funeral trains have in times past seriously interfered with the regular work of the train despatcher's office. The cemetery, with its green grass and flowers, seemed to justify its name—Mount Hope. We went through the numerous storehouses opposite. The office work is facilitated by a thorough-going card-catalogue system, which accounts for all supplies handled. Three sections of one of the two buildings (dimensions over all, 580 x 160 ft., with 200-ft. exterior platform), are devoted to French hand-tools and hardware. Among the new material are roofing tiles, lead and wrought-iron pipe, fence wire, hotel supplies and household furniture. In the yards are piled perhaps 100 carloads of old French bar-iron of excellent quality.

An interesting bit of new construction is the 10-in. pipe line which has been laid across the Isthmus, alongside the railroad track, by the Union Oil Company of California, to convey crude oil from ship to ship, and to supply the railroad and the commission with any desired amount. A license fee of $500 per month is paid by the oil company to the zone government, and it is stipulated that the commission and the railroad company may purchase the crude oil for 90c. per barrel. At the time of our visit the pipe had just been tested by flushing it with sea water, pre-



Awaiting the Presidential Train.

Mr. Bierd, the General Manager of the Panama Railroad, to whom our party was indebted for numerous courtesies, showed us his new track-throwing device, the essential feature of which is a swinging boom, mounted on a flat car, hauled over by a side-arm, which can throw 200 ft. of track 3 ft. 4 in. in 29 minutes with 17 operations. We noted in the Cristobal yards a 75-ton Bucyrus wrecking crane, and a Great Northern (Hill type) coal dock (20 per cent. incline up to pockets). We saw a Brown Hoisting Company coal unloader at work on her fourth vessel, near an old French drydock slip which is being widened to 310 ft.

Just beyond the yards, at Mount Hope, are the general stores of the commission. Across the track from the storehouses is the famous Monkey Hill cemetery, and at this point the toy railroad starts for the Mount Hope reservoir, two miles distant, a panoramic view of which is appended to the President's special report. This reservoir is a mile long and half a mile wide, and contains 520,000,000 gallons. The water elevation is about 55 ft. above high tide at Colon. From the reservoir a 20-in. cast-iron pipe line, connected with a 500,000-gal. steel standpipe, carries water to the city of Colon. The statement that salt water has been pumped through the mains to Colon is branded by Chief Engineer Stevens as untrue. The other great reservoir, made by damming the Rio Grande river, which supplies the city of Panama, furnished during the last dry season 56,000,000 gallons of water for the city and environs, without materially reducing its resources. There is no likelihood of a water famine ever again occurring upon the Isthmus.

sumably the first occasion on which the waters of the Atlantic and Pacific have come in contact at the Isthmus!

At Gatun the 7,900-ft. dam, 3,100 ft. through at base, from upper to lower toe, will completely obliterate the little native village that now stands at the confluence of the Chagres river and the old French canal at this point, 27 ft. deep. This dam is one of the features of the 85-ft. lock-level plan that will necessitate the relocation of a large portion of the railroad; nevertheless, so heavy is the traffic, it is intended to proceed with the double-tracking, pending these changes. Up to Gatun, which is about 5¼ miles from the Atlantic terminus of the canal at Colon, the French canal will prove useful for construction purposes in building the big dam. Two French dredges are constantly busy at the Colon entrance, and three at La Boca (Panama). No American dredges are as yet in use on the Isthmus. It is possible to ascend the canal at the Atlantic and for a mile and a half in a tug, and for nine miles further in a launch, except when the Chagres is in flood. Cayuccas (native dug-outs) can go half way across the Isthmus when the water of the Chagres is high, and even around the bend and up to Alhajuela, some 15 miles above the Gamboa dam site of the sea-level plan.

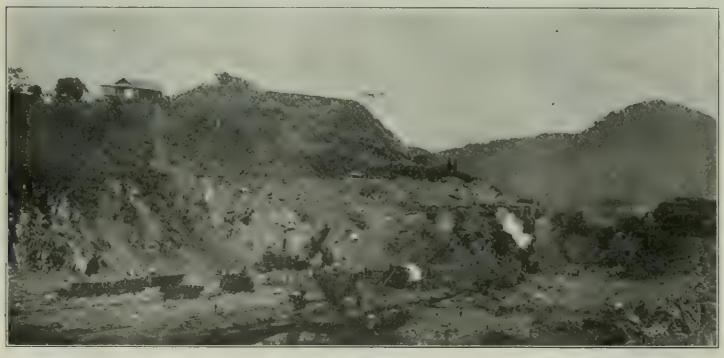
At Gatun the "lay of the land" is plainly apparent from a point of observation on the hill above the railroad station. The dam, with a single angle, crosses the valley to a point of equal elevation on the hills opposite. A clearing of perhaps 200 acres has been made on the valley floor. As is generally known, the

dam is to be built chiefly of earth, with some of the local deposit of indurated clay, and it has been a mooted question with certain engineering critics whether an earth dam of the contemplated dimensions, containing some 22,000,000 cu. yds., will stand. The commission calls attention to the fact that the San Leandro dam in California is only 15 ft. lower than the contemplated height of the crest of the Gamboa dam, which is 135 ft. above mean Colon sea-level, and the San Leandro dam is also an earth dam, built by hydraulic methods, and other dams of similar type exist which may be cited as precedents. There will be no deep excavation in the hope of getting a firmer foundation than that afforded by the natural valley bottom of impervious soil. The delay in beginning the excavation for the locks at Gatun is due to the thoroughness with which borings have been taken over the entire site. Every 200 ft. square these borings have been made, some 500 in all, 200 of which are on the actual lock site. One of the critics of the stability of the dam has stated that but four borings were made. The locomotives used for hauling in the soft earth at Gatun weigh 72 tons—as heavy as it is practicable to use. Two 70-ton Bucyrus shovels with 3-yd. buckets have now begun excavating for the locks. It will be a year or a year and a half before the masonry work of reinforced concrete is started.

At Frijoles, three weeks before our visit, traffic was interrupted for two days by a rainstorm which flooded the track here and at Matachin to a depth of 4, 6 and 8 ft. Operations in the Culebra cut had to be suspended during an entire week. Yet on the 10th of December, when the flood had abated sufficiently to permit of a resumption of work, the yardage record for daily output was broken, which illustrates the recuperative power of the present engineering plant. There were no serious landslides in the cut, and the roadbed was practically uninjured. Whenever in the wet season there is danger of a landslide, shovels are sent in on the higher levels of the cut to dig preventive benches.

The iron bridge across the Chagres at Barbacoas has six iron spans of perhaps 80-ft. with a slight bowstring girder arch, these spans being supported on five stone pillars. At the time the bridge was built, some 20 years ago, it was necessary to assemble the parts on the spot by hand riveting, and it was perhaps the largest iron bridge of its type in the world. The destructive potentialities of the Chagres may be studied to advantage from this point.

We went through the machine shops at Gorgona and found a force of 800 men at work with pneumatic riveters, planers, steam hammers, lathes and cold-saws, converting old French material into usable implements, putting a dozen Lidgerwood unloaders into commission, rebuilding the little Belgian locomotives used by the French and repairing American locomotives. About 25 ft. of filling in the Chagres bed had to be done at this point to secure a foundation, and about 75,000 cu. yds. were excavated by steam shovel. A cupola foundry 70 x 120 ft. has been built, fully equipped with a steel concrete double-core oven, and a six-oven brass furnace,



The Canal at Bas Obispo, October, 1906.

the charging floor of the foundry being reached by an air lift of five tons capacity. There is a core room, a casting cleaning room and a flask room, and the usual tool room for ensuring standard sizes. The present capacity of the foundry is 250 tons gray iron per month. A planing mill 60 x 120 ft. has been erected and a boiler shop 60 x 180 ft. Boiler makers, by the way, are in great demand on the Isthmus, just as there is a premium on the services of experienced railroad men of every type. The first class men in the foundry, whatever the particular nature of their occupation, get 75c. per hour, gold. As bearing on the length of the working day the following proclamation which I saw posted at Gatun is of interest:

Circular No. 84. Culebra, Oct. 16, 1906.

Beginning Monday, Oct. 22, 1906, non-contract unskilled alien labor will be worked on a daily 10-hour basis on any work wherever deemed necessary by the head of the division employing such laborers.

All contract unskilled alien laborers who desire to do so, will be worked regular 10 hours' straight time. Those who do not so desire will be worked eight hours, as heretofore.

This order will take the place of or modify any and all orders heretofore issued bearing upon the length of the established working day. —*Chief Engineer.*

It struck me that the machine shops at Gorgona were a first rate place for American skilled labor. The site is healthful, the shops are free from grime and smoke owing to the tropical open-



Building Sewers at Colon.

air order of architecture. The sanitary arrangements are admirable. There is a wash-room with 210 basins, where every man at the noon whistle finds hot water ready for him. The sanitary closets are automatically flushed every 30 minutes, and, as everywhere on the Isthmus, separate provision is made for white and colored employees. While we were on the Isthmus the decision was reached not to employ the Chinese, regarding whom there has been so much discussion in labor circles in the United States. It would be well if American organized labor should send delegates to Panama to study the peculiar conditions. I do not see how Mongolian labor would in the least conflict with the kind of work the white men from the States would qualify for. The white labor would do none of the pick-and-shovel, navvy work that the Canton coolie does. The white man's burden in this instance would be in the machine shops or other places where specialized labor is wanted and paid its wages. The best paid mechanics are the men on the steam shovels —$210 per month for the shovel engineer and $185 for the craneman. They earn their money, as was clearly demonstrated to us at Bas Obispo.

At Bas Obispo, where the Culebra cut begins, extending through the heart of the divide at Gold Hill to Pedro Miguel, we saw the 95-ton Bucyrus shovels Nos. 227 and 229 handling the hard basaltic rock after it had been thoroughly "shot" by dynamite blasts. There are some 28 steam shovels at work from end to end of the Culebra cut, varying from 50-ton shovels employed in grading work to the 95-ton giants which grapple with the heavy, close-textured rock. Each shovel has from two to five dirt trains serving it, and the rapidity with which the shovel can work is, of course, conditioned upon the service of the dirt trains and the length of the haul to the dumps. A mistake made by the French was to dump their spoil too close to the point of excavation, which on the new plan necessitates considerable rehandling. I saw a western car loaded, under pressure, in a minute and a quarter—seven three-yard bucketfuls—but the average time for filling a dirt train of 10 cars is 30 minutes. The Lidgerwood unloaders, with drum and cable, plowing from end to end of the flat car trains (vestibuled by extensions) have greatly facilitated the work. The chief offices of the commission in the field are at Culebra. Through Mr. Stevens' office in the dry season a strong trade wind blows that necessitates weights on all the papers. By February 1 the last of the smaller French dwelling houses at this point will have been removed.

At La Boca, the Pacific terminus of the canal, several large ships were constantly unloading by means of four electric cranes

of 3,500 lbs. individual capacity. Many French lighters (chalets) and dredges lay half submerged, choking the confluence of the Rio Grande and the French canal excavation. The tide here has a maximum rise of 20.24 ft., with an average of 17. The Pacific entrance will require constant dredging up to the point where the lock-flight of two locks in duplicate begins, lifting the ships 55 ft. above the mean tide level to the lake surface. The creosoted piles of the immense La Boca wharves will not survive the ravages of the *teredo* more than three years. The teredo worm, with its hard shell and augur-bit head, growing sometimes to a length of 18 in., is as much of a 'longshore nuisance as the red ant is upon the land. It was thought that these yellow pine piles, with some cypress ones, would last a dozen years after the application of the creosote. Unprotected, the timber would hold out perhaps two years. But for the clamoring insistence on haste in beginning canal construction, the wharf foundations would have been built of iron or concrete so as not to require early renewal.

In the city of Panama many surprises, pleasant and unpleasant, await the visiting American. An unpleasant feature is the enormous quantity of bad liquor retailed at almost every store. The streets, with their abutting balconies, are squalid and dirty and narrow. But the city, thanks to the paternalism of the United States government, received in good part by the infant Republic, is now the best paved and sewered municipality in Central America or in the northern half of South America. Vitrified brick from Dubuque, Iowa, has been laid in cement on all the principal thoroughfares. Some of the side streets, as at Colon, are covered with crushed rock. A fine macadamized driveway has been built for six miles into the country—the most pretentious bit of road-building on the Isthmus. The price of real estate at Colon and Panama is appreciating, and a bright day dawns for the little Republic.

At the time of Secretary Taft's visit he disbanded the army and sold the navy, consisting of one or two small boats; a stroke of diplomacy which has proved a natural blessing. The President's visit did a great deal to reassure the faint-hearted and stimulate the laggards, and from one end of the zone to the other I heard nothing but enthusiastic expressions of recognition of the value of his visit, in giving the canal builders to feel that their work is understood and appreciated at home, and has the cordial sympathy of the Chief Executive. It made every man on the Isthmus proud to be able to show his Panama brethren what a splendid American we have chosen to be our President. The native population seem to feel that an almost God-like being came and sojourned among them for a little while and departed. it is good to see, too, on the Isthmus that the inestimable value of the services of Dr. Gorgas is generally recognized, and that this quiet, unassuming Christian gentleman is receiving in his lifetime his due meed of thanks and praise for the extirpation of the agencies of dreaded diseases.

It speaks much for his unfailing tact and courtesy that he has been able to invade thousands of native homes with fumigants and disinfectants without once giving cause of offense to a proud and sensitive people. Finally, in John F. Stevens the engineer corps of the Isthmus have a dean qualified for his command by years of experience; a man whom other men instinctively trust and obey; a man with no personal idiosyncrasies to stand in the way of getting the big ditch dug.

The Conduct of Business on the Pennsylvania.

The following compilation [illegible] of the freight traffic on the Pennsylvania Railroad [illegible]

Pennsylvania Railroad statistics.

Total freight cars on U. S. Jan. 1, 1905	[illegible]
Total freight cars on U. S. Jan. 1, 1906	[illegible]
Total freight cars on Pennsylvania:	
Lines East and West Jan. 1, 1905	295,251
Lines East and West Jan. 1, 1906	241,099
Increase in U. S. in 1 year [illegible] per cent.	6[illegible]
Increase on Pennsylvania [illegible] per cent.	8[illegible]
Increase in cars on Pennsylvania since Jan. 1 1906	17,647
Ordered by Penn. R.R. for 1907 delivery	37,411
Freight ton-miles on Penn. R. R. 1899	[illegible]
Freight ton-miles on Penn. R. R., 1905	[illegible]
Increase [illegible] per cent.	56,179,125
Freight car capacity, Penn. R.R., in 1899, tons	2,549,560
Freight car capacity, Penn. R.R., in 1906, tons	5,171,485
Increase [illegible] (more than 100 per cent.)	2,621,920
(Increase in number of cars only 50 per cent.)	

	1905	1906
50-ton cars owned by Penn., Jan. 1	56,801	71,283
Cars available for freight service, Dec. 1	206,545	221,810
Of these there were on lines East	99,926	97,480
" " " " West	49,709	52,482
" " " " foreign roads	56,917	72,040
Foreign cars on Penn., E and W	57,200	56,354
Net loss in one year, 15,929.		
Penn. cars west of Miss. River, Dec. 1		4,435
West of Miss. cars on Pennsylvania		2,523
Men on foreign roads hunting Penn. cars, 30.		

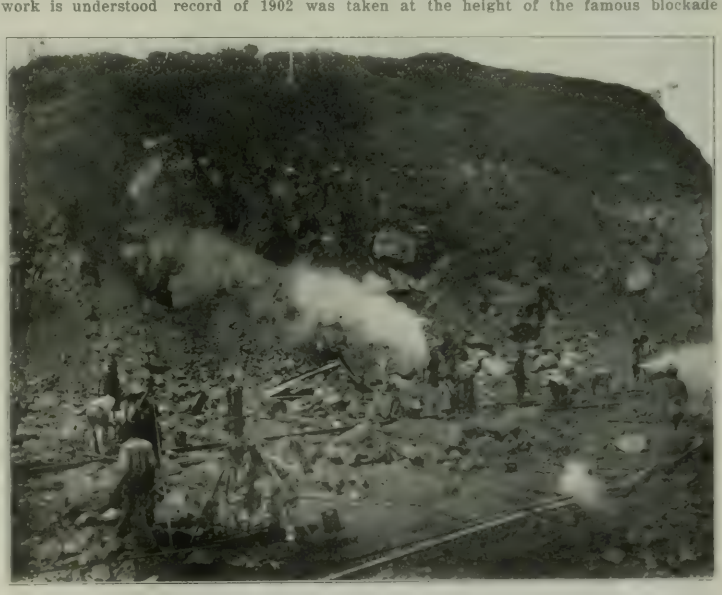
	1905	1906
Cars passing Lewistown Junctn in Oct.	170,558	179,849

	1901.	1906.
Freight car mileage, P. R.R., 9 mos.	835,887,283	983,216,237
Increase in 1906, 17.5 per cent.		
Millions, frt. ton-miles, P. R.R., 9 mos.	10,776.4	15,142.8
Increase in 1906, 40.5 per cent.		

	1905.	1906.
Av. mileage per car per day in October.	26.06	27.19

In connection with the statement concerning the large number of Pennsylvania cars on foreign roads it is explained that a good many of these cars have been used for shipments of structural steel to the cities of the Middle West. In connection with the comparison of car movement between 1902 and 1906, it is pointed out that the record of 1902 was taken at the height of the famous blockade of that year, whereas the figures for the present year represent the movement under fairly normal conditions. With the great increase in the capacities of cars the increase in the quantity of freight moved was, of course, very much larger than is indicated by the increase in cars, as will be seen from the comparisons next following. The efforts of the officers of the road to reduce delays to freight cars caused by slow unloading have also met with gratifying success. The cars sent out from the North Philadelphia yards on September 6 last had been detained in that yard an average of 6.41 days each. The same average on October 11 was 5.72 and on October 18, 5.03. In Pittsburg, where there is usually the greatest congestion and the freight most difficult to move, August 16 showed a detention of 8.19 days; August 30, 6.65 days; September 13, 6.06; October 4, 5.90; October 11, 5.56, and October 25, 6.08 days.

The Pennsylvania still keeps up its effort [illegible] several years



Steam Drills at Work in the Bas Obispo Cut.

The Baden State Railroads in connection with the training of mechanical engineers for the higher duties of the railroad service have made regulations for admitting to practice as enginemen on locomotives such persons as do not purpose to serve permanently as such. These must be young men who aim to become mechanical engineers, but after their service and passing the examination required of enginemen they do not acquire right to appointment as such. The privilege of service on locomotives is granted only to those who aim to positions as mechanical engineers or as inspectors in railroad shops; and also to students in the Karlsruhe Technical School; all after having reached a certain grade in the preliminary studies and examinations, the men of the Technical School in their fourth year of the mechanical engineering course. The first two classes have the precedence over the school students. The period of service is three months for one class, six months for candidates as shop inspectors, and from four to eight weeks for students; and these latter only on locomotives served by a regular engineman and fireman.

ago, to compel shippers to load bulk freight to the full capacity of the cars. This is usually far from easy, but the enforcement of the rule is persistently followed up. A committee of officers and heads of departments has lately been appointed to expedite the repairing of cars, and on October 29 12,004 cars were repaired in all the freight shops of the companies east and west, the largest day's work of the kind ever done except on October 1, when the figure was 12,065.

It is asserted that while there is great pressure at some points on the Pennsylvania Railroad lines no one anywhere is "suffering" because of lack of cars. The ability of the Pennsylvania to keep freight moving with reasonable freedom from congestion, in spite of the enormous increases shown, is due largely to the new main tracks and new yards that, at enormous expense, have been built during the past four years. These yards, concerning which the readers of the *Railroad Gazette* are already well informed, are at Pitcairn, Hollidaysburg and Enola. These, with the Brilliant cut-off and the additional main line east of the Susquehanna river, furnish facilities for an enormous movement of freight. The plan of making up yard records four times a day and telegraphing them promptly to the superintendents is now in use at Altoona, Baltimore, Buffalo and Olean, and is to be put in use in other yards. This system locates and corrects detentions and contributes materially to the prompt movement of cars.

Mr. Hill on the Railroad Situation.

The President of the Great Northern on January 14 sent a letter to Governor Johnson, of Minnesota, on the traffic needs of the country and the condition of the railroads, an abstract of which is given below:

The business of the United States is to-day so congested that from every portion of the country arises clamor for relief. The railroads everywhere are taxed beyond their power. The people of the United States, therefore, are face to face with the greatest business problem that has ever threatened the nation. During recent years the volume of business has increased, and is increasing with extraordinary rapidity, while the necessary additional trackage and terminals have not been equal to the demands upon them.

The resulting situation is a freight blockade of enormous proportions, especially at all terminal points. How to remedy this is a problem financial, mechanical and physical. No time should be lost in applying such measures of remedy as may be possible, and the first step toward this is to reach a proper understanding of actually existing conditions. The following figures, compiled from the official reports of the Interstate Commerce Commission, and covering the growth of the railroad business for the last ten years, exhibit the significant facts:

	1895.	1905.	Inc., per ct.
Total single track, miles	180,667	218,101	21
Locomotives	36,699	48,350	35
Passenger cars	33,112	40,715	23
Freight cars	1,196,119	1,731,409	45
Passenger mileage	12,188,446,271	23,800,149,436	95
Freight, ton-mileage	85,227,515,891	186,463,190,510	118

These figures show the cause of delay in the national traffic movement which threatens to bring industry to a standstill. Within the last ten years the volume of railroad business in this country has increased over 110 per cent. Meanwhile the railroads have endeavored to meet it. Equipment is being increased as rapidly as capital and labor can do it. There are and will be cars enough to carry the country's traffic if the cars can be moved, but engines and cars must have tracks upon which they may run.

A striking tale is told by the statistics of railroad building in the United States. Not only is it true, as stated above, that there has been in the ten years ended 1906 an increase of only 21 per cent in mileage, but the most impressive fact is that railroad building has within a generation fallen off just as the demand upon trackage has increased. At this moment, when that demand is greatest, and the whole country is clamoring for relief, it is the smallest in years. These are the figures:

Year.	Mileage.	Increase.	Increase, per cent.	Increase per cent. per year.
1870	52,898	.....	.....	.....
1881	93,671	40,773	77.0	7.0
1894	163,597	69,926	74.6	7.46
1904	213,904	50,307	30.75	2.19
1906 (estimated)	220,000	6,250	2.9	1.45

The limit of service of a common carrier has been reached when it has moving at all times over its system as many cars as can be run on its tracks with safety and transferred and dispatched from its terminals and junction points without unreasonable delay. Beyond that point increase of business cannot be handled by increasing cars and engines. The disparity between the growth of traffic and the additions to railroad mileage and the extension of terminals shown by new mileage of less than 1½ per cent. a year since 1904, to take cars of a traffic increase averaging 11 per cent a year for ten years past, presents and explains the real problem. The best judgment of many conservative railroad men in the country is that an immediate addition of not less than 5 per cent. per annum to the railroad trackage of the country for, say five years, should be made to relieve the situation and put an end to unreasonable delays in the transaction of business.

Investigations recently made by public officials and facts accessible before those investigations disclosed that the railroads of the country have been endeavoring to meet the growing demand upon them. In order to handle this enormous addition of 110 per cent. in business with only 21 per cent. more track, they have utilized as never before the carrying capacity of each mile. Not only were there 35 per cent. more locomotives and 45 per cent. more cars in service in 1905 than in 1895, but each engine and car did much more work. The passenger-miles traveled by a locomotive increased from 1,218,967 to 2,048,558, or more than 68 per cent., and the ton-miles a freight locomotive from 4,258,221 to 6,690,700, or more than 57 per cent. Trains run faster, cars are larger, locomotives are more powerful and methods of handling the business have so improved as to increase the general efficiency.

In the great centres, the inadequacy of terminal facilities prevents the free flow of traffic. The Great Northern has 34 switch engines in use in the Twin Cities, while only 28 engines are used in hauling freight in and out.

Suppose that only 25 per cent. additional track with necessary terminals and equipment, making 33 per cent., is to be built during the next five years; or, say, in round numbers, 75,000 miles of tracks as the requirement for the country to meet immediate needs. No practical man would furnish the facilities required, including additional equipment and terminal facilities for less than $75,000 a mile. The question of terminals alone is almost prohibitive. Terminals now in use were acquired when property was cheap, and can be enlarged only by heavy outlays. In many cities it is not even a question of cost, since the area necessary to handle railroad business properly is not to be had at any price.

The new work, then, would amount to $5,500,000,000 in round numbers, or a yearly average of $1,100,000,000. That is the sum which should be spent before the commerce of the country can be moved properly. It is just twice the total amount of the bonded debt of the United States after the close of the Civil War. It is more than twice the entire currency in circulation in the country, and only a little less than twice the deposits in all the savings banks in the United States put together.

Almost all the complaints made to-day, either by shippers or by operating railroad men of obstacles and dangers in transportation service are due to deficient trackage. The average speed of a freight train is from 12 to 15 miles an hour. The average distance traveled by each freight car is about 25 miles a day. That is, the entire freight equipment of the country is employed to the fair limit of its capacity only two hours out of the 24. On single track lines, freight must wait on sidings while passenger trains have the right of way; cars stand for days or weeks in yards or at tranfer points awaiting their turn.

The problem and necessity are enormous. At 140 tons to the mile, it would require 2,000,000 tons of steel rails every year to furnish the 1,500 miles of track required. This is nearly two-thirds of the product of all the rolling mills to the United States. It would call for the labor of 200,000 men in grading, besides track layers, bridge builders and others. Labor, even for such ordinary extensions and improvements as are now being made, is not to be had in sufficient quantities on any terms. And it demands, as has been seen, the investment in permanent railroad plants of $1,100,000,000 a year for five years to provide the railroads of the country with means to handle properly the business already in sight, not allowing for future growth.

This is the real railroad problem of the United States, and it is one which people have been singularly slow to perceive and reluctant to realize.

Two remedies must be found. The prohibitory expense now attached to enlargement of terminals at many points, and the absolute lack of available space at any price, may be met by a decentralization of traffic. There must be more points for export, more interior markets. A 15-ft. canal or channel from St. Louis to New Orleans would go further to relieve the entire Middle West and Southwest than any other work that could be undertaken. With such a depth of water a single powerful towboat could carry from 30 to 40 train loads.

Terminal troubles admit of a more general diffusion of business, permitting transfers to take place and forwarding to be done where land can be secured in adequate quantities and at more reasonable prices.

To this the traffic systems of the country must be adjusted. The heavy transfers must be made away from the larger cities.

It is not by accident that railroad building has declined to its lowest within a generation, at the very time when all other forms of activity have been growing most rapidly. The investor declines to put his money into enterprises under ban of unpopularity, and even threatened by individuals and political parties with confiscation or transfer to the state. This feeling must be removed and greater confidence be mutually established if any considerable portion of the vast sum necessary is to be available for the work.

Traffic Through the "Soo" Canals.

The following table shows the amount of traffic passing through the United States and Canadian canals at Sault Ste. Marie during the season of 1906:

	1905.	1906.	Inc. or dec., per cent.
Vessels: Steamers, No.	17,197	18,138	+ 5
Sailing, No.	3,263	2,817	—14
Unregistered, No.	1,219	1,200	— 2
Total No.	21,679	22,155	+ 2
Lockages, No.	13,792	14,523	+ 5
Tonnage: Registered, net	36,617,699	41,098,324	+ 12
Freight, net	44,270,680	51,751,080	+ 17
Passengers, No.	54,204	63,033	+ 16
Coal: Hard, net tons	984,701	1,011,375	+ 3
Soft, net tons	5,324,355	7,728,255	+ 40
Flour, bbls.	5,772,719	6,495,350	+ 13
Wheat, bush.	68,321,299	84,271,558	+ 23
Grain (other than wheat), bush.	39,229,553	54,343,155	+ 39
Manufactured and pig iron, net tons	237,696	391,105	+ 65
Salt, bbls.	423,122	468,162	+ 11
Copper, net tons	106,520	107,633	+ 1
Iron ore, net tons	31,332,637	35,357,042	+ 13
Lumber, M. ft., B.M.	966,806	900,631	— 7
Building stone, net tons	10,899	6,222	—43
General merchandise, net tons	836,583	1,134,851	+ 36

The United States canal opened for navigation April 13 and closed December 17, a season of 249 days. The Canadian canal opened April 14 and closed December 22, a season of 253 days. Of the total number of vessels passing, 5,680 used the Canadian canal, carrying 6,570,788 tons of freight and 32,108 passengers. The eastbound freight was 41,584,905 tons, and westbound 10,166,175 tons.

GENERAL NEWS SECTION

NOTES.

On January 7 the Florida specials of the Seaboard Air Line, Atlantic Coast Line and Southern Railway made their initial runs.

Two thousand employees of the Chicago, Burlington & Quincy at the Aurora car shops have received a 10 per cent. increase in wages.

Judge Duncan, of the United States Circuit Court, has held that the Maryland "cut-off law" of 1906 will prevent the Baltimore & Ohio from building a freight loop around Baltimore.

The conductors of the Mexican Central have had their pay increased from $225 a month to $250, and in some cases more (on passenger trains) and to an average of $250 on freight trains.

On the Southern Pacific line west of Ogden a practical test is reported to be under way of the rules laid down in the new 16-hour law for railroad employees recently passed by the Senate.

A bill has been introduced in the Massachusetts Legislature providing for the appointment of a special committee to investigate the advisability of cancelling the lease of the Boston & Albany to the New York Central.

The employees of the Ohio Central in Bucyrus have been granted a 10 per cent. increase in pay dating from the first of the year. The increase affects nearly 500 of the local resident employees of the company.

The Wisconsin Railroad Commission has called upon the roads entering Milwaukee for a detailed report of all delays in December, with the causes. The act creating the commission gives it powers to regulate such matters.

In a decision recently rendered, Judge Newman, of the Federal Court, sustained the right of the Georgia Railroad Commission to advance the Southern Railway from Class C to Class B. The effect of the decision is to reduce freight rates 10 per cent. within the state.

Bids for building the Panama Canal by private contract were opened at Washington, January 12. The lowest bid was that of W. J. Oliver and A. M. Bangs, who offered to do the work for a compensation of 6.75 per cent. of the money expended by the Government in the work.

Railroad traffic in the Canadian Northwest is said to be demoralized and many local trains have been canceled. The Canadian Pacific transcontinental limited train carrying the Japan and China mails has been over 24 hours late in making connection with the Atlantic steamer at St. Johns, New Brunswick.

Chicago's share of the net receipts from the traction companies provided for under the proposed settlement ordinances has averaged $3,645.07 a day since the first of January. This average would mean $1,330,430.55 a year. Both traction companies opened new books the first of the year with the city as a partner in the transportation business.

The Nashville, Chattanooga & St. Louis has taken the ground that issuing transportation between two points on its lines within the state, although the train passes through parts of other states, is not a violation of the Interstate Commerce Law and that the issuance of such passes is not under the jurisdiction of the United States government.

Captain James E. White, General Superintendent of the Railway Mail Service, has resigned on account of ill-health. He has been in the service for more than 40 years and for the last 16 years has been General Superintendent. It is said that Alexander Grant, of Michigan, will succeed him. Mr. Grant has for a long time been assistant to the general superintendent.

It is announced that a 23,700-ton steamship named the Rotterdam, is being built for the Holland-America Line by Harland & Wolff, Belfast. Every inside and outside room on the saloon deck will have an adjoining private bath-room. It is expected that the Rotterdam will be launched in the latter part of this year, and make her maiden trip to New York, in April, 1908.

Governor Chamberlain, in his message sent to the Oregon legislature January 15, urges with great emphasis the enactment of a law creating a state railroad commission, clothed with adequate powers. No state has been so liberal as Oregon, he says, in its policy toward the railroads, though "rich sections of the state have been left neglected by the one great railroad system which practically controls its whole transportation business."

The city of Spokane, the Chamber of Commerce and the Spokane Jobbers' Association have filed suits against the Great Northern, the Northern Pacific and the Oregon Railroad and Navigation and allied lines. The complaint charges unjust discrimination in freight rates, in that rates on goods shipped from Eastern points to Spokane are based on the through rate from the East to the Pacific Coast, plus the return rate from the coast to Spokane.

Continued snowstorms and heavy winds are piling the tracks in North Dakota and Montana with such drifts that it is almost impossible to get trains through. Drifts are said to be ten feet high on each side, and the snow accumulates faster than it can be shoveled away. Considerable anxiety is expressed in St. Paul for the passengers on trains which have been stalled two or three days in North Dakota. Fuel and provisions are being provided by the neighboring villages.

Governor Deneen, of Illinois, sent a special message to the Legislature January 10 recommending an emergency appropriation of $150,000 for the purpose of preparing and trying a suit against the Illinois Central Railway Company to collect back taxes. These taxes, it is claimed, are due the state under a provision of the road's charter, the provision requiring payment of 7 per cent. of the road's gross earnings yearly to the state. President Harahan denies that the road is in default.

By a vote of 107 to 0 the lower house of the Minnesota legislature adopted a resolution January 15 directing a legislative investigation of the transaction by which J. J. Hill, president of the Great Northern Railroad, sold certain ore lands to the United States Steel Corporation. Representative Knutson, who introduced the resolution, said the transaction was practically a railroad deal, and that the Great Northern Railroad Company's charter did not permit the company to deal in ore lands.

Oren Root, General Manager of the New York City Railway, is quoted as saying that the nuisance of flat wheels on the cars of the system would probably be removed in the near future by substituting steel wheels for the cast iron ones now in use. In the meanwhile the company is coping with the difficulty by removing wheels found to be defective, and has sent a statement to Dr. Darlington, of the Health Department, showing that 1,568 such changes were made on the electric cars in the month of December.

Senator Hansbrough has given notice that he will offer this amendment to the bill S 5133 to promote the safety of travelers: "That it shall be unlawful for any interstate railroad to move any train or trains from one point to another containing tonnage in excess of the registered capacity of the engine or engines attached thereto. Any officer, agent, or employee of any such railroad who violates the provision of this section shall be deemed guilty of a misdemeanor and punished by a fine not exceeding $1,000 for each offense.

The switchmen on the Toledo Terminal Railway inaugurated a strike January 11, completely tying up that road. The tie-up is the result of the company's refusal to grant an increase in wages of about 30 per cent. Heretofore the wages of switchmen have ranged from 23 to 29 cents an hour, but the new schedule calls for a graded scale, ranging from 32 to 36 cents an hour. There is no present prospect of settlement. The Toledo & Ohio Central also is considering an increase wanted. All the other Toledo roads are said to have met the demands of the men.

The Virginia Corporation Commission handed down a report January 14 on its investigation of alleged negligence of the Southern Railway relative to the collision near Lawyers, Va. The report takes up the whole subject of negligence, and says that the full measure of deterrent law will not be reached until the hand of such law has been laid heavily upon the person, be he president, manager or brakeman, whose negligence or infidelity has brought death and suffering to his fellowmen. It holds Mattox, the operator at Rangoon, immediately responsible, but puts primary responsibility on the whole management.

On January 4 the railroad presidents located at Chicago made a personal appeal to the Chicago Commercial Association to join hands with them in a friendly and united attempt to improve the existing transportation conditions and relieve the present car shortage. The same day a convention of shippers representing forty associations in some 20 different states went on record emphatically in favor of reciprocal demurrage by passing a resolution that it was the sense

of the convention that congress should pass a federal law indorsing and making it the duty of the Interstate Commerce Commission to make proper rules for reciprocal demurrage.

The Senate, by a vote of 70 to 1, passed the Railway Hours bill January 10. The bill, as passed, prohibits railroads engaged in interstate and foreign commerce from requiring or permitting those of their employees who have to do with the movement of trains to work more than 16 hours consecutively, nor an aggregate of more than 16 in each 24 hours, and requires that when an employee shall have worked for 16 hours there shall follow a period of rest of not less than 10 hours before the employee shall resume his duties. Certain exceptions are made to provide for accidents, the failure of trains to make their regular schedules, connections, etc. Violation of the act is declared to be a misdemeanor punishable by fine of from $100 to $1,000, and the Interstate Commerce Commission is charged with the duty of enforcing the law, and all authority necessary to do so is given it.

Trolley Roads Not for the Boston & Maine.

The general attitude of the Boston & Maine in regard to the acquisition of electric roads has been defined in the following statement by President Tuttle:

Whatever the policy of the New Haven road, that of the Boston & Maine is strongly opposed to the wholesale absorption of trolley lines. I have found that when you provide a market for electric lines they are built almost as fast as the public highways will accommodate them. The Boston & Maine does not intend to constitute itself a market to which trolley promoters may take their securities.

So far as any interest in the Massachusetts Electric Co. is concerned, the Boston & Maine has never owned, directly or indirectly, a share in the stock of this corporation, and has no disposition to obtain any interest in it whatsoever. If the New Haven road wants the Massachusetts Electric Co., either the whole or any part, it is welcome to buy it without opposition from the Boston & Maine.

Where the trolley can be made a feeder to the steam road the latter may here and there find it to its interest to own the electric line, but the Boston & Maine is not seeking to buy up competing or parallel roads.

Exports of Grain in 1906.

The amount and value of various grains exported during the calendar year 1906 and also the corresponding figures for the previous year are as follows:

	1906		1905	
	Quantities.	Values.	Quantities.	Values.
Wheat	62,848,437 bush.	$49,134,718	20,555,817 bush.	$16,907,480
Corn	102,168,255 "	52,658,474	110,928,065 "	59,946,752
Barley	14,358,218 "	7,245,347	13,363,921 "	6,706,920
Oats	25,480,162 "	9,322,213	28,641,633 "	9,915,068
Rye	1,972,251 "	717,626	470,230 "	304,477
Wheat flour	14,261,115 bbls.	58,138,598	11,281,379 bbls.	49,691,762
Total breadstuffs		$180,462,232		$146,107,883

Exports of canned beef fell off 74,752,361 lbs. in 1905 to 35,410,679 lbs. last year, probably as a result of the packing house scandals.

Steamship Connections for the Tehuantepec Route.

By an arrangement made between the American-Hawaiian Steamship Company and the Tehuantepec National Railroad which, with its two terminal harbors—one on each side of the Isthmus of Tehuantepec—is to be formally opened for operation this month, the service of the steamship company through the Straits of Magellan has been discontinued, and the company plans to have weekly sailings from New York to Coatzacoalcos, the Atlantic terminal of the Tehuantepec road. Through freight will from there be carried by rail to Salina Cruz, the Pacific terminal, where it will be loaded on the American-Hawaiian Company's steamers for coast ports and Hawaii. The Pacific boats will make a triangular trip, beginning at Salina Cruz, thence north along the coast to San Francisco with general cargo, thence to Honolulu with general cargo, and from Honolulu to Salina Cruz with sugar and other products. By this arrangement it is expected that the Hawaiian sugar that has been carried via the Straits of Magellan will now be carried by the Tehuantepec route. These shipments amount to nearly 300,000 tons.

Fuel Scarcity in the Northwest.

In view of cumulative reports of fuel scarcity in North Dakota, the Interstate Commerce Commissioners, upon their return to the city to-day, again took up the matter, and a despatch was sent to President Hill, saying:

"Upon return to office this afternoon found telegrams indicating acute and serious situation at Clyde, Hannah, Milton, and Park River. Senator Hansbrough, in letter to-day to Commission indicates lack of foodstuffs as well as coal, and urges abandonment of other traffic if necessary to give immediate relief. I assume that you will keep in close personal touch with the situation and take effective measures to rush supplies where needed regardless of expense or other sacrifice."

Senator Hansbrough's letter said:

"My advices from North Dakota are alarming. It is reported to me that many farmers are killing their stock to prevent their starving; that the lights in more than one hundred villages were extinguished several days ago, and that the prospect for relief from the fuel famine grows less day by day. If these conditions continue indefinitely, supplies of provisions will soon be exhausted, and this will add to the prevailing distress."

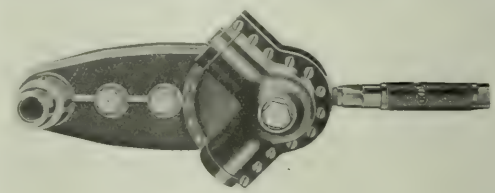
The following notice has been received at the Great Northern station at Fergus Falls, Minn., and it is understood that similar notices have been sent to agents all along the line:

"Superintendents have been instructed and authorized to furnish coal to people at any station on the Great Northern where they are short or actually suffering for lack of fuel. If your station is out of coal, you should promptly notify your superintendent."

Mr. Hill is quoted as saying that in 35 years he has not seen weather conditions as severe as those now prevailing in North Dakota and other points west of St. Paul. "The snow on the level out there is from three to four feet deep, and that means something. Men cannot walk on it without snowshoes, and it is impossible for horses to travel. There are some places along our line where the snow is from 10 to 25 feet deep, and then there are places where all we can see of a freight car is the brake wheel sticking up out of the snow. We will have to dig those cars out. We have had from 1,200 to 1,500 men working along our line, and have kept it open, but part of the time the weather has been so cold that the men could not work."

"Little Giant" Corner Drill.

A new type of pneumatic drill for work in close quarters, and especially in corners, has recently been put on the market by the Chicago Pneumatic Tool Co. It is compact, simple and powerful



Little Giant Corner Drill.

and weighs only 35 lbs. Under load the spindle has a speed of 100 r.p.m. with 80 lbs. pressure, and when running light has a speed of 150 r.p.m. It will drive 1½-in. twist drills and in emergency cases 2-in. drills. There are four pistons working on a common shaft, and the rotation is geared down through a chain of four gears and pinions to the spindle. This insures positive spindle movement. All the parts are interchangeable with the No. 4 "Little Giant" drill. The limiting dimensions are 5¾ in. from end of socket to point of feed screw when run down, feed 2 in., distance from outside of housing to center of spindle, 1 $^{9}/_{16}$ in.

A New Buffalo Outdoor Forge.



Buffalo Outdoor Forge.

A new design of outdoor forge has been placed on the market by the Buffalo Forge Company, Buffalo, N. Y. In interior construction it is not unlike the company's new direct drive blower, the blast being provided by a fan wheel operated by gearing driven through a noiseless clutch motion from a hand lever. The horizontal cross section of the body of the machine is semi-elliptical. The handle is fastened by a chain so that it can be detached and slipped inside the body of the forge, and cannot get lost. With the handle slipped out of the socket and inside the casing, the dash hood lowered forming a cover to the fire pan, within which tools may be placed, and the cover padlocked to the barrel of the forge, the smith's tools are safe from being stolen during the night or during shipment. The weight is 125 lbs.

Municipal Accounting.

By a notable coincidence, the deficit in the first year's operation of New York's municipal ferry is very nearly the same as that of the steamboat service on the Thames, maintained by the London county council. Commissioner Bensel estimates the city's loss on the Staten Island ferry as $250,000. The loss on the Thames boats was £53,000. The cases differ, of course, but are alike in illustrating the need of that distinction between ordinary commercial accounting and municipal accounting, upon which G. Bernard Shaw gravely insists. He admits that if the usual tests of bookkeeping were applied, many a municipal enterprise would wear an unhappy air of bankruptcy. But the skilled municipal accountant argues the whimsical but, apparently, this time serious, Mr. Shaw—we refer to his book on "Municipal Socialism"—must reckon in the "invisible profits." This means that he must rise above mere sordid shillings

and pence and figure in the satisfaction which cannot be stated in terms of money. We must not omit, for example, the content of the employees who are given good and regular wages, though at work in an industry not self-supporting; we must also consider the gratification of the citizens in carrying on an enterprise themselves, even if they do do it badly. By a little of such hocus-pocus with invisible profits, a municipal deficit may be made to look like a surplus. The only one who will surely have doubts about the process is the taxpayer. However it may be with profits, his taxes are painfully visible.—*New York Evening Post*

Latest Fashions in Passes.

In issuing passes to members of the legislatures the Great Northern and Northern Pacific have specified that the passes are "only good for a trip wholly within the state."

The Harriman lines will continue to sell tickets to army officers and clergymen at half fare, but only for trips within a single State.

The Wabash will exchange passes for advertising in country newspapers, but the passes are only good in one state.

Pullman passes, good only in New York state, have been received by members of the New York legislature. They are made in the name of "Mrs. ——— and one."

Railroads in Illinois have given the legislators of that state passes good within the state of Illinois.

The Rock Island will make no more contracts to exchange transportation for advertising.—*Railway World.*

The First Railroad Train in Morocco.

On December 15 the first train ran over the new narrow-gage railroad to the quarries built by the German Harbor Construction Company. The railroad, the first in Morocco worked by steam traction, is 2 kilometers (1¼ miles) long.

Freight Congestion in the Northwest.

In discussing the congestion of traffic on northwestern roads, Mr. Hill made the following comment at the opening session of the Northwestern Lumbermen's Association at Minneapolis, January 15:

"At this time, when the lumber business is a constantly increasing factor, the lumber trade of the country is being concentrated on the forests of Washington and Oregon. I was talking to the president of the Northern Pacific within a month. Their capacity is measured by the tunnel through the Cascade range. Everything working fairly, good grade and good rails, they can get from 300 to 350 cars a day in each direction, and that is all they can move through that hole, and often they are called on to move 600 or 700 cars a day.

"The remedy to-day is more trackage facilities, and we cannot increase those facilities without more money. It is not more cars, but more movement of the cars already in use which will solve the car shortage problem."

Better Grain Rates Wanted by Boston.

The following comment on Boston grain rates is taken from the annual report to the directors of the Chamber of Commerce:

While all the North Atlantic ports are suffering to a greater or less degree from the rapid growth of the grain exporting business of the Gulf ports, Boston's grain business makes a relatively poor showing, as compared with those Atlantic ports enjoying the differential rates fixed by the Interstate Commerce Commission at the time of the decision made in 1905. If Boston is to retain any fair proportion of the North Atlantic business in competition with these ports and with the St. Lawrence and provincial ports, a readjustment of these rates must eventually be made.

Corporation Legislation Favored by McCrea.

James McCrea is quoted as expressing the belief that free railroad chartering throughout the states should be abrogated and the commerce commission empowered to say whether proposed new roads are needed in the interests of trade and commerce in their respective districts. Furthermore, Mr. McCrea has a remedy which he believes would be effectual in preventing the watering of stock. He would restore a provision formerly in effect, but which has for many years fallen into disuse, whereby there should be inserted in every charter issued a statement describing specifically what shall constitute a controlling vote. This he would not have uniform in all cases, but made to vary according to the necessities of each charter issued.

New Steamship Line to Greece.

A new steamship line is to be established between the Piraeus and the United States to accommodate the increasing tide of emigration. The service will be begun about April 10, and three new ships are being built, which will make regular trips.

TRADE CATALOGUES.

Ingersoll-Rand Co.—Catalogue No. 91 illustrates and describes the Davis calyx diamondless core drill. It is a prospecting drill producing cores from 1⅝ to 15 in. in diameter to depths down to 6,000 ft. It does not use diamonds and the cost of the entire apparatus is often less than that of the diamonds alone where these are employed, and the cost of diamond maintenance and replacement is entirely eliminated. It gives a double record, depositing the cuttings successively as they occur and removing the core in convenient lengths. For ordinary materials a rotating toothed steel cutter is used, this having a chattering action instead of a smooth cut, and for the harder materials chilled steel shot are used as an abrading material. The apparatus is built in different sizes, the smallest operated by hand, and the largest requiring 20 or more horse-power and capable of removing cores of large diameter from a great depth.

The Southern has issued an unusually attractive four-page folder about its Palm Limited, which began running January 7. This gives a colored picture of a scene in Florida, a map of the route of the train, condensed time-tables, and, most striking of all, detailed diagrams showing the separate berths and staterooms of each of the seven cars which make up the train.

Manufacturing and Business.

C. A. Wales has been appointed Purchasing Agent of the Federal Railway Signal Company at the works, Troy, N. Y.

The British Westinghouse Electric & Manufacturing Company, whose offices are at Manchester, England, is to reduce its capital by $5,000,000.

The year 1906 proved to be a specially good one for the Falls Hollow Staybolt Company. It reports a volume of business 50 per cent. greater than for any previous year.

On December 26, 1906, the corporate name of the Cook's Railway Appliance Company was changed to Cook's Standard Tool Company. The ownership and management remain the same.

The Glidden Varnish Company, Cleveland, Ohio, has increased its capital stock from $200,000 to $1,000,000. The additional funds will be used to provide for further extension of the company's business.

H. H. Newsom, formerly with the Victor Stoker Company, has been appointed sales agent for the Locomotive Appliance Company, with headquarters at the general offices of that company, 490 Old Colony Building, Chicago.

The Power Specialty Company, 111 Broadway, New York, has opened an additional branch office, 1012 Chemical Building, St. Louis, Mo. The company has recently received a number of large orders for installing the Foster superheater which it makes.

The B. F. Sturtevant Co., Boston, Mass., is installing complete blower systems for heating and ventilating the 18-stall roundhouse of the Canadian Pacific Railway Co., Broadview, Saskatchewan, P. Q., and the car repair shops of the Somerset Railway Co., Oakland, Me.

William J. Clark, General Manager of the Foreign Department of the General Electric Company, has been appointed by the Governor of New York as a delegate from that state to the national convention for the extension of foreign commerce of the United States, which was held in Washington, D. C., beginning January 14.

J. W. Duntley, President of the Chicago Pneumatic Tool Company, sailed for Europe on January 8 to close a number of important contracts for pneumatic tools and appliances. During the past year a number of large European manufacturers made exhaustive tests of the products of this company, and are ready now to finally place their orders.

Howard M. Post has been appointed Advertising Manager for the Quincy, Manchester, Sargent Co., Chicago. He formerly was a telephone engineer with the Western Electric Co., Chicago, and was later with the Kellogg Switchboard & Supply Co., Chicago, first in telephone work for five years and then as advertising manager for a number of years. He left the latter position to go to the Quincy, Manchester, Sargent Co.

H. J. Lamborn has been appointed Superintendent of Power & Plant at the works of the Yale & Towne Manufacturing Company, succeeding F. A. Waldron, who resigned about a year ago. He was formerly Mechanical Engineer and Superintendent of the magnetic separating plants of Witherbee, Sherman & Company at Mineville, N. Y. S. E. Dauchy, who has been Acting Superintendent of Power and Plant, has been made Assistant Superintendent under Mr. Lamborn.

Colonel John T. Dickinson has severed his connection with the Consolidated Railway Electric Lighting & Equipment Company to become Vice-President of the Bliss Electric Car Lighting Company of Milwaukee, with headquarters in New York at the new offices of the company in the Night and Day Bank Building, Fifth avenue and 44th street. The Chicago office of the Bliss Electric Car Lighting Company will be in the Monadnock Building, with W. N. Lalor, formerly also with the Consolidated Railway Electric Lighting &

Equipment Company, in charge as Assistant General Sales Manager. The extensive additions to the large plant of the Bliss Electric Car Lighting Company will be completed February 1.

The Otis Elevator Company has been given a contract by the New York & Long Island Railway, the company which is building the Belmont tunnel between Forty-second street and Long Island City, for the two largest escalators ever built to be used in the Manhattan terminal of the tunnel railroad at Forty-second street between Lexington and Third avenues. It is believed that these escalators will have a capacity equal to the entire stairway equipment of the Manhattan terminal of the Brooklyn bridge. They will provide service between levels about 55 ft. apart. Most of the time one will be operated going up and the other going down, but during the morning rush hour both will be operated going up.

The firm of Charles Hansel & Company, bankers, engineers and investigators, has been established with offices at 43 Wall street, New York. They will furnish bankers and investors with plans, reports and exact information concerning the physical condition of existing or projected railroads, water powers and industrials. They are prepared also to analyze and complete statistics, to report on inventions and carry on engineering work in its various branches. The value of such a firm to its customers depends entirely upon the qualifications of the chief member of the firm. There are few engineers in the United States who have had a more varied service than has Mr. Hansel. He has been chief engineer of many important undertakings aside from railroads. He was consulting engineer for the Illinois Railroad and Warehouse Commission. For a considerable period he made a specialty of signaling, and four times he was sent to England and the Continent to make investigations. In connection with legislation, he formulated the rules relating to interlocking, which were embodied in the laws of Illinois, Ohio, Indiana, Texas and Canada. He has also done much work, and may be classed as an expert, in plans and estimates for factories, systems of cost finding and factory accounting and economic operation. We are mentioning only a few of his fields of activity in the past, but they have been so wide and so varied as to well qualify him for the consulting engineering work which he is now undertaking.

Iron and Steel.

The San Antonio & Aransas Pass has ordered 7,000 tons of rails.

The South Dakota Central has given orders for 6,000 tons of rails, and the Minneapolis & Rainy River for 1,300 tons.

The Great Northern has ordered 1,500 tons of steel and the Chicago, Rock Island & Pacific 700 tons of steel for bridges from the American Bridge Company. The Denver & Rio Grande has ordered 950 tons of steel for bridge work from the Pennsylvania Steel Company, and the Chicago & North-Western 350 tons for station work.

There is a large demand for steel for industrial and commercial buildings principally in Chicago, where about 30,000 tons will be used, and in San Francisco about 8,000 tons. A number of railroads are in the market for large quantities of bridge material. About 30,000 tons of steel will be required to complete steel cars and locomotives recently ordered by the railroads.

OBITUARY NOTICES.

George Erbelding, Secretary of the St. Louis Southwestern, died at his home in Brooklyn on January 10 at the age of 43.

Thomas W. Dodd, Vice-President and General Attorney of the Texas-Mexican Railway, a subsidiary of the National of Mexico, and General Attorney for Texas of the National Lines of Mexico, died at Laredo January 13 after a long illness. He was born in 1840 in Georgia, and graduated from the University of Georgia in 1868. He had held his present position since 1888.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

New York Railroad Club.

At a meeting of this club to be held January 18, an address, illustrated with lantern slides, will be made by Clarence L. Chester on the Isthmian Canal.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Central of Georgia.—W. C. Askew, Assistant Treasurer, has been elected Treasurer of the Central of Georgia and of the Ocean Steamship Company, succeeding T. M. Cunningham.

Great Northern.—William R. Begg, Assistant General Solicitor, has been appointed General Solicitor, with headquarters at St. Paul, Minn. Mr. Begg is a graduate of Yale College, class of 1893.

Illinois Central.—H. G. Hackstaff, Third Vice-President and Secretary, has been elected Vice-President in charge of the New York office of the company. W. J. Harahan, Fourth Vice-President, has been elected Vice-President, with headquarters at Chicago, in charge of the traffic and construction departments. I. G. Rawn, General Manager, has been elected Vice-President, with headquarters in Chicago, in charge of the operating department.

Macon, Dublin & Savannah.—Alfred Walter, President of the Seaboard Air Line, has been elected President, succeeding Thomas K. Scott.

New York, New Haven & Hartford.—James McCrea, President of the Pennsylvania, has been elected a Director, succeeding the late Alexander J. Cassatt.

Overton County.—George L. Wilkins, of Chicago, has been elected President, succeeding H. E. Overstreet.

Seaboard Air Line.—See Macon, Dublin & Savannah.

Temiskaming & Northern Ontario Railway Commission.—Frederick Dane has been appointed a member of the Commission, succeeding Cecil B. Smith, resigned.

Vandalia.—Joseph Wood, First Vice-President of the Pennsylvania Lines West, has been elected President, succeeding James McCrea. J. J. Turner, Second Vice-President; E. B. Taylor, Third Vice-President, and D. T. McCabe, Fourth Vice-President of the Lines West, have been elected First, Second and Third Vice-Presidents respectively of the Vandalia.

Operating Officers.

Baltimore & Ohio.—Frank C. Batchelder, who has been appointed General Superintendent, with headquarters at Baltimore, of the Baltimore & Ohio, was born on May 27, 1857, at Fall River, Wisconsin. After a common school education he entered railroad service on April 14, 1874, as an operator on the Chicago, Milwaukee & St. Paul. He was on that road until April, 1888, as agent, despatcher and chief despatcher. In 1888 he went to the Minneapolis, St. Paul & Sault Ste. Marie as despatcher, later becoming Assistant Superintendent and Superintendent. From June 30, 1899, until January 1, 1907, the date of his recent appointment, he was Superintendent on the Baltimore & Ohio.

Chicago, Rock Island & Gulf.—See Rock Island Lines.

Chicago, Rock Island & Pacific.—See Rock Island Lines.

Denver & Rio Grande.—D. E. Cain, formerly General Manager of the Southwestern and Choctaw districts of the Rock Island Lines, has been appointed Assistant to the resident Vice-President at Denver.

Lake Erie & Western.—H. A. Boomer, Assistant General Superintendent, has been appointed General Superintendent of the Lake Erie & Western and the Northern Ohio, with headquarters at Indianapolis.

Louisville & Nashville.—Fred H. Benjamin, Trainmaster at Nashville, has been appointed Inspector of Transportation, a new position, with headquarters at New Orleans. His jurisdiction will run as far north as Decatur, Alabama.

Merchants' Despatch Transportation Company.—W. B. Pollock, Manager of the Foreign Freight and Marine departments of the New York Central & Hudson River, has been appointed also General Manager of the Merchants' Despatch Transportation Company, succeeding as General Manager, Arthur Mills, deceased.

Missouri, Kansas & Texas.—T. F. Gardner has been appointed Trainmaster of the Choctaw division, succeeding T. A. Wilson, resigned.

Rock Island, Arkansas & Louisiana.—See Rock Island Lines.

Rock Island Lines.—The following changes in divisions and districts were effective January 15, 1907:

Minnesota division—Cedar Rapids (mile post 100) to Minneapolis; Vinton to south yard limit board, Estherville. Office at Cedar Rapids, Iowa.

Cedar Rapids and Dakota divisions—These divisions are to remain as at present, with the exception of the territory that is withdrawn to form the Minnesota division.

Des Moines Valley division—This division to remain as at present, with the exception that the Winterset and Indianola branches are added.

The Northern district is composed of the Cedar Rapids, Minnesota, Dakota, Des Moines Valley and Iowa divisions; office at Cedar Rapids, Iowa.

Iowa division—This division to remain the same as at present, with the exception of the territory that is withdrawn and added to the Des Moines Valley division.

Arkansas division—Memphis to Booneville (east yard limit board); Brinkley to Jacksonport; Wiville to Gregory; Mesa to Searcy; Little Rock to Hot Springs; Butterfield to Malvern. Office at Little Rock, Ark.

Indian Territory division—Booneville to Shawnee (west yard limit board); Haileyville to Ardmore; Tecumseh Junction to Asher. Office at Haileyville, Ind. T.

Louisiana division—Haskells to Wirand; Tinsman to Crossett. Office at Ruston, La.

The Choctaw district is composed of the Arkansas, Louisiana and Indian Territory divisions; office at Little Rock, Ark.

Oklahoma division—Caldwell (south yard limit board) to Chickasha (south yard limit board); Shawnee to Geary (east yard limit board); Chickasha to Mangum; Kingfisher to Chandler; North Enid to Billings; Chickasha to Lindsay. Office at Chickasha, Ind. T.

Pan-Handle division—Geary to Texola; Enid to Anadarko (north yard limit board); Geary to Anthony; Ingersoll to Alva. Office at Geary, Okla. T.

Fort Worth division—Chickasha to Terral; Waurika to Anadarko (south yard limit board); Lawton to Chattanooga. Office at Fort Worth, Tex.

The Southern district is composed of the Oklahoma, Pan-Handle and Fort Worth divisions; office at Fort Worth, Tex.

Southern.—R. A. Dugan having resigned to engage in private business, the office of Assistant General Manager has been abolished. P. L. McManus, Superintendent of the Charlotte division, has been appointed Assistant to General Manager, with office at Washington, D. C.

The operating divisions as recently reorganized, including the new divisions which were created, and the officers of each division are as follows. Each district is in charge of a General Superintendent:

Washington division—Washington, D. C., to Monroe, Va.; Bluemont, Warrenton and Harrisonburg branches and Monroe terminals. C. S. Lake, Superintendent, with headquarters at Alexandria, Va.

Danville division—Monroe, Va., to Spencer, N. C.; Rocky Mount and Asheboro branches and Danville terminals. W. S. Andrews, Superintendent, with headquarters at Greensboro, N. C.

Richmond division—Neapolis to West Point, Va. W. T. West, Superintendent, with headquarters at Richmond, Va.

Norfolk division.—West Norfolk to Danville, Va.; Pinners Point, Va., to Selma, N. C.; Claremont, Hitchcock, Buffalo Lithia Springs, Portsmouth and Copper Mines branches. E. T. Lamb, Superintendent, with headquarters at Norfolk, Va.

Durham division—East Durham, N. C., to Keysville, Va.; Oxford to Henderson, N. C.; Greensboro to Goldsboro, N. C.; University to Chapel Hill, N. C. G. V. Peyton, Superintendent, with headquarters at Durham, N. C.

Winston-Salem division—Mt. Airy to Sanford, N. C.; Climax to Ramseur, N. C.; Wilkesboro to Greensboro, N. C., including Winston-Salem terminals; Stokesdale to Madison, N. C.; Mt. Airy to Granite Quarry, N. C. J. M. Bennett, Superintendent, with headquarters at Winston-Salem, N. C.

Mooresville division—Mooresville Junction to Winston-Salem, N. C.; Charlotte to Taylorsville, N. C. D. W. Newell, Superintendent, with headquarters at Winston-Salem, N. C.

The Northern district consists of the Washington, Danville, Richmond, Norfolk, Durham, Winston-Salem and Mooresville divisions.

Charlotte division—Spencer, N. C., to Greenville, S. C., including Spencer terminals; Whitney, Norwood and Union Copper Mines branches. P. L. McManus, Superintendent, with headquarters at Charlotte, N. C.

Greenville division—Greenville, S. C., to Armour, Ga.; Elberton, Athens and Roswell branches and Greenville terminals. J. A. Heether, Superintendent, with headquarters at Greenville, S. C.

Rock Hill division—Marion, N. C., to Kingville, S. C., including Rock Hill terminals; Sumter Junction to Sumter, S. C.; Blacksburg to Gaffney, S. C. J. H. Herne, Superintendent, with headquarters at Rock Hill, S. C.

Columbia division—Charlotte, N. C., to Savannah, Ga.; Batesburg to Perry, S. C.; Cayce, S. C., to Augusta, Ga.; Edgefield to Aiken, S. C.; Columbia terminals. H. A. Williams, Superintendent, with headquarters at Columbia, S. C.

Charleston division—Charleston to Columbia, S. C.; Branchville, S. C., to Augusta, Ga.; North Augusta and Navy Yard branches and Augusta terminals. A. G. Jones, Superintendent, with headquarters at Charleston, S. C.

Spartanburg division—Columbia to Spartanburg, S. C.; Alston to Greenville, S. C.; Abbeville, Lockhart and Ware Shoals branches. R. E. Simpson, Superintendent, with headquarters at Columbia, S. C.

Jacksonville division—Savannah, Ga., to Jacksonville, Fla. W. L. Pierce, Superintendent, with headquarters at Jacksonville, Fla.

The Eastern district consists of the Charlotte, Greenville, Rock Hill, Columbia, Charleston, Spartanburg and Jacksonville divisions.

Asheville division—Salisbury to Asheville, N. C.; Biltmore, N. C., to Spartanburg Junction, S. C.; Hendersonville to Lake Toxaway, N. C.; Asheville terminals. A. Ramseur, Superintendent, with headquarters at Asheville, N. C.

Murphy division—Murphy Junction to Murphy, N. C. T. S. Boswell, Superintendent, with headquarters at Bryson, N. C.

Knoxville division—Asheville, N. C., to Morristown, Tenn.; Bristol to Knoxville and Coster, Tenn.; Embreeville and Rogersville branches; Coster and Knoxville Belt. C. L. Harris, Superintendent, with headquarters at Knoxville, Tenn.

Coster division—Coster to Jellico, Tenn., and Middlesboro, Ky.; Clinton to Harriman Junction, Tenn.; La Follette, Clear Fork, Big Mountain, Coal Creek and Bennett's Fork branches. E. E. Norris, Superintendent, with headquarters at Knoxville, Tenn.

Chattanooga division—Knoxville to Chattanooga, Tenn.; Austell, Ga., to Ooltewah Junction, Tenn.; Attalla, Cleveland and Cedar Bluff branches and Chattanooga terminals. C. C. Hodges, Superintendent, with headquarters at Chattanooga, Tenn.

Nashville division—Harriman to Nashville, Tenn.; Isoline, Crawford and Carthage branches. F. P. Pelter, Superintendent, with headquarters at Nashville, Tenn.

Memphis division—Chattanooga to Memphis, Tenn.; Florence and Somerville branches. H. E. Hutchens, Superintendent, with headquarters at Memphis, Tenn.

The Middle district consists of the Asheville, Murphy, Knoxville, Coster, Chattanooga, Nashville and Memphis divisions.

Birmingham division—Birmingham, Ala., to Columbus, Miss.; Woodlawn-Bessemer Branch; Coalburg Loop and Birmingham terminals; Ensley Southern Railway. W. M. Deuel, Superintendent, with headquarters at Birmingham, Ala.

Mobile division—Selma to Mobile, Ala.; Marion Junction to Meridian, Miss., and Akron, Ala. J. H. Stanfiel, Superintendent, with headquarters at Selma, Ala.

Selma division—Atlanta Junction (Rome, Ga.) to Selma, Ala.; Wilton to Birmingham, Ala.; Frog Mountain, Masena, Lapsley, Piper, Belle Ellen and Blocton branches. J. Lasseter, Superintendent, with headquarters at Wilton, Ala.

Atlanta division—Atlanta, Ga., to Birmingham, Ala.; Atlanta Belt and terminals. A. H. Westfall, Superintendent, with headquarters at Atlanta, Ga.

Columbus division—Atlanta to Fort Valley, Ga.; McDonough to Columbus, Ga. W. J. Bell, Superintendent, with headquarters at Williamson, Ga.

Macon division—Brunswick to Atlanta, Ga.; Hawkinsville branch. F. J. Egan, Superintendent, with headquarters at Macon, Ga.

The Western district consists of the Birmingham, Mobile, Selma, Atlanta, Columbus and Macon divisions.

W. H. Gatchell, Superintendent of the old Nashville division, has been appointed Superintendent of Transfers, with headquarters at Washington, D. C.

Union Pacific.—W. H. Jones, Trainmaster of the Idaho division of the Oregon Short Line, with headquarters at Pocatello, Idaho, has been appointed Assistant Superintendent at that point. J. P. Folger, Chief Despatcher at Kemmerer, Wyo., has been appointed Trainmaster of the First district and of the Wyoming Western, with headquarters at Kemmerer.

Traffic Officers.

Chicago, Burlington & Quincy.—E. A. Abbott, Southwestern Passenger Agent at Kansas City, has been appointed Advertising Agent of the Burlington System, with headquarters at Chicago.

Erie.—D. W. Cooke, Assistant General Traffic Manager, with headquarters at New York, has been appointed General Traffic Manager with headquarters at Chicago. The office of S. P. Shane, Freight Traffic Manager, has been moved from Chicago to New York.

Nashville, Chattanooga & St. Louis.—W. I. Lightfoot, chief rate clerk in the passenger department, has been appointed Assistant General Passenger Agent, succeeding W. F. March, deceased.

New York Central & Hudson River.—Milton C. Roach, Assistant General Passenger Agent, has resigned, effective January 15, to go into private business. Mr. Roach was born in Erie, Pa., and began railroad service in the engineering corps and later in the shops of the Canada Southern. After the road was taken over by the Michigan Central, Mr. Roach was made General Agent successively at Detroit, Toledo and Buffalo. In 1886

he was appointed General Eastern Passenger Agent of the New York Central in New York, and was promoted to Assistant General Passenger Agent three years ago.

Northern Pacific.—W. J. Horrigan has been appointed Freight Claim Agent, with headquarters at St. Paul, succeeding T. F. Hughes, resigned.

Engineering and Rolling Stock Officers.

Boston & Maine.—Henry Bartlett, who has been appointed General Superintendent of the Mechanical Department of the Boston & Maine, was born on March 29, 1864, in Lowell, Mass. His early education was in the Lowell and Boston schools and he graduated from Harvard University in March, 1886, he went to Altoona as special apprentice on the Pennsylvania, where he was for three years. From 1889 to 1891 he was Assistant Road Foreman of Engines successively of the Pittsburg, Middie and Maryland divisions, and in 1891 became Assistant Superintendent of Motive Power at Altoona. He was appointed Superintendent of Motive Power of the Boston & Maine on January 1, 1895, the position which he held until January 1 of the current year, when he was appointed to his new position, with headquarters at Boston.



Henry Bartlett.

Charles W. Higgins, who is now Superintendent of Motive Power, with headquarters at Boston, was born September 23, 1859, at Durham, N. H. He was educated at the public schools and Phillip's Exeter Academy. He began railroad work on July 1, 1882, on the road of which he has now been made Superintendent of Motive Power. For five years, from September 1, 1886, to October 1, 1891, he was a machinist in the Boston shops. In 1891 he was made Master Mechanic of the Concord division, and on July 1, 1895, of the Concord & White Mountains divisions. He became Assistant Superintendent of Motive Power on October 1, 1891, and was on January 1, 1897, promoted to his present position.

Buffalo & Susquehanna.—E. P. Tuffer has been appointed Engineer of the Northern division, with territory from Buffalo to Wellsville.

Erie.—See Lehigh Valley.

Lehigh Valley.—G. W. Wildin, Mechanical Superintendent of the Erie, has been appointed Assistant Superintendent of Motive Power of the Lehigh Valley.

South Buffalo.—F. R. Cooper, formerly Master Mechanic of the Lehigh Valley, has been appointed Superintendent of Motive Power.

Union Pacific.—Martin Bylander has been appointed Acting General Shop Demonstrator, with headquarters at Omaha, Neb., succeeding F. M. Titus, temporarily assigned to other duties.

Purchasing Agents.

Dunkirk, Allegheny Valley & Pittsburg.—See Lake Shore & Michigan Southern.

Lake Erie, Alliance & Wheeling.—See Lake Shore & Michigan Southern.

Lake Erie & Western.—See Lake Shore & Michigan Southern.

Lake Shore & Michigan Southern.—G. R. Ingersoll, chief clerk in the purchasing department, has been appointed Purchasing Agent, with headquarters at Cleveland, Ohio, of the Lake Shore & Michigan Southern, the Lake Erie & Western, the Lake Erie, Alliance & Wheeling and the Dunkirk, Allegheny Valley & Pittsburg.

LOCOMOTIVE BUILDING.

The Missouri & North Arkansas has ordered five locomotives.

The Southern is reported to be asking bids on 50 locomotives

The Chicago, Milwaukee & St. Paul will build in 1907, 105 locomotives.

The Tidewater is reported to be in the market for eight locomotives.

The Northern Pacific is reported to be in the market for 25 locomotives.

The Nevada Northern is reported to be in the market for two locomotives.

The Chicago & North-Western is reported to be in the market for 80 locomotives.

The Kansas City Southern is likely shortly to purchase 20 consolidation (2-8-0) locomotives.

The Atlantic Coast Line is reported to have ordered 80 locomotives from the Baldwin Works.

The Evansville & Terre Haute is reported to have ordered eight locomotives from the Baldwin Works.

The National Tube Company, Pittsburg, is reported to be in the market for five switching (0-6-0) locomotives.

The American Railroad of Porto Rico has ordered a number of locomotives from the Baldwin Locomotive Works.

The Higginsville Switch Co. has ordered one 40-ton mogul (2-6-0) locomotive from the East St. Louis Locomotive & Machine Company.

The Lehigh Valley is reported to have ordered 55 locomotives, the order being divided between the American Locomotive Company and the Baldwin Works.

The Japanese Imperial Government Railways have ordered a number of locomotives from the Baldwin Locomotive Works through Frazar & Sale, New York.

The Chicago, Burlington & Quincy has ordered 25 Prairie (2-6-2) locomotives from the American Locomotive Company, in addition to the 55 locomotives reported in our issue of December 28, 1906.

The Wabash has ordered 70 Prairie (2-6-2) and 20 consolidation (2-8-0) locomotives from the American Locomotive Company, and 20 switching (0-6-0) locomotives from the Baldwin Works. The specifications are:

	Prairie.	Consolidation.
Type of locomotive		
Weight, total	205,900 lbs.	225,000 lbs.
Weight, on drivers	150,500 lbs.	200,000 lbs.
Diameter of drivers	70 in.	58 in.
Cylinders	22 in. x 28 in.	22 in. x 30 in.
Boiler, type	Radial stayed; extended wagon top.	
" wrkg. stm. pressure	200 lbs.	
" No. of tubes	301	360
" diameter of tubes	$2\frac{1}{4}$ in.	
" length of tubes	19 ft.	14 ft. 6 in.
Firebox, length	$108\frac{1}{8}$ in.	
" width	$72\frac{1}{4}$ in.	$67\frac{1}{4}$ in.
Tank capacity	8,000 gals.	
Coal capacity	16 tons.	

Type of locomotive	Switching
Weight, total	153,700 lbs.
Diameter of drivers	52 in.
Cylinders	21 in. x 26 in.
Boiler, type	Radial stayed; straight boiler
" working steam pressure	180 lbs.
" No. of tubes	254
" diameter of tubes	$2\frac{1}{4}$ in.
" length of tubes	15 ft.
Firebox, length	72 in.
" width	60 "

The Des Moines Union has ordered two simple switching (0-6-0) locomotives from the Baldwin Works for June delivery. The specifications are as follows:

General Dimensions.

Type of locomotive	Switching
Weight, total	100,000 lbs.
Diameter of drivers	51 in.
Cylinders	18 in. x 24 in.
Boiler, type	Wagon top
" working steam pressure	180 lbs.
" number of tubes	235
" diameter of tubes	2 in.
" length of tubes	11 ft. $1\frac{1}{2}$ "
Firebox, length	$89\frac{13}{16}$ "
" width	$34\frac{3}{8}$ "
" material	Schoenberger steel
" grate area	21.4 sq. ft.
Heating surface, total	1,488.9 "
Tank capacity	3,000 gals.
Coal capacity	4 tons

Special Equipment.

Air brakes	Westinghouse
Bell ringer	Golmar
Boiler lagging	Asbestos sectional
Couplers	Gould
Piston rod packing	Sullivan
Valve rod packing	Sullivan
Safety valve	Crosby
Sanding devices	Leach
Sight-feed lubricators	Nathan bull's-eye
Springs	French
Steam gages	Crosby

CAR BUILDING.

The Erie is reported to have issued specifications for 3,000 box cars.

The Southern is in the market for 35 passenger coaches and five chair cars.

The American Car & Foundry Co. has orders for 700 miscellaneous cars.

The Erie has ordered from the Pullman Company 60 vestibule suburban coaches.

The Kansas City Southern, it is reported, will soon be in the market for 1,400 cars.

The Pittsburg & Lake Erie has ordered one private car from the Pullman Company.

The Pittsburg, Shawmut & Northern is reported to be asking prices on 250 coke cars.

The Chicago, Milwaukee & St. Paul is reported to be in the market for ten motor cars.

The Chicago & North-Western has ordered 25 passenger cars from the Pullman Company.

The South & Western has ordered one passenger car from the Hicks Locomotive & Car Works.

The Lehigh Valley is reported to have ordered some passenger cars from the Pullman Company.

The Lutcher & Moore Lumber Company has ordered 10 logging cars from the Orange Iron Works.

The New Orleans & North Eastern has ordered 125 gondola cars from the American Car & Foundry Co.

The El Paso & Southwestern is in the market for 250 steel underframe stock cars of 60,000 lbs. capacity.

The Missouri & North Arkansas has ordered two passenger coaches from the American Car & Foundry Co.

The Walter A. Zelnicker Supply Company, St. Louis, has ordered five tank cars from Robert M. Burns & Company.

The Dry Fork Lumber Company has ordered 10 flat cars of 60,000 lbs. capacity from Robert M. Burns & Company.

The Indian Refining Company has ordered 39 tank cars of various capacities from Robert M. Burns & Company.

The Northern Pacific is reported to be ordering material for 100 cabooses to be built at its own shops during 1907.

The American Car & Equipment Company has ordered 20 gondola cars and five tank cars from Robert M. Burns & Company.

The Great Northern, as reported in our issue of January 11, has ordered 500 steel hopper cars from the American Car & Foundry Co.

The Erie, it is reported, has ordered 1,000 gondolas from the Pressed Steel Car Company and 2,000 gondolas from the Standard Steel Car Company.

The Lehigh Valley is reported to have ordered 5,000 freight cars, the order being divided between the Standard Steel Car Company and the American Car & Foundry Company.

The St. Louis Refrigerator Car Co., St. Louis, Mo., will build 200 steel underframe refrigerator cars of 80,000 lbs. capacity. These cars will weigh 52,000 lbs., and measure 37 ft. 3 in. long over all.

The Atlantic Coast Line is reported to have ordered 750 flat cars from the Standard Steel Car Company, and 1,000 box cars from Barney & Smith, and has ordered 1,500 box cars from the South Baltimore Steel Car & Foundry Company.

The Chicago, Milwaukee & St. Paul will build at its own shops in 1907, 3,000 steel underframe box cars of 80,000 lbs. capacity, 1,000 36-ft. standard stock cars, and 1,000 Haskell & Barker ballast cars, and after these are built 5,000 coal and 2,000 box cars.

The Great Northern will probably order during the year 1907 144 passenger cars. The order includes the following: Twelve 12-section sleeping cars, 10 18-section tourist sleeping cars, four dining cars, 30 first class coaches 70 ft. long, five second class coaches 60 ft. long, 25 baggage cars 65 ft. long, 15 baggage and mail cars 70 ft. long, 10 mail cars 60 ft. long, 30 express refrigerator cars, three 16-section sleeping cars.

The Tonopah & Goldfield, as reported in our issue of December 14, 1906, is asking bids on 115 drop bottom coal cars of 80,000 lbs. capacity. They will be 35 ft. 7½ in. long, 8 ft. 10 in. wide and 8 ft. 3¼ in. high, inside measurements. The special equipment is as follows:

Bolsters	Enterprise
Brake-shoes	Christie
Brakes	Westinghouse
Draft rigging	Miner
Wheels	Griffin

The Harriman Lines have ordered for the Cananea, Yaqui River & Pacific 75 flat cars from the Standard Steel Car Company. These cars will weigh 32,570 lbs., and will measure 30 ft. 10 in. long over floor, 9 ft. 4½ in. wide and 3 ft. 8 13/16 in. high. There have been ordered for the Galveston, Harrisburg & San Antonio, as reported in our issue of January 11, four coaches and two mail and baggage cars from the St. Louis Car Company. The coaches will weigh 88,000 lbs. and will be 60 ft. long, 9 ft. 8 in. high over sills, and 14 ft. 1 in. high. The mail and baggage cars will be 60 ft. long. The specifications for these cars will be the same as for a previous order, reported in our issue of October 12, 1906.

The Missouri Pacific has ordered 3,000 gondola and 2,500 box cars from the American Car & Foundry Company; 2,000 box cars from the Mount Vernon Car Mfg. Company, and 750 ballast cars from the Rodger Ballast Car Company, to be built by the American Car & Foundry Company. All of these cars are to be of 80,000 lbs. capacity. Delivery to begin in April. The gondola cars are to be 36 ft. long, 9 ft. wide and 4 ft. high, inside measurements; all box cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements; all ballast cars will be 36 ft. long over end sills, 10 ft. 4 in. wide and 8 ft. 7½ in. high, over all. The special equipment for all brakes is Westinghouse; couplers, Tower; draft rigging, Miner.

The Buffalo, Rochester & Pittsburg, as reported in our issue of January 11, has ordered 500 steel hopper cars of 100,000 lbs. capacity from the Berwick Works of the American Car & Foundry Company. These cars will be 30 ft. long inside, 31 ft. 6 in. long over all, 10 ft. wide and 10 ft. high over all. The following special equipment will be used:

Bolsters	Scullin Gallagher
Brake-beams	Pennsylvania Oval
Brakes	Westinghouse
Couplers	Tower
Doors	Dunham
Draft rigging	Sessions Standard Friction
Journal boxes	Symington
Paint	Railway Steel Spring

The Chicago Terminal Transfer, as reported in our issue of November 9, 1906, has ordered 300 side dump cars of 100,000 lbs. capacity from the McGuire, Cummings Mfg. Co. for March delivery. These cars will be 38 ft. long, 8 ft. 6 in. wide and 3 ft. 6 in. high, inside measurements. The special equipment is as follows:

Bolsters	American Steel Foundries
Brake-beams	Simplex
Brake-shoes	Congdon
Brakes	Westinghouse
Brasses	Ajax
Couplers	Washburn
Draft rigging	Miner
Journal boxes	Symington
Paint	Lowe Brothers
Springs	Railway Steel Spring Company
Wheels	Griffin

RAILROAD STRUCTURES.

BAY CITY, MICH.—The Michigan Central will soon start work on a new transfer freight house, to be 400 ft. long, with room for 40 cars, at the northern end of the viaduct crossing its yards on Marquette avenue.

CENTRAL CITY, NEB.—Local reports state that the Union Pacific will build a brick passenger station.

DENISON, TEX.—Work has been begun by the Missouri, Kansas & Texas on a new concrete freight house 45 ft. x 300 ft.

LITTLE ROCK, ARK.—A contract has been given to the Murch Bros. Construction Co., of St. Louis, for building the superstructure of the new union passenger station.

MIFFLINVILLE, PA.—The Board of Public Grounds and Buildings at Harrisburg has given the contract for building a state bridge over the Susquehanna river here to the York Bridge Co. at $122,000. There were 13 other bidders.

MONCTON, N. B.—The Intercolonial has given a contract to E. A. Wallberg, of Montreal, at about $500,000, for putting up locomotive shops.

TROY, N. Y.—According to local reports, the New York Central has bought land on Adams street adjoining its present freight house, on which a large new freight house will be built

VICKSBURG, MISS.—New passenger station is to be built for the Yazoo & Mississippi Valley at the corner of Grove and Mulberry streets, one block north of the present station. Work is to be started at once, and will cost about $50,000.

WATERBURY, CONN.—According to local reports, plans are about ready for a new passenger station to cost $200,000.

WORCESTER, MASS.—The Worcester Grade Crossing Commission is considering plans for a new concrete union passenger station.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ABILENE & NORTHERN.—See Colorado & Southern.

ANDERSON & SALINE RIVER.—This company which last year built 10 miles of road from York, Ark., to Grant Spur, is making

surveys for a further extension to Leola, on the Chicago, Rock Island & Pacific, seven miles. Robert York, Treasurer and General Manager, Pine Bluff, Ark.

Appomatox & Charlotte.—An officer writes that this company proposes to build a line from Drakes Branch, Va., northwest to West Appomatox, 40 miles. Address E. B. Eggleston, Charlotte Court House, Va. (See Construction Record.)

Arkansas, Louisiana & Gulf.—An officer writes that permanent location has been made for a line from Pine Bluff, Ark., south to Monroe, La., 150 miles. Address E. G. Hammock, Monticello, Ark. (Sept. 7, p. 62.)

Arkansas Pacific.—An officer writes that contracts will be let by February 1 for building this line. Surveys are being made from Denison, Tex., to Memphis, Tenn., 469 miles. George D. Locke, Missouri Trust Building, St. Louis, Mo., is President. (Nov. 9, p. 128.)

Canadian River.—See Santa Fe, Liberal & Englewood.

Cincinnati, Georgetown & Portsmouth (Electric).—Contracts let to Thomas Daulton, of West Union, Ohio, for an extension from Russellville, Ohio, to West Union, 14 miles.

Clear Lake & Southern.—Surveys are being made for building this proposed line from San Francisco, Cal., north to Lakeport, 130 miles. Le Grand Brown, 745 Monadnock Bldg., San Francisco, may be addressed.

Colorado & Southern.—The Abilene & Northern is being extended from Abilene one mile south. M. T. Reed is the contractor. The road is projected from Abilene, Tex., south to Brady, 85 miles.

Corvallis & Eastern.—An officer writes that surveys have been made for extending this road from Yaquina, Ore., west to Newport, five miles.

Danville & Mt. Morris.—An officer writes that this company is making surveys for a line from Danville, N. Y., south to Hornell, 16 miles. William Humphrey, General Manager, Danville, N. Y.

Delaware & Hudson.—Contracts for double tracking this road from Schenectady, N. Y., southwest to Delanson, 13 miles, were recently let to Elmore & Hamilton, for $600,000. It will take about eight months to complete the work. The contractors will shortly open an office in Albany or Schenectady and begin the work.

Eastern Tennessee & Western North Carolina.—An officer writes that this company is laying third track to make the road double gage from Elizabethton, Tenn., to Hampton, five miles.

Eldorado & Wesson.—This road, which is projected from Eldorado, Union County, Ark., southwest to Wesson, 10 miles, has completed grading and will soon begin track laying. James Harrington, Chief Engineer, Eldlorado, Ark.

Franklin & Clearfield.—See Lake Shore & Michigan Southern.

Georgia Coast & Piedmont.—An officer writes that this company, which last year built 18 miles of road in Georgia, is making surveys to extend its line from Darien, Ga., south to Brunswick, 17 miles.

Glenville & Kanawha.—An officer writes that surveys are being made by this company for its proposed line from Glenville, W. Va., northeast to Weston, 30 miles. R. L. Ruddell, General Manager, Glenville, W. Va.

Gulf & Northwestern.—Surveys have been made by this company for a line from Waco, Tex., northwest to Strawn, 120 miles. McCarthy, Starnes & Co., Lupton, Tex., are interested. The line is projected for an additional 250 miles from Strawn, northwest to Plainview.

Gulf, Hutchinson & Northwestern.—This company is building with its own forces a line from La Crosse, Kan., north to Hays, 25 miles. The road is projected from La Crosse southeast to Hutchinson, 100 miles, and from Hays north to Phillipsburg, 75 miles.

Kansas City, Lawton & Pacific.—An officer writes that contracts have been given to R. F. King, of Ada, to W. T. Sherwin, of Paul's Valley, Ind. T., for building this line from Wagoner, Ind. T., southwest to Lawton, Okla., 250 miles, and from Wewoka, Ind. T., east to Dustin, 30 biles. E. A. Hill, Assistant General Manager, 401 Odd Fellows' Building, St. Louis, Mo.

Kentucky Midland.—An officer writes that this company is building with its own forces a line from Central City, Ky., west to Earles, 10 miles. Surveys from that place west to Madisonville, an additional 12 miles, are under way. N. M. Wheeler, Chief Engineer, Central City, Ky.

Kentucky North & South.—Surveys are being made for this line from Fullerton, Ky., on the Ohio river, to Bristol, Tenn., 200 miles. Work is to be started early this month. R. G. Taylor, Fullerton, Ky., is interested (Oct. 26, p. 115.)

Lake Shore & Michigan Southern.—Contracts let for building the Franklin & Clearfield from Franklin, Pa., southeast to Brookville, 56 miles, to the following firms: Crary Construction Co., McNalley Co., Ferguson Contracting Co., Mills Construction Co., King Bridge Co., and American Bridge Co. Samuel Rockwell, Chief Engineer, Cleveland, Ohio.

Las Vegas & Tonopah.—Contracts let to Deal Bros. & Mendenhall for an extension from Rhyolite, Nev., north to Goldfield, 76 miles. (Sept. 14, p. 69.)

Live Oak, Perry & Gulf.—Extension being built from Rigler creek, Fla., west 30 miles.

Lorain & Ashland.—An officer writes that this company, which recently completed six miles of road between Lorain and Wellington, is making surveys for an extension from Wellington south to Loudonville, 39 miles. Address August Mordecai, Wellington, Ohio. (Dec. 7, p. 161.)

Lotbiniere & Megantic.—An officer writes that this company has projected an extension of its road from Lyster, Que., to Lime Ridge, 60 miles.

Louisiana East & West.—Grading completed for an extension of this road from Ville Platte, La., to Eunice, 16 miles; track-laying with company's own forces under way. C. J. Carpenter, Superintendent, Bunkie, La.

Mangham & Northeastern.—This company, which built one mile of road in Louisiana last year, is building three miles additional from Mangham to Baskinton. O. A. Wright of Mangham, La., is interested.

Messabe Southern.—This road has been opened for operation from St. Louis River, Minn., to Gowans, 38 miles.

Natchez, Columbia & Mobile.—This company, which last year built an extension from Divide to Loweton, Miss., 3½ miles, is building with its own forces an extension from the latter place to Pearl river, 3½ miles.

New York, Auburn & Lansing.—An officer writes that this company, which built 19 miles of line from Auburn to Genoa, N. Y., south, last year, has given contracts to the Auburn Construction Co., of Auburn, N. Y., and work is now under way from Genoa south to Ithaca, 20 miles. Both steam and electricity are to be used as motive power. H. A. Clarke, Chief Engineer, Wright avenue, Auburn, N. Y.

North & South Texas.—This company, which last year built two miles of road from Groveton, Tex., northwest, will shortly let contracts for the additional 34 miles to Lufkin; also from Groveton to Oakhurst, 25 miles. Surveys are also being made from Oakhurst to Houston, 70 miles. McCarthy, Starnes & Co., Lufkin, Tex., are interested.

Oklahoma Central.—An officer writes that contracts have been let for extending this road from Purcell, Ind. T., to which point the road was completed last year, west to Chickasha, 42 miles. Surveys also completed from Lehigh, the present southern terminus, southeast to Paris, Tex., 86 miles. F. C. Hand, Chief Engineer of Construction, Purcell, Ind. T.

Oregon & Southeastern.—An officer writes that this company, which built two miles of road in Oregon last year to mile post 20, has projected an extension from that point to Bonita, seven miles.

Oregon Short Line.—It is said that this company is planning to build a line through Boise, Idaho, which is to form part of the main line of its Idaho division.

Pound Gap-Elkhorn.—Incorporated in Kentucky, with $100,000 capital, by C. T. Smith and G. W. Morehead, of Elkhorn City; W. Meredith and J. Day, of Hellier, Ky., to build a 25-mile line from Pound Gap near the Kentucky-Virginia state line; not yet surveyed.

Powells Valley.—Surveys are being made by James R. Russell, of Blackwood, Va., from Blackwood up Powells river, about 12 miles, to coal and timber lands.

St. Louis Belt & Terminal.—This company last year built eight miles of road in Missouri, from Easton avenue, St. Louis, to Hanly road, and is planning to build an extension to the St. Louis & San Francisco, two miles. B. C. Jackson, Chief Engineer, St. Louis, Mo.

Salt Lake & Ogden.—This company is building with its own forces an extension of its road from the Davis-Weber county line to Ogden, 5½ miles; also from Ogden to Ogden Canyon, 2½ miles. Grading has been finished on all of this except a mile and a half on the line to Ogden.

San Diego & Arizona.—An officer of the San Diego Eastern writes that the franchises and other property of this company have

been sold to J. D. Spreckels, who has formed a new corporation under the above name and proposes to at once build a line from San Diego, Cal., east to the Colorado river, 200 miles. (Dec. 21, p. 175.)

SAN DIEGO EASTERN.—See San Diego & Arizona.

SANTA FE, LIBERAL & ENGLEWOOD.—Work is now under way on a new through line through New Mexico, Kansas and Oklahoma, to be known as the Santa Fe, Liberal & Englewood system, consisting of four sections, two of which are already completed. The first section is the Santa Fe, Raton & Eastern from Raton, N. Mex., east to Carisbrooke, 16 miles, with two branches forking north into the coal fields of Colfax county; the second section, the Santa Fe, Raton and Des Moines, from Carisbrooke, N. Mex., east to Des Moines, 40 miles. The third section, the Santa Fe, Liberal & Englewood proper, is building the whole length of Beaver County, Okla., from Des Moines east to Hooker, where connection is made with the C., R. I. & P.; from Hooker the main line is to run east to Woodward, Okla. The fourth section, the Canadian River, is to run from Woodward, Okla., southeast to Watonga, from which point connections with the Atchison and Rock Island is made by two lines, one to Guthrie, and the other to Oklahoma City. The whole road is to be stone ballasted, with steel bridges and zinc treated ties 3,000 to the mile and to be laid with 85-lb. rails. Maximum grades will be 0.6 per cent. eastbound and 0.8 per cent. westbound. It will depend largely for its earnings hauling coal from the large coalfields in Colfax County, New Mexico. The annual output of coal from fields adjacent to the road is estimated at 1,000,000 tons, and it is also expected that the road will haul annually 100,000 tons of ice.

SANTA FE, RATON & EASTERN.—See Santa Fe, Liberal & Englewood.

SANTA FE, RATON & DES MOINES.—See Santa Fe, Liberal & Englewood.

SHELBY LONG FORK.—J. M. Stewart, of Ashland, Ky., and Eugene Zimmerman, of Cincinnati, Ohio, are quoted as saying that this road is to be extended up Long Fork valley from Shelby Station on the Chesapeake & Ohio, through Pike and Letcher Counties to coal fields, about 40 miles.

SIBLEY LAKE, BISTENEAU & SOUTHERN.—An officer writes that this company is building a four mile extension in Louisiana; contract let to Blackman Bros. J. H. Martin, General Manager, Yellow Pine, La.

SPRINGFIELD, CLEAR LAKE & ROCHESTER (ELECTRIC).—This company, which last year built two miles of electric road from Springfield, Ill., east, will build during the present winter 10 miles additional to Rochester. A further extension is projected south, also from Rochester, to Pawnee, about 15 miles. J. E. Nelick, Springfield, Ill., is Superintendent.

TAMPA NORTHERN.—This company is building an extension of its road from Tampa, Fla., to Brooksville, 48 miles.

TENNESSEE & NORTH CAROLINA.—Surveys are being made for an extension of this road from Waterville, N. C., to Canton, 35 miles.

TENNESSEE RAILWAY.—An officer writes that this company, which last year built 14 miles of road in Tennessee, has given contracts to Walton, Wilson, Rodes & Co., of Knoxville, Tenn., for extending its road from Smoky Creek to Beech Fork, six miles, and from Smoky Creek to Asher's Fork, 8½ miles. The company is planning to reduce grades on the old line in Scott County between Oneida and Almy, eight miles. W. O. Dyer, Chief Engineer, Oneida, Tenn.

TEXAS SOUTHEASTERN.—An officer writes that this company, which last year built eight miles of road in Texas, is building a line from Vair to Lufkin, 10 miles.

UNION PACIFIC.—The plans for changing the grade on the Athol Hill section of the Denver-Cheyenne branch of this road it is said include a double cut-off, one part of which is to end at Cheyenne and the other at a point between Boris and Granite Canon stations, respectively eight and 18 miles west of Cheyenne. The proposed route of these cut-offs is from a point 20 miles south of Cheyenne on the present line west up Lone Tree Valley for several miles to a point about 10 miles southwest of Cheyenne, where the line will divide into two branches, one running northeast to Cheyenne, and the other northwest to a junction with the main line between Boris and Granite Canon.

WISCONSIN CENTRAL.—The Lake Superior & Southeastern, which this company is building north to Duluth, Wis., has been built from Owen to Ladysmith about 45 miles, and considerable grading completed beyond that point. It is expected to have the road completed to Duluth by the middle of this year. The new line will provide a direct and short route for ore shipments from the Hill roads in Northern Minnesota.

It is probable that this company will build a connecting line from Portage, Wis., south to Janesville, on the Illinois, Iowa & Minnesota, about 40 miles.

RAILROAD CORPORATION NEWS.

ALEXANDER & EASTERN.—This is the new name of the Alexander & Rich Mountain Railway, which has 18 miles of line from Alexander, W. Va., to Long Run Junction, including a three-quarter mile branch up Long Run and a one-half mile branch up the left fork of Buckhannon river. The road is operated only for freight traffic.

ALEXANDER & RICH MOUNTAIN.—See Alexander & Eastern.

ATCHISON, TOPEKA & SANTA FE.—See Northwestern Pacific.

BOSTON & MAINE.—An issue of $3,000,000 one-year notes has been sold to a syndicate consisting of Kidder, Peabody & Co., R. L. Day & Co., Esterbrook & Co., and F. S. Moseley & Co. Of this issue $1,000,000, already sold, are dated January 15.

An issue of $2,000,000 Fitchburg Railroad, 4 per cent., 20-year bonds dated April 1, 1907, has been sold to Moffat & White, of New York. Of this issue $1,500,000 is for refunding and the other $500,000 to reimburse the Boston & Maine for improvements to the Fitchburg. The new bonds are legal investments for savings banks in Massachusetts and Connecticut.

CALIFORNIA NORTHWESTERN.—See Northwestern Pacific.

CHICAGO & NORTH-WESTERN.—At a meeting of the Board of Directors on January 15 it was resolved that to obtain funds for constructing, improving and equipping the road there be issued $24,403,105 common stock, equal to 25 per cent. of the total preferred and common shares now outstanding. There is $22,395,120 Chicago & North-Western preferred and $75,217,300 common outstanding, a total of $97,612,420. A little more than $100,000,000 new common stock was authorized by the stockholders at the annual meeting on October 18, 1906. Chicago & North-Western rights on the new issue opened at about 18 on the New York Curb.

CINCINNATI, HAMILTON & DAYTON.—*The Commercial and Financial Chronicle* learns from Judson Harmon, Receiver, that no receiver's certificates were issued to raise funds to pay the interest due January 1, 1907, on bonds of the Cincinnati, Hamilton & Dayton and Pere Marquette, as the net earnings were sufficient. The receiver's certificates dated January 1, 1906, which matured January 1, 1907, were extended for six months at 6 per cent. The previous rate of interest was 5 per cent.

DELAWARE & HUDSON.—See United Traction Company.

EUREKA & KLAMATH RIVER.—See Northwestern Pacific.

ILLINOIS CENTRAL.—On January 10, Governor Deneen sent a special message to the legislature dealing with the question of taxes due by the Illinois Central to the state, in which he held that the railroad company had never complied with the requirements of its charter providing that it render a correct accounting and an honest and fair division of the receipts and income of the entire system, among the shorter lines and the lines leased, owned and operated by the company. He takes the position that the Illinois Central was authorized to construct, own and operate only the main line and the two branches there described, and alleges that the state has been defrauded by the division of earnings among the different lines.

A resolution was introduced in the Illinois Senate on January 15 calling for a committee of senators to investigate the election of J. T. Harahan as President of the Illinois Central on the ground that the election was illegal because it took place outside the state; also to inquire into the right of the board of directors to act, as only two of the 12 directors are residents of Illinois, while the law provides that a majority of the directors of an Illinois railroad corporation shall be residents of the state.

LEHIGH VALLEY.—At the annual meeting, which opened on January 15, President Thomas made the following answer to the request from some of the stockholders for larger dividends:

> At a time when there is so much uncertainty as to the future cost of operation and the effect on the company of recent laws, your Board believes a conservative policy in the matter of dividends is to the best interests of the stockholders. The labor situation is unsettled. Heavy demands have been made on the company for shorter hours and increased wages because of the increased cost of living and higher rates of wages paid by others, many of which have been granted where a fair and impartial review of the situation indicated the necessity of so doing. This will have its effect in tending to increase the future expense of operation. The shortage of freight equipment cars which is everywhere engrossing the attention of both railroad officials and the general public is one that must be dealt with broadly in order to carry on the continued prosperity of the country.
>
> It must be borne in mind that the business of producing anthracite coal is not alone a mining proposition, but a manufacturing and commercial undertaking as well. The combined gross business of the railroad and coal companies is over $65,000,000 a year, and to provide ample working capital, as well as to meet expenditures for improvements as they become due, it is necessary to have ample cash [illegible] constantly at the

company's disposal, even though the cost of such work is not included in operating expenses, but is ultimately charged to capital account and provided for by the issue of securities.

If the railroads of this country are to be successful and their securities are to become desirable investments, the physical managements of the properties must appeal to the public sense as satisfying reasonable requirements, and their financial operations must command the confidence of investors. It is to that class this management appeals. They are the class by whom the bulk of the company's securities are held, the speculative holders being comparatively few, and it is to the conservative investing class, who believe in this property as a means of investing their funds, that this management looks for support. It is the belief of the management that it has had, and still has, the confidence of this class, and the fact that they have had confidence in the property and in the management is indicated by the few changes in the stockholders for many years, both during the period when no dividends were paid and at the present time, when the market value of the stock has been so considerably enhanced by the increased earnings and better financial conditions.

LITTLE MIAMI.—At the annual meeting to be held on January 29 important modifications will be made to the lease under which the road is held by the Pennsylvania Company, and the capital stock is to be increased from $8,000,000 to $10,000,000 to buy the Dayton & Western Railroad, which is under lease to the Little Miami.

MOBILE, JACKSON & KANSAS CITY.—This road, which has been freed from its recent brief receivership and returned to its former managers, has issued an annual report for the year ended June 30, 1906. This shows gross earnings of $1,083,692 against $677,528 in 1905, and net earnings of $309,931 against $273,385. There was a surplus of $29,000 against $18,800 in 1905. These results were obtained on the basis of a ton-mile rate of 2.2 cents and a passenger-mile rate of 2.74 cents, both of which, however, are large decreases from the 1905 figures.

NEW YORK & PORTCHESTER.—The New York State Railroad Commissioners have approved the issue by this company of a mortgage for $20,000,000 and an increase of its capital stock from $250,000 to $20,000,000. It appears that substantially all of the capital stock of the New York, Westchester & Boston, whose proposed line runs over nearly the same route as that of the New York & Portchester, is owned by the owners of the stock of the New York & Portchester. It is agreed that at no time shall the total amount of mortgage bonds or of capital stock outstanding on both railroads exceed $20,000,000.

NEW YORK CENTRAL & HUDSON RIVER.—The New York State Court of Appeals has reaffirmed a decision of the lower courts in favor of the New York Central as lessee of the New York & Harlem. The question at issue was as to whether the New York Central should get the benefits of the interest saved through refunding $12,000,000 7 per cent. bonds into 3½ per cent. bonds. An agreement had been ratified by a majority of the stockholders of the two companies that in return for the advantage gained by the New York Central through refunding, the dividends on the Harlem stock should be increased from 8 to 10 per cent., and this was held a valid agreement.

NEW YORK, CHICAGO & ST. LOUIS.—A dividend of 4 per cent. was on January 16 declared for the year on the second preferred stock against 3 per cent., which has been paid for the past four years. In 1901 the stock received 2 per cent., and before that nothing.

NEW YORK, NEW HAVEN & HARTFORD.—An issue of $10,000,000 5 per cent. notes, half of which mature in four and half in five years, has been sold to Hornblower & Weeks, and Lee, Higginson & Company. An earlier issue of $7,000,000 5 per cent. notes, one-half maturing in four years and one-half in five years, was also sold to the same firms. These issues of $17,000,000 in short term notes follow an issue of $6,000,000 of similar securities late in December, making a total of $23,000,000 in 5 per cent. short term notes recently sold by the New Haven road.

The New York, New Haven & Hartford has bought at a price of about $1,000,000 land from the Boston Consolidated Gas Company, to be used as a steamship terminal.

NORTH SHORE.—See Northwestern Pacific.

NORTHWESTERN PACIFIC.—This company was incorporated in California on December 21, 1906, as a joint enterprise of the Atchison, Topeka & Santa Fe and Southern Pacific to consolidate railroads owned by these two companies north of San Francisco. The new company is capitalized at $35,000,000, and its directors are E. E. Calvin, William F. Herrin, W. T. Smith and Peter F. Dunne, of the Southern Pacific, and A. H. Payson, E. S. Pillsbury and Edward Chambers, of the Santa Fe. The roads merged into the Northwestern Pacific are the California Northwestern, the San Francisco & Northern Pacific, the North Shore and the Eureka & Klamath River, controlled by the Southern Pacific, and the San Francisco & Northwestern and Fort Bragg & Southeastern, controlled by the Santa Fe. The consolidated company has something over 500 miles of road. By building a 150-mile connecting line between the northern terminus of the California North-western at Sherman, Cal., and the southern terminus of the San Francisco & Northwestern at Camp 5, a through route will be established over these roads from San Francisco north to Trinidad, about 300 miles.

PENNSYLVANIA.—It was announced on last Thursday that at the annual meeting of the stockholders of the Pennsylvania on March 12 authority would be asked to increase the capitalization probably by $100,000,000 in capital stock and $100,000,000 in bonds. The reasons given for the new issue were that the amount of capital stock already issued with that reserved for conversion of outstanding convertible bonds nearly approximates the full sum now authorized. Though it may not be necessary to issue any of the new capital during the current year, yet the company desires authority to make such issues should circumstances require. As the increase in capital must first be authorized by a majority of the stockholders, early announcement was made of the proposed increase in order to give stockholders due time for consideration before the annual meeting. The announcement of this proposed increase in the capitalization of the company came as a general surprise, and was followed by a decline of four points in Pennsylvania stock at the opening of the New York stock market on January 11. The Pennsylvania has within the last few years called for great amounts of new capital, the authorized stock having been increased in six years from $151,700,000 to $400,000,000. Of the total authorized issue of $400,000,000 there is outstanding a little over $300,000,000. At the time the Pennsylvania loan of $48,250,000 was placed in France last June, President Cassatt stated that as far as could be seen no large capital requirements would have to be met for some years beyond what will be necessary to pay off $50,000,000 notes maturing November 1, 1907, and to provide money needed in 1907 and 1908, estimated at $40,000,000, to complete the New York terminal. It is not possible to determine from the official statement in regard to the proposed issue how much new capital it really represents. In case the bonds are convertible, part of the $100,000,000 new stock would probably be used for converting the bonds.

The Pennsylvania has issued a statement of earnings for the year ended June 30, 1906. Gross earnings were $141,752,620 and net earnings $44,808,237; net income was $22,622,063, dividend requirements $18,242,068, surplus $4,379,995, other deductions $1,408,845, and net surplus $2,971,160. The regular fiscal year of the Pennsylvania ends on December 31.

PERE MARQUETTE.—See Cincinnati, Hamilton & Dayton.

SAN FRANCISCO & NORTHERN PACIFIC.—See Northwestern Pacific.

SAN FRANCISCO & NOTHWESTERN.—See Northwestern Pacific.

SANTA FE, LIBERAL & ENGLEWOOD.—This is the name of a projected road in Oklahoma with which are to be consolidated two recently built roads in New Mexico and another projected railroad in Oklahoma. These four roads which, when built, will make a new through line about 600 miles long from Raton, N. Mex., to Guthrie and Oklahoma City, Okla., are the Santa Fe, Raton & Eastern, now built from Raton to Carrisbrooke, 16 miles, with two branches running northward into the coal fields of Colfax County, and the Santa Fe, Raton & Des Moines, running from Carrisbrooke east 40 miles to Des Moines, New Mexico. The Santa Fe, Liberal & Englewood is to be 221 miles long and run the length of Beaver County, Okla., connecting Des Moines, N. Mex., with Englewood, Kan., and Woodward, Oklahoma. The other projected railroad is the Canadian River Railroad, which is to run from Woodward, Okla., southwest to Guthrie and Oklahoma City, 220 miles. The whole road is to be built with 85-lb. rails and maximum grades 0.6 per cent. eastbound and 0.8 per cent. westbound. There are to be $14,800,000 first mortgage 5 per cent. 30-year bonds and the same amount of stock.

SANTA FE, RATON & DES MOINES.—See Santa Fe, Liberal & Englewood.

SANTA FE, RATON & EASTERN.—See Santa Fe, Liberal & Englewood.

SOUTHERN PACIFIC.—See Northwestern Pacific.

UNITED TRACTION COMPANY.—This company, which owns the street railway systems of Albany, Troy and Cohoes, N. Y., and is controlled by the Delaware & Hudson, has increased its stock from $5,000,000 to $12,500,000, the increased funds to be used in buying the Hudson Valley Railway, which runs north from Albany and Troy with about 100 miles of line, and has hitherto been an independent electric road.

WABASH.—Application has been made to the New York Stock Exchange to list $16,500,000 additional preferred and $16,500,000 additional common stock.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- A Train Accident Investigation Law.... 97
- The Southern's Predicament 97
- The American Railway Clearing House and Car Pools 98
- Engine Failures 98
- Eminent Domain in Minority Shares.... 99
- New Publications 99

ILLUSTRATED:
- New Passenger Station at Salt Lake City for the Harriman Lines..... 101
- New Car Shops of the Wabash at Decatur 102
- Strengthening Ends of Postal Cars on the Seaboard Air Line..... 104
- Shop Belting Practice on the Santa Fe... 105
- New Texas & Pacific Station at Sweetwater, Tex. 108
- Timmis' Smoke and Spark Consuming System..... 110
- Rotary Snow Plow for the Denver, North-Western & Pacific 114
- The Tetlow Canal 118
- Induced Draft and Heating Equipment of the Erie R. R. Roundhouse at Susquehanna, Pa. 120

CONTRIBUTIONS:
- Canton-Hankow Railroad Equipment..... 100

MISCELLANEOUS:
- The Trouble with Railroad Discipline.... 100
- Life of Vulcanized Timber..... 100
- The Elmira Railroad Commercial Training School 101
- Report of New York State Railroad Commissioners..... 102
- Evolution of Railroad Car Trucks..... 103
- Proposed Railroad Legislation in Pennsylvania 105
- Milling-in-Transit with Variations..... 105
- Resolutions by National Board of Trade. 108
- Modifications of the Diversion Agreement 109
- Visible Supplies of Grain..... 111
- Elimination of Grade Crossings in New York State 111
- Transatlantic Passenger Traffic in 1906. 113
- Railroad Conditions in the South. 113
- Railroading in the Forties. 115
- Putting the Italian Railroads in Order. 116
- National Characteristics in Locomotive Building 116
- Waterproofing Masonry and Concrete Structures 119
- Foreign Railroad Notes 112
- Electrification in Italy 108

GENERAL NEWS SECTION:
- Notes 121
- Obituary 124
- Meetings and Announcements 124
- Elections and Appointments 124
- Locomotive Building 127
- Car Building 127
- Railroad Construction 128
- Railroad Corporation News 129

VOL. XLII., No. 4. FRIDAY, JANUARY 25, 1907.

The twelve bills affecting railroads, which are now in the hands of the House committee, ranging from the proposal to enforce a 2-cent passenger fare throughout the United States to the bill requiring the use of the block system, have been diagnosed as a disposition among Congressmen to stop "jumping on the railroads." Like dogs which stop barking because they have forgotten their incentive, the Congressmen are turning up something else. Some of last summer's proposals to further patch the rate law seem to have died of inanition. Most of those now in committee are crude measures. The hours-of-labor law, which has a good purpose, will probably prove to be full of troubles. But there is a bill which ought not to die simply because it is in bad or doubtful company—the bill empowering the Interstate Commerce Commission to investigate accidents. Collisions of a magnitude to alarm the public do not seem to be growing less frequent, and the need of a judicial form of investigation and a determination of their causes is undisputed. The public, competent independent critics, and far-sighted railroad officers ask for this. The correction of those defects in railroad practice which have caused the notable train accidents of the past two years is not in all respects easy, and many of the features of the desired improvement in practice cannot be dealt with by a Government board to any profit; but as a "promoter of publicity" the Federal Government not only has a useful function, in this particular field, but a plain duty. Letting such subjects go over from session to session, because of the exigencies of politics, is a sin.

We print this week the full text of a circular addressed by Mr. W. W. Finley, President of the Southern Railway, to the people served by his road. It is in many ways a remarkable document, not only because it portrays very strikingly the predicament into which a great railroad system can be brought by excess of prosperity—if prosperity is to be measured simply by increase of business—but because it presents in a very graphic manner a number of troubles which are not confined to any special railroad system or section of country. Mr. Finley shows that in eleven years his ton miles have increased over 300 per cent. and his passenger miles over 200 per cent.; that the company has spent nearly $100,000,000 in providing for these increases; that it is unable to receive equipment at the contract time, and that improvement work is from five to ten months late owing to the difficulty which contractors are having in getting labor and material. Labor cost has increased from an average of $1,621.67 per mile in 1905 to $2,874.71 in 1906, and the increase in labor cost during the last fiscal year alone has been over $350 per mile of road. The statement that the cost of locomotives has increased from $11,392 in 1898 to from $16,000 to $20,000 in 1906, does not mean anything, because the heavier motive power can and does haul heavier trains, while the average cost of a locomotive was not far from 10 cents a pound in 1898 and 1906 alike. But the figures showing that bridge timber has considerably more than doubled in price in eight years, that the cost of ties has increased from 28 cents to 34½ cents per tie (and Mr. Finley is lucky to get them for that!) and that rails have increased from $17.75 per ton to $28 per ton, cannot be gainsaid. Yet these things, bad as they are, do not trouble the President of the Southern Railway so much as does the present marked tendency on the part of many states through which his line passes "to regard any failure of service as wilful and to impose upon the carrier a heavy fine therefor." Here then is the situation. The Southern Railway cannot raise capital, hire men, or get its orders filled, fast enough to meet the demands of traffic, but the communities which the railroad serves refuse to take these facts into account, and see as their remedy only the steady increasing application of penalties to the company which is doing its best. Mr. Finley points out that the logical result of imposing penalties for failure to furnish cars under such circumstances would be simply that the carrier would withdraw facilities from localities where there was no penalty in order to use them in localities where penalties existed, and that this same process carried a step further would simply result in a race between states to see which could inflict the highest penalty so as to obtain a preference for its own citizens. It is noteworthy that at the same time the communities in the South are saying to the railroad companies "You must provide facilities at any cost," the communities in the Northwest are saying to their railroads, "You must raise no more funds!" The state of affairs in the South Atlantic states is surely no more discouraging than this indication that legislative study of railroad economics in Minnesota could get no further, in the year 1906, than the belief that increased capital to enable the Great

Northern Railway to effect much needed extension and improvement work would result in an increased charge to shippers within the state. What is a railroad president to do, when Wall street and the state governments at one and the same time insist that he must not raise new funds, while in the meantime the traffic that he was just able to take care of a few years ago has doubled? We suspect that the answer to this problem, like the answer to many another seemingly unsolvable question, lies along the lines of compromise. Work must be done somehow, and funds must be raised, and state legislatures must be appeased, until the tide turns and allows facilities to catch up with traffic, and until the criticisms of the American people and of the American President take a constructive in stead of a destructive form.

THE AMERICAN RAILWAY CLEARING HOUSE AND CAR POOLS.

At the fall meeting of the American Railway Association, as the result of a proposition made by Mr. Stuyvesant Fish, a committee was appointed to inquire into and report on the causes of car shortage and the lessening efficiency of equipment, and to recommend remedies. (*Railroad Gazette*, Nov. 2, 1906.) The specified remedy proposed by Mr. Fish was a freight car clearing house, and the committee, known as the Car Efficiency Committee, was instructed to devise a plan for the formation of such a bureau. Pursuant to these instructions, and stimulated by the recent report of Interstate Commerce Commissioners Lane and Harlan, which was well received and carried considerable weight with the railroads, it was decided that the best way to work out a scheme such as proposed and show its practicability would be by the actual establishment of a clearing house; therefore with the approval of the Executive Committee of the American Railway Association this was undertaken. On January 7 there was held at Chicago a meeting at which were present the presidents of most of the principal lines having headquarters there, and the American Railway Clearing House was formed. It is a voluntary association and is administered at present by an executive committee, of which Mr. Arthur Hale, General Superintendent of Transportation of the Baltimore & Ohio, is Chairman. The other members are: J. Kruttschnitt, of the Harriman Lines; W. A. Gardner, of the Chicago & North-Western; H. I. Miller, of the Chicago & Eastern Illinois, and Daniel Willard, of the Burlington. At the present writing the undertaking has the support of the Atchison, Topeka & Santa Fe; Baltimore & Ohio; Chicago & Alton; Chicago & Eastern Illinois; Chicago & North-Western; Chicago, Burlington & Quincy; Chicago, Milwaukee & St. Paul; Erie; Illinois Central; New York Central; Pennsylvania Lines and the Pennsylvania Railroad, and the Southern Pacific and Union Pacific. Others may be added. Some of these companies will support the movement only to the extent of interchanging statistical information, the functions of the organization being three-fold, namely, collection of statistics, keeping of clearing house records, and formation and administration of a freight car pool.

The most radical and interesting feature of the three will be the car pool, which will be formed by a certain number of the clearing house roads. These cars will be marked with the clearing house name and numbers and will carry the names of the pool members in smaller letters. The pool will be formed under a separate agreement but will be inside the clearing house. Since the creation of such a pool is based on the idea of equal interchange, and therefore presupposes the use of similar cars, plans are being made for three separate pools—a box, a gondola and a coal car pool, each having a separate membership and operated separately from its companion pools, though the methods for each will be alike, of course. The several tasks of the clearing house are each of considerable magnitude, and the initial step in each case will be confined to box cars. To that end the members of the clearing house have been asked to report the number of their box cars on all other foreign lines. Likewise, the box car pool will be the first to be put in commission. The penalty or charge to be imposed when one member of the pool uses more than its share of cars has not yet been established, but the opinion has been expressed that this should be a variable quantity regulated by the traffic activity, the scale to be fixed by the executive committee.

Attention should be directed to the fact that although to the casual observer there is some appearance of complication, of wheels within wheels, in the number and relation of American Railway Association committees that have under consideration matters pertaining to freight car service, these several committees have each the same chairman, Mr. Hale, and also the same secretary, Mr. Allen, Secretary of the American Railway Association, who also, in all probability, will be the secretary of the clearing house when it is fully organized. Harmonious working is therefore assured.

The Hamilton National Bank, Chicago, has been selected as depository for the clearing house. The headquarters of the American Railway Clearing House, as well as of the Committee on Car Efficiency of the American Railway Association, are at 411 Grand Central Station, Chicago. While the clearing house is at present administered by an executive committee, as mentioned above, it may later be put in charge of the Car Efficiency Committee. Meantime, this committee will continue its work in connection with the reports on surpluses and shortages of cars.

ENGINE FAILURES.

Engine failures are bad things to have at any time. The disturbance to the schedule, the lost time, and the other troubles that ensue, are sufficiently objectionable when operating conditions are normal. Under abnormal conditions they become correspondingly more objectionable. It is therefore unfortunate that it is just these conditions that multiply the frequency of their occurrence. In summer, under normal traffic conditions, engine failures should be few. Winter weather increases them; an unusual volume of traffic increases them; the two combined mean grief in plenty for the locomotive men. Said a master mechanic whose engines are pooled: "In the summer time it's first in and first out; in the winter, first in and *right* out." When every available engine must thus be kept in service every moment possible, with only such attention at terminals as is absolutely necessary, failures are bound to multiply to an extent measured only by the severity of the conditions and their duration. But by the exercise of suitable measures, even under the adverse conditions mentioned, the number may be kept down to a minimum. The paper of Mr. Dunham, of the North-Western, read at the January meeting of the Western Railway Club, and printed in these columns last week, points out the wisdom of reducing tonnage in times of unusual traffic activity; for, as he says, it means greater speed of trains, more frequent attention to the locomotives, better rest hours for crews, reduced delays waiting at meeting points, and therefore a greater number of cars, and consequently increased tonnage handled in a given time. Another suggestion he makes, which would aid materially in lessening failures, is that no engine should be permitted to start on a trip unless the roundhouse foreman feels pretty sure it is able to make the trip if properly handled and not delayed unreasonably. This would avoid failures of the kind he cites at one point in the paper, where, at the request of the despatcher, an engine crew will attempt one more trip with the engine before sending it in for repairs, often resulting in a dead engine—the fault really being, as he says, a man failure rather than an engine failure.

The discussion served to emphasize the fact of there being at present no basis whatever by which this feature of locomotive performance—engine failures—can be compared between different roads. The desirability of having standard definition for the term "engine failure" was advocated and the suggestion made that it become the subject for a committee of the Master Mechanics' Association; such committee not only to formulate a definition, but a list of the locomotive characteristics and the numerous varied conditions of operation on which any definition would need to be predicated in order to enable comparisons to be made. At present, when one road reports 5,000 miles per failure and another road 10,000 miles, it is not at all to be inferred that the second road is twice as efficient as the first in this regard; for what one road will call a failure another will disregard entirely; some have no rules at all as to what does and does not constitute a failure, while others have rules formulated which are explicit on all points and which vary in character from liberal to severe. In the absence of such rules, decisions regarding failures usually lie altogether with the despatcher and records are made up from his reports; for that reason, one master mechanic suggested that despatchers should have a good working knowledge of the care and handling of a locomotive to enable them to charge failures fairly and justly.

Since "engine failures, like the poor, are always with us," and their minimization is a most important desideratum with all roads, action by the Master Mechanics' Association such as suggested, with such amplification as careful investigation and study by a conscientious committee would develop, would no doubt be productive of valuable and helpful results, and it is to be hoped that the matter will be given early consideration.

EMINENT DOMAIN IN MINORITY SHARES.

Some three years ago (March 25, 1904) in these columns in connection with the case of Offield versus the New York, New Haven & Hartford Railroad Company, and at the beginning of the suit we discussed the subject of the legal and equitable rights of railroad corporations to condemn, under eminent domain, the shares of minority holders of the stock of subsidiary lines. The case in question, after plodding its long way through the Connecticut courts and going to the United States Supreme Court on appeal, was decided some time ago by the latter tribunal; and the textual finding of the court is now at hand. In many respects it seems a fundamental decision not only because the case is somewhat unique in itself but because of the principle laid down and the extension of that principle so as to include the vast interests of our railroads at a period in their development when absorption of shares preliminary to consolidation has brought the legal status of the minority shareholder into considerable prominence. As consolidation and centralized control proceeds that prominence of minority interests is not likely to lessen.

The case has been an interesting one. Making the legal narrative as brief here as possible Charles K. Offield, of Chicago, held two shares of the New Haven & Derby Railroad Company, a subsidiary single-track line 17 miles long, leased for 99 years at 4 per cent. on stock by the defendant corporation which owned all the remaining 4,468 shares. Offield asked an exorbitant price—as now recalled, several thousand dollars a share—for his residuary stock. Condemnation proceedings were brought against him in the state courts under a statute passed in 1902 which authorized any Connecticut railroad corporation, after acquiring "more than three-fourths of the capital stock of any steamboat, ferry, bridge, wharf or railroad corporation and not agreeing with the holders of outstanding stock for the purchase of the same" to obtain such minority stock on appraisal after a finding by a superior court judge that the acquirement was in the public interest. After remanding of the case by the United States Circuit Court to the state tribunals they found against Offield. The Supreme Court of the state, all five judges assenting to the opinion written by Judge Baldwin, Professor of American Constitutional Law in Yale Law School, held that "any kind of property can be taken for public use on making just compensation"; that the New Haven & Derby Railroad Company was the mere "ghost of a corporation"; that its merger was essential, physically and financially, to allow the controlling corporation to make improvements that were in the public interest; and that there was no violation of the contract contained in the lease. Judges and courts are but human, at best, and it is not improbable that the undue price asked by Offield for his stock somewhat prejudiced his case.

But it is on the decision of the United States Supreme Court that prime interest rests. Before that tribunal counsel for Offield raised three points: (1) that the stock sought was for private not public use; (2) that the defendant corporation could make the improvements without taking the stock and accomplishing the merger; and (3) that the proceedings and the Connecticut statute violated the due process clause of the federal constitution and impaired Offield's contract rights under the lease. These points the federal court now sweeps away. It declares almost unqualifiedly the power and right of the state to declare and define public uses of property. It rests here upon two decisions both, by singular coincidence, in Utah, and both recent, one being rendered in May, 1905, and the other last February. In the one case the constitutionality is asserted of the Utah law that allows for purposes of irrigation a party to widen a ditch on the property of another, and in the other case eminent domain for a mining company in running a *private* railroad across a resisting party's land. It is true that further reference to the two cases shows that the federal court to some extent limits the ruling to an arid and mountainous mining state of the west and says, in effect, that there may be one law for such a commonwealth and another for an eastern state. But, on the other hand, it calls attention to the extent to which the Utah law goes beyond the Offield case, which "does not need the support of such broad principles." As to the actual public interest in condemning the two residuary railroad shares the federal judges accept absolutely the findings of the Connecticut court. As regards contract rights of a minority stockholder under the lease the federal court considers the contention only as "parts or incidents of the contention that the stock is sought for a private use," and, if not so, answered by one of its earlier decisions holding the right of a municipality to condemn, for public use, after due appraisal a corporation under contract to supply water adding "whatever value the lease gives the shares of stock will be represented in their appraisement."

Even the eye of the layman can see the fundamental, not to say radical, elements of the decision as applied to minority railroad stock holdings. Under legislation based on the principle of eminent domain the "majority" corporation can coerce the minority share owner, and the finding of the state court as to public interest seems to be final. The public interest may be small or remote without affecting the legal decision. In the New Haven & Derby Railroad case, for example, with the controlling corporation in full possession, save two shares, it is hard to see any practical limitation on improvements, or, if such limitations exist, why they could not have been met by special legislation. Do American railroad companies in such or similar conditions always or even often condemn and merge subsidiary or component lines before they extend or improve? The old theory also that the state's sovereign power of eminent domain, while established should be exercised cautiously and only where the public interest is clear and not remote or inferential seems to be badly jarred.

The situation now may be summed up substantially as follows: In the case of small minority holdings of railroad shareholders as against large majority holdings of a railroad corporation seeking a merger there are, in practice, two dangers. On the one hand the peril of a "strike" by the minority seeking an exorbitant price for its stock and willing to avail itself of its artificial and obstructive vantage; and, on the other hand, the danger of a "freeze-out" by the majority corporation which can be exercised in a variety of ways—an abnormally low lease rate, reduced dividend, diversion of traffic or other starvation and coercive methods applied to the property for which merger is sought. The decision now rendered by the supreme federal judges is distinctly adverse to the minority holder inasmuch as it amplifies the state processes if not powers of condemnation. But throughout the whole litigation and the court rulings bearing on the subject one principle stands firm: The minority stockholder may be deprived of his shares, but it cannot be done without just compensation. His property may be taken but it must be equitably paid for. The future line of rational legislation bearing upon the situation is therefore plain. It should simply aim to perfect the methods of fair and searching appraisal in the condemnation of minority stock with power of appeal to the courts for both sides. On that point the stress of future statute-making should be laid, and, with the agencies of appraisal high in quality, perils to both majority and minority interests if not quite removed will be minimized. If such is the resultant of the rulings of the courts, state and federal, the outcome, on the whole, will be very satisfactory; and, in the present temper of legislatures and the trend of law-making it hardly seems as though the railroad corporations would be unduly favored in the construction of appraisal bodies or anything else.

NEW PUBLICATIONS.

Symmetrical Masonry Arches. By Malverd A. Howe, Professor of Civil Engineering of Rose Polytechnic Institute. New York: John Wiley & Sons. 6 in. by 9 in.: 170 pages; 28 illustrations in the text; 4 folding plates. Cloth, $2.50.

The book considers not only arches of natural stone, but those of both plain and reinforced concrete, and is intended for use in designing in accordance with the elastic theory. It is not claimed that the formulæ and methods presented are rigidly accurate, on account of the uncertain character of the materials that are used; they are, however, sufficiently close approximations to serve the purpose for which they are intended. The greater portion of the book is taken up with the solution of examples in which each step is given in detail, so as to be easily followed. Starting in with the fundamental formula of the elastic arch, it takes up the mathematical consideration of the distortion produced by bending, and the changes in the co-ordinates of the points of the arch by both bending and axial stresses. This is followed by the consideration of the action and stresses of various types of arches that are fixed at their ends, followed by examples of the application of the formulæ. The book proper closes with a chapter on typical arches, in which a few typical bridges are illustrated in order to show the method of reinforcement used in the ordinary arch, and this concludes with an abstract from specifications that give an outline of what should be required.

The appendix contains one table of the physical properties of the stone and concrete that are used for building purposes, and a second table giving the general data of about 500 masonry bridges that are located in different portions of the world. The data of this

table include the place, span, rise, material, class and what is of more value still, a reference to a publication where a full description of the bridge can be found.

The Engineering Index. Vol. IV., 1901 to 1905. Published by the Engineering Magazine. Edited by Henry Harrison Suplee and J. Cuntz in co-operation with Charles B. Going. Cloth. 1,234 pages. Price, $7.50.

The *Engineering Magazine* for some years has published each month a resume of important articles in the technical press, giving not only short titles, but a three or four line summary of the subject matter as well. The first volume of this index, now out of print, covered articles appearing from 1884 to 1891 inclusive; the second volume, from 1891 to 1895; the third volume from 1896 to 1900, and the fourth volume brings the record up through the close of 1905. It is almost needless to point out that such a compilation is of the highest value for reference purposes, and the *Engineering Magazine* is to be congratulated on its devotion to this task, which must surely be classed as an aid to the scientific professions rather than as a direct source of profit to the publishers. The use of this index, which is well cross-referenced, makes it not only possible but easy to trace and locate papers which one dimly remembers to have read, and which meet a present need better than any other source of information. It is quite true that access to a good technical library is necessary, if the usefulness of such a compilation is to be fully developed, but even where no such library exists, back numbers of periodicals can generally be obtained from the publishers. The important thing is that there should be a permanent record of the exceedingly valuable information which technical journals bring out with increasing diffuseness each year. The Engineering Index excellently fills this need.

CONTRIBUTIONS

Canton-Hankow Railroad Equipment.

New York, Jan. 18, 1907.

To the Editor of the Railroad Gazette:

The photograph you published with the short article on the Canton-Hankow Railroad equipment in your issue of Oct. 12, 1906, may be rather misleading to American railroad men. The cars



A Train on the Canton-Hankow Railroad.

shown in your photograph were ordinary flats covered, and were only used for passengers until the arrival of the first, second and third class coaches from America. I am enclosing you a photograph showing one of the two locomotives built by the American Locomotive Company, to which are attached two third class coaches, one baggage car, one first class and one second class coach, taken near Shui Tong, on the Sam Shui division of the Canton-Hankow Railroad.

P. H. ASHMEAD,
Late Engineer-in-Chief, Canton-Hankow Railway.

The Trouble With Railroad Discipline.

[The following communication, addressed to the Editor of the *Railroad Gazette*, is significant because of the name attached to it, which is that of a trainmaster who has had long experience in dealing with the question on which he writes. His opening paragraphs read as though they might have been written by any one of a hundred space writers who have lately deluged the daily papers with remedies for collisions, but they were not. Mr. Love's article appears to have a very accurate perspective.—Editor.]

Many times in the past, as well as just now, there has been much discussion, written and oral, in regard to the dangerous side of American railroad operation, but all efforts to remedy the defects have been spasmodic and the results not what they should have been had persistent effort been made. Much greater results could be obtained if the financial managers of railroads would delegate this part of the work to a capable man and themselves keep entirely out of it. There may be men who are capable of grasping both the economic and the safety sides of railroad operation in all their details, but they must be very few. Economic administration is mathematical. The largest elements in safe management are psychological. The lines of research and action do not run parallel. Economic administration is an exact science that may be mastered. Safe operation can only follow analysis and deduction with few absolute facts as a basis, and can only be mastered when psychology shall have become an exact science. The assurance with which many men will advocate the most absurd systems, methods or practices as perfectly safe would be ludicrous if the results were not appalling.

If a United States or state commission would thoroughly investigate some of the accidents it might prove beneficial. Where there is a general practice directly in violation of the printed rules of operation which has extended over a long period of time, finally resulting in a collision, is it a sufficient investigation when the person who violated the rule at that particular time admits it and submits to his punishment? Usually the division superintendent makes the investigation. He is judge of the court.

The fact is generally ignored that the division superintendent is often the most interested person present, as the accident is often the direct result of his own action or inaction. If these investigations were actually for the good of the service the very first information desired would be whether this was an isolated case or a general practice. Can railroads ever attain a truly scientific basis of operation unless the investigations are thorough and impartial? This cannot be done until it is fully understood that the division superintendent and the trainmaster are interested parties and debarred from occupying the judge's bench. I do not question the integrity of these officials. The system of investigation is one of the greatest obstacles to putting railroad work on a scientific basis. You do not obtain all the facts. You may adopt every mechanical appliance that has ever been or ever will be invented, but until the human side of the operation is put on a better scientific basis you will be about as far from safety as in the beginning.

This particular science will never be as exact as mathematics, but there is no doubt that it may be far more exact than it is. In the main division officials have gone as far as they could go.

This is a matter directly affecting the directors and owners, for the time is likely to come when the investigation of accidents in this country will be made, as in England, by a government officer who will at once recognize and expose the absurdity of promulgating orders that the ordinary man will not obey, or of neglecting to enforce those that are reasonable. The way to safety will be slow even with this obstacle removed. No general deduction can be made from a single case. It is doubtful if there will be much advance even with many cases to judge from unless there shall be some person with authority whose duty it shall be to analyze, decide and act. Even then it would be useless unless the authority was ample to enforce the corrections without question. In a multitude of counselors there may be much wisdom but there is usually little action.

If the railroads of the country can appoint an officer independent of all ofganizations with sufficient force to investigate and authority to act it would probably anticipate a government commission and be much more valuable.

A. J. LOVE,
Late Assistant Superintendent, Alabama Great Southern.

Life of Vulcanized Timber.

The following report on the life of ties treated by the vulcanizing process and laid in the tracks of the Erie Railroad in 1882 has been made to the General Manager at the request of the American Lumber Vulcanizing Co.:

Jersey City, N. J., Nov. 7, 1906.

JAMES BURKE, Engr. M. of W., Erie Railroad.

Dear Sir:—Replying to your letter of Oct. 26th to the attached papers in reference to vulcanized pine ties which have been laid in tracks on this division:

I would state that these ties were laid on a three-degree curve on the westbound track on the Bergen County Railroad, mile 11, during the year 1882. They were removed in the year 1900, and while in the track at that point were given very severe test and when removed showed no signs of decay. They were removed owing to the fact that they were cut down somewhat by the light 63-lb. rail which we had in tracks. There were a few of these ties, however, remaining in the track after the 63-lb. rail was replaced by 90-lb. On investigating this matter I am advised that these vulcanized ties held spikes much better than any ties that have been furnished since. In addition to those placed in tracks on the Bergen County Railroad, there were some put in storage tracks at Saddle River yard and are still in tracks at that point. They are sound and good and as they have shown but very little wear to date, I am not in position to state how long they will last, but it is

our opinion that they will last several years. The majority of the vulcanized pine ties were eight feet long.

I will forward a piece of one of these to your office within the next few days. In regard to the number of those applied, I would state that there were about 700 put in the main tracks on the Bergen County Railroad and 50 in Saddle River yard.

(Signed) A. C. ELSTON, Superintendent.

These ties were treated by vulcanizing, at the plant of the United States Wood Vulcanizing Co., later the Haskin Wood Vulcanizing Co., in New York City on the Harlem river. This plant was in operation for a number of years in the '80s and turned out large amounts of vulcanized lumber which was used for the interior finish in a number of buildings put up about that time. Only a few railroad ties were treated. Part of these were put in the structure of the Manhattan Elevated and a few on the New York Central, the New York, New Haven & Hartford, the Erie and the Brooklyn Union Elevated. The original process consisted of subjecting the timber to heat under air pressure, thus cooking the wood fiber in its own liquids, which undergo a chemical change and harden in the pores, making the timber impervious to moisture and imparting a rich color somewhat like that obtained in very old seasoned stock.

A number of improvements have recently been made in the original process by the Messrs. Howard, who for many years were associated with Col. Samuel E. Haskin at the old plant. The principal change has been the substitution of a vacuum for pressure. The result obtained by this process is to remove the aqueous components of the sap, thereby eliminating the prime cause of decay. The denser fluids, albumen and pitch, are retained in the pores of the wood and, being operated upon in a vacuum by the application of the proper degree of heat, vulcanizing takes place and in the gradual cooling these fluids fill and adhere permanently to the walls of the pores, coagulating, crystallizing and solidifying in such a manner as to hermetically seal them. This action serves to strengthen the wood, and it becomes much harder and of greater solidity and tenacity. The destructive principle of the albumen is eliminated, and the pitch is converted into resin. All the soluble liquids which cause fermentation and decay, or serve as food for destructive insects are removed. The process is particularly applicable to the soft woods, such as pine, gum and cypress. It is controlled by the American Lumber Vulcanizing Co., 535 Fifth avenue, New York.

The Elmira Railroad Commercial Training School.

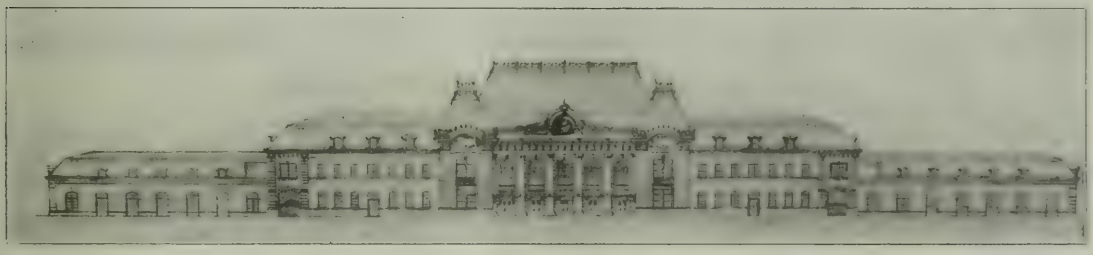
The Railroad Commercial Training School at Elmira, N. Y., which was established about 18 months ago to train young men as station agents and telegraph operators, has already passed beyond the stage of an experiment. Already 34 men have been graduated and placed in positions on the trunk lines, and the fact that all have given perfect satisfaction is best proof of the success of the work of the school. The use of a railroad telegraph line running through the building gives students actual experience in reading train orders and familiarizing themselves with such railroad business as daily passes over the wires. A miniature double-track railroad, equipped with block towers and block signals, over which pass one complete passenger train and two freight trains, gives practical as well as theoretical operating knowledge. The books of instruction were specially prepared by some of the most expert operating men in the country and the blanks used by the students in their daily work are exact duplicates of those used by freight and ticket agents in their work. All this equipment gives the student a chance to thoroughly learn the business of agent, operator or despatcher before he takes up actual work, and forms a sure stepping stone to success in railroad life. Any boy possessing an ordinary school education, good health and good morals can complete the course and be ready to fill a good position in one year from the date he begins study. He is in a railroad atmosphere continually from the beginning of his study. E. E. Tingley, the manager, has had 30 years' experience as operator and chief train despatcher on a trunk line and gives his personal attention to each student. L. J. Baird, the chief instructor, is not only an excellent block signal operator, but has had years of experience as chief clerk in a freight department, so that all intricacies of handling freight accounts are thoroughly taught.

By the system in use in the school, each student is appointed an agent and carries on the business with the others just as he would with other agents, with shippers and passengers, making his reports to the manager as he would to a railroad superintendent, auditor, treasurer or other officials. At the same time, he is instructed in the duties of an operator, train despatcher and tower signal operator. All instruction under this plan is intensely practical and has proven so successful that the problem of turning out competent agents and telegraph operators can be solved if the school can secure the students.

New Passenger Station at Salt Lake City for the Harriman Lines.

Plans have recently been completed for a large union passenger station at Salt Lake City, which will be used jointly by the Union Pacific, the Oregon Short Line and the San Pedro, Los Angeles & Salt Lake. This will complete the extensive terminal improvements which these roads have been making in Salt Lake City. A new freight yard has been built in North Salt Lake, and a large modern freight house has also been completed. Work on a steel viaduct carrying North Temple street over the approach tracks, and the lowering of the railroad grade for a distance of half a mile north of the new passenger station, is under way.

The new station will face east on South Temple street at the intersection of West Third street. It will be a through station, and the building will be parallel with the tracks. The accompanying illustration from the architect's drawing shows the appearance of the front of the building, which will be 700 ft. long, considerably larger than the proposed station in Salt Lake City for the Gould Lines, the Rio Grande Western and the Western Pacific, which is to be 575 ft. long.



East Front of Proposed New Station of the Harriman Lines in Salt Lake City.

The building will be of brick with sandstone facing and terra cotta cornices and other ornamentation. The central portion, 300 ft. long, will be three stories high, the two top floors being used for railroad offices. The main entrances, five in number, lead from a vestibule into a central grand hall; to the left will be the telegraph office, and beyond in the space under the south tower will be located the men's smoking room; opposite, on the right hand side will be an information bureau with the ladies' waiting room beyond in the other tower. The main concourse, reached through the grand hall, will be 30 ft. wide and 312 ft. long, running parallel to the building between it and the tracks. The train shed will be about 300 ft. long and 240 ft. wide. The extensions of the train platforms at each end beyond the train shed will be protected by umbrella shads. Baggage elevators will be built in each train platform, and these will be connected under the tracks by a subway leading into the basement, where other elevators will raise the baggage trucks to the level of the baggage room floor. An overhead viaduct will be built out across the tracks from the second floor of the main building, with stairways leading down to each train platform, so that passengers may reach any track without crossing other tracks on the surface.

The two-story part of the building at the south end will have rooms for the news company, employees' toilet room, conductors' room, Pullman supply storeroom and baggage room, which is next to the main building. The south end of the main building between the baggage room and the main hall will be occupied by an immigrants' cafe and waiting room and barber shop. On the opposite side of the grand hall will be the news and parcel stand and ladies' rest rooms. In the two-story section north of the main building will be the yardmaster's office, emergency hospital and a cafe, dining room, kitchen, mail room, and quarters for the Pacific Express Company and the Wells Fargo Express Company.

The general design of the building is in the French renaissance

school of architecture. The interior decoration of the grand hall in the center of the main building, which will be 130 ft. long and 35 ft. wide, will be elaborately worked out with massive marble columns and marble finish. The mosaic floors will be of elaborate design, among other features being a colossal mosaic under the central skylight, representing some important epoch of the early history of the state. The building will cost approximately $400,000.

Report of New York State Railroad Commissioners.

The following are extracts from the 24th annual report of the New York Railroad Commissioners. That part of the report dealing with grade crossings will be found in another column.

We believe that the time has come when by statute it should be provided that all passenger cars on all steam railroads (including Pullman cars) shall, within a limited period, be lighted by gas or electricity. We also believe that out-of-date passenger coaches, many of which are operated on steam railroads in this state, should be replaced as soon as practicable. The use of steel freight cars is increasing, and on the electric lines of the New York Central and Long Island railroads near New York City steel passenger cars are generally in use. Steel passenger cars are safer than wooden cars, and their quick installation on those railroads whose financial condition is such that it may reasonably be said they can afford them, should follow. The companies in their consideration of this subject should give the proper weight to what is due the public from whom the revenues are derived, and not consider alone the matter of economy to themselves. The improvements in passenger equipment which have come in the past have covered long periods of time, and the platforms, couplers and brakes which are now considered indispensable were slow in arriving. Conditions, however, have changed, and the public expects that proved advances such as are represented by gas or electric light and by steel cars shall be adopted by prosperous companies without delay.

During the year a locomotive boiler inspector was appointed. He reports as follows:

The inspection of locomotive boilers under state supervision has been attended with much success during the past year. Nearly 22,000 inspections were made and reported to the Board, resulting in the discovery of a large number of defects and the condemnation of many boilers.

Prior to the passage of the boiler inspection law many roads made no inspections at all, while others employed "handy men" or other incompetent inspectors, which meant that boilers were often operated under dangerous conditions. Several roads operating in this State have no mechanical officers, consequently the boilers in the past received little or no care. These roads now realize the danger of operating old and oftentimes cast-off locomotives from other roads, and are inspecting the boilers regularly. The larger roads made inspections more or less thorough and with varying degrees of regularity, dependent on the demand for power. In busy seasons inspections and repairs were often of a most superficial character, and the safety of the boiler was a matter of doubt.

The past year has been one of great activity. There has been an enormous demand for power, and as a result locomotives have been left in service as long as possible and extensive repairs made only when absolutely necessary. These conditions are gradually being corrected, and at present all roads are inspecting their locomotive boilers regularly. Competent inspectors are employed, the officials are paying more attention to inspection and repairs and employees have been given more explicit instructions regarding inspections.

The inspector of the board reports that motive power and rolling stock, although considerably added to by purchase or construction of new locomotives and cars, are not generally in as good physical condition as one year ago, owing to the fact that the volume of business has been so tremendous that it has overtaxed the carrying capacity of practically all railroads, necessitating their continued use, when their condition could have been much improved by making some repairs to them. Another reason for there being more delay to traffic than there has been generally in former years is the fact that owing to the coal strike of last summer the roads were unable to accumulate any quantity of coal previous to the heavy fall and winter movement of freight, and since that movement commenced have experienced great difficulty in getting sufficient coal, of even inferior quality, for use, and have been obliged to use motive power and rolling stock which should have been in other service in transporting coal for their own use, and, besides, were obliged to use much coal of an inferior quality.

New Car Shops of the Wabash at Decatur.

The Wabash has recently completed new car shops at Decatur, Ill., which are especially interesting in the construction of the larger buildings. The plant includes a car shop, 88 ft. x 464 ft.; blacksmith and machine shop, 80 ft. x 294 ft.; storehouse with two story office building at one end, 40 ft. x 464 ft.; wood mill, 80 ft. x 238 ft.; tin, cabinet, upholstering, glazing and electrical shop, 40 ft. x 350 ft.; power house, 60 ft. x 108 ft., besides a dry kiln, dry lumber sheds, iron, coal, coke and other material sheds and racks, and a lavatory building.



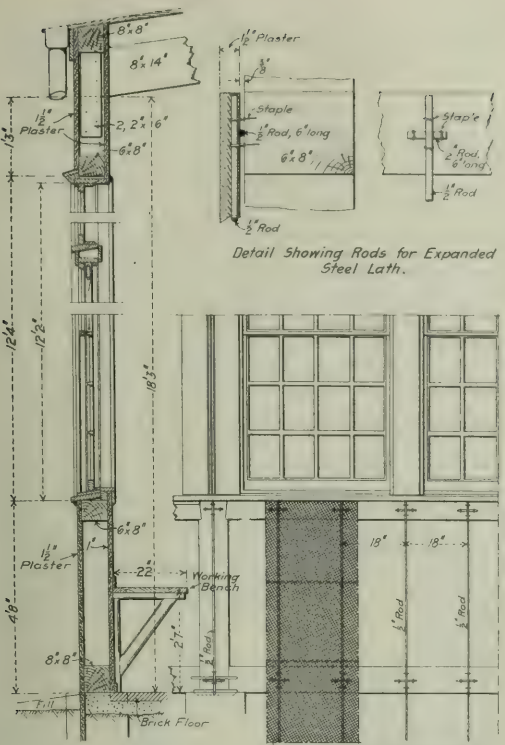
General View, New Wabash Shops at Decatur, Ill.

The large shop buildings have timber frames with walls formed of expanded metal plaster. There are two slabs, one on the inside and the other on the outside of the line of posts, leaving an air space between. Sections of the car shops are shown to illustrate the general character of the construction, and a detail illustrating the wall construction is also included. In wall construction the thickness of the outer slab is 1½ in. and of the inner, 1 in., the space between being 8 in. The plaster is applied to 24-gage diamond-mesh expanded steel lath secured to 1½-in. round rods stapled to the timber as shown. The shop buildings are given maximum window area for ample lighting, as may be observed in the photographic view reproduced herewith. The building at the right-hand side, illustrating this feature best, is the blacksmith and machine shop. The brick building about the center of the picture is the power station, to the left of which is the wood mill and the dry kiln, the latter being the low brick building at the left-hand side of the group. This building has a reinforced concrete roof, a cross-section of the building being included in the drawings. The front of the dry kiln is covered with rolling painted canvas curtains.

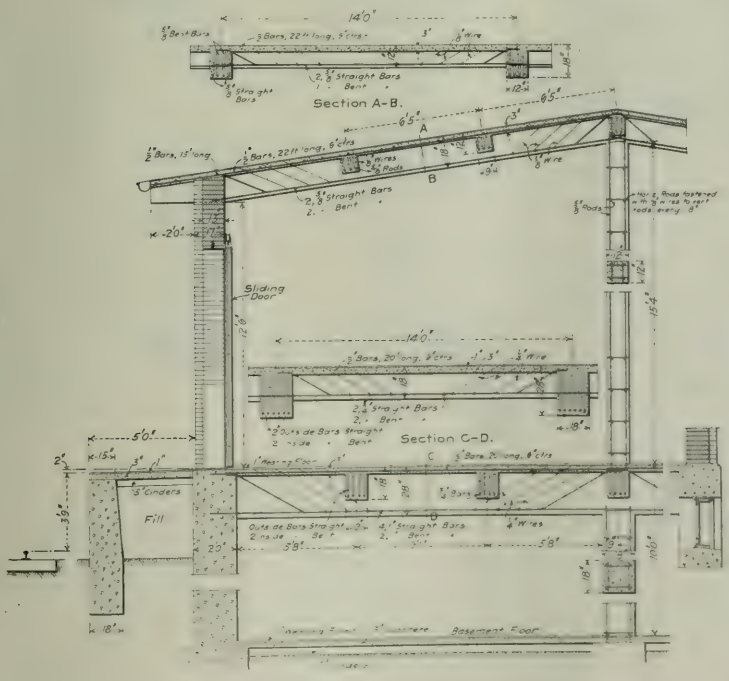


Sections of Car Shop; New Wabash Shops at Decatur.

The opposite end of the storehouse from the office portion is reinforced concrete for 57 ft. of its length to provide fireproof storage for oils. The basement of this room contains 12 oil tanks, each 6 ft. x 12 ft. There is also in the yard a concrete pit, 20 ft. x 40 ft., with two large tanks for fuel oil for the furnaces. The yard contains a complete sewer system with septic tank, and water and compressed air systems. All machinery in the plant is a.c.



Typical Section Illustrating Wall Construction.



Details of Reinforced Concrete Oil House.

motor-driven, and the shops are lighted throughout with electricity. The Miller vacuum heating system is used for the buildings and dry kiln.

The total cost of the plant, including grading, buildings, machinery and shop yard and tracks was $368,000. The cost per cubic foot of the different buildings was:

Car shop	2.7 cts.
Blacksmith and machine shop	3.0 "
Storehouse and office building	3.5 "
Wood mill	2.9 "
Cabinet, upholstering, etc., shop	4.5 "
Power house	3.4 "
Lavatory building	5.4 "
Dry kiln	11.1 "
Dry lumber sheds	2.3 "
Iron, coal and coke sheds	3.5 "
Material sheds and racks	5.8 "

The general contractors for the work were James Stewart & Company, St. Louis, Mo. Work was begun about the first of May and completed within six months' time. This included grading, requiring the removal of 13,300 cu. yds. of earth.

We are indebted to Mr. A. O. Cunningham, Chief Engineer of the Wabash, for plans and information.

Evolution of Railroad Car Trucks.*

In 1831 the first passenger car on any railroad in America was put on the Baltimore & Ohio on July 4th. It was built in the company's shops at Baltimore, Md., from drawings and specifications made by Ross Winans. It was twice the length of the four-wheeled cars, with center pins or king bolts, on which the trucks turned or swiveled. Experience with this car, the "Columbus," led Jonathan Knight, Chief Engineer of the Baltimore & Ohio, to report strongly in favor of the use of springs under freight cars on that road. His recommendation was approved, and a test of springs followed to determine which kind could be safely used.

As 1831 drew to a close, the vexatious question of front trucks under engines was solved by Ross Winans, who took out the front pair of wheels of an engine, replacing them with a four-wheel truck, swiveling successfuly in rounding curves on the Baltimore & Ohio. John B. Jervis reached the same conclusion as to the "Robert Franklin" on the Mohawk & Hudson. It is difficult to say just which one of these, if either, thought out the plan. In either event it was not new in principle in 1831 any more than in 1830 on the Quincy & Granite road, or in 1813 with the Chaplins in England. It had its origin in the first cars built to run on the road, in which the first wheel was turned by a locomotive, the "Merthyr Tydvil," in South Wales, and these cars still exist to prove the fact that the bogie truck is primarily and historically an English, or rather a Welsh idea. There is no question, however, as to the experiment built at the West Point foundry from designs and plans of Jervis being the first locomotive in the world constructed with a bogie or swiveling truck under the front end.

The trucks used on the Baltimore & Ohio in 1862 had side frames made of a piece of oak timber, extending beyond, and resting upon the oil boxes, to which they were fastened with light bolts, no springs being used. A truck used on the Illinois Central Railway in 1873 was of the arch bar or diamond pattern without springs.

Mr. John Kirby, the veteran car builder of Lake Shore & Michigan Southern, says: "My earliest recollection of freight car trucks was 1848. They were built with wood wheel-pieces, cast-iron jaws, and half elliptic steel springs through the jaws. The bands rested in a recess on the oil box. The ends bore on cast-iron shoes under the side of the wheel-piece. There being no factory in the United States where springs of that kind were made, they were imported. Aaron French was a journeyman blacksmith at that time, or was going to school. When rubber began to be put in for springs, steel springs in a measure were discontinued. The rubber, about 5½ in. in diameter and 5 in. high, was placed on top of the wheel-piece; a spindle passed through the spring and wheel-piece and one end rested on top of the oil box. That was in about 1850. At a later date rubber was placed on top of the oil box. My recollection is not clear as to the date when the first diamond

*Extract from a paper by W. E. Symons, read before the Southern and Southwestern Railway Club, Nov. 15, 1906.

freight car truck was made, but it must have been as early as 1860."

Some 12 or 15 years ago the Fox pressed steel truck came into quite general use, and many thousands of them are still doing good service under cars in all parts of the country. Following the Fox came the Kindl, Sterlingworth, Buckeye, Cloud, Schoen and several other types, some pedestal, and others of the open jaw pattern, but all made of steel plates and assembled with rivets. In some instances these pressed steel shapes have been displaced by the old arch bar type, with its multiplicity of parts, and unavoidable dead weight, while others have taken up the cast-steel designs, of which there are several now offered the railroad trade.

A large steel company in St. Louis has made wonderful strides in the past two years in the introduction of cast-steel in the railroad field. It has made a car truck, which differs somewhat from any others, in that a section of the top member is removable to permit of placing the truck bolster in its proper location, after which this member is returned to place, and becomes a compression member. The usual forms of column and oil box bolts used in the arch bar type of truck are retained. Another large company in St. Louis makes a pedestal type truck. Another device is a passenger car truck of the six-wheel type, the frame of which is made entirely of cast-steel in place of a combination of wood, iron plates, bolts, brackets, angle bars, rods, stiffening plates, etc. It is a new departure in this direction, and is indicative of the extent to which it is possible to use cast-steel in car and locomotive construction. Still another company is making a cast-steel truck, which is a radical departure from the old arch bar, and all other types of built-up trucks, in that the side frames and oil boxes are all cast in one piece, thus eliminating not only the parts entering in and constituting the frame proper, but also the oil box and bolts or keys ordinarily used in other types of steel trucks to retain the oil boxes in place. These trucks to date have been placed under 5,000 cars, and 5,700 more are on order to fill, which would require 10,165 tons of steel.

One company is offering the railroads a cast-steel car and tender truck, wherein the side section of an arch bar type of truck is displaced or substituted with cast-steel. Every piece entering into the construction of, or used in assembling the arch bar truck frame is eliminated, except the outside oil box bolt in place of which is used a semi-circular key. There is also provided what is termed the universal oil box receptacle, which permits the use of any style, type or make of oil box coming within the M. C. B. requirements. A low or straight top arch bar style is provided for cars of a low floor level or center of gravity, such as furniture, ballast, buggy, tank or other cars for similar service; also engine tenders. This truck is also provided with a poling pocket device when desired. The cross or connecting members are provided with a view of absorbing, as far as possible, all torsional strains due to undulating track or imperfect roadway, without the possibility of either the side frames or cross members sustaining any injury, and at the same time retaining sufficient rigidity between the two respective side members, to insure their being kept in proper alinement. The present designs offered by the company referred to are a modification of their earlier type, some of which were placed in service five or six years ago, and in the construction of which the cross members were also of cast-steel, quite heavy, and which proved to be entirely too stiff or rigid to allow the truck to adjust itself to the imperfections of roadway.

The evolution of the freight car truck is clearly detailed in a comparative statement as follows:

First.

Pieces.		Weight.
2	top arch bars	294
4	columns	100
2	bottom arch bars	314
2	tie bars	124
4	journal boxes with lids	340
8	journal box bolts	77
16	nuts	17
8	cotters	1
1	spring plank	272
8	spring plank bolts	7
16	nuts	8
4	column bolts	76
8	nuts	32
4	cotters	1
4	Brake-beam hanger bolts	7
4	nuts	3
95	Total pieces	1,673

Second.

2	frames (cast steel)	690
2	compression bars	90
2	tie bars	124
4	journal boxes with lids	340
8	journal box bolts	76
16	nuts	17
8	cotters	1
1	spring plank	272
8	spring plank bolts	7
16	nuts	8
4	column bolts	76
8	nuts	32
4	cotters	1
4	brake-beam hanger bolts	7
4	nuts	3
91	Total pieces	1,744

Third.

2	frames (cast steel)	700
4	brake-beam hanger studs	32
4	journal boxes with lids	340
8	journal box bolts	76
16	nuts	17
8	cotter for journal box bolts	1
2	tie bars	124
2	angles for spring plank	212
16	bolts for spring plank	12
32	nuts for spring plank	17
94	Total pieces	1,532

Spring plank and all nuts and bolts must be removed to permit removal of bolster from truck frame.

Fourth.

2	frames with boxes (cast st'l)	950
1	spring plank	90
3	Total pieces	1,040

Fifth.

2	frames (cast steel)	750
1	spring plank	90
4	journal boxes with lids	340
4	journal box bolts	39
8	nuts	9
4	cotters	1
23	Total pieces	1,229

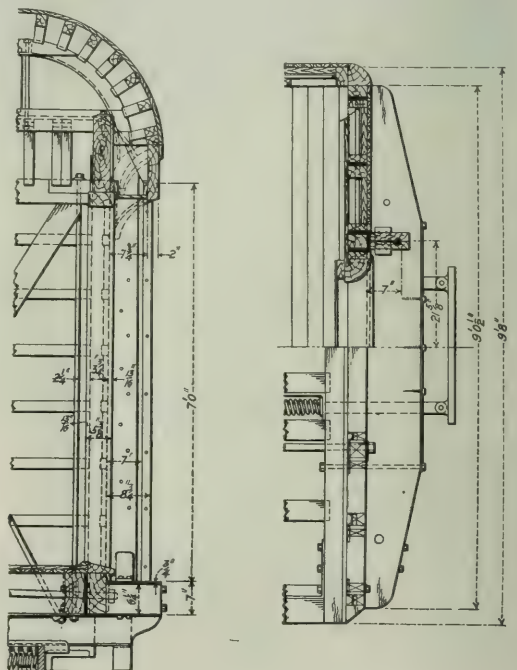
Summary.

	Weight.	Excess w't, per truck.	Excess w't, per car.
Second	1,774	734	1,468
First	1,673	633	1,266
Third	1,532	492	984
Fifth	1,229	189	378
Fourth	1,040	0	0

The purpose of most, if not all, the inventors of steel trucks has been to eliminate the multiplicity of parts entering into the construction of the arch bar type of truck, and, while some may have been actuated or stimulated by other motives, yet the general result has been beneficial in that railroad officers have recently, almost unconsciously in some instances, substituted steel castings for wrought-iron in the construction of freight and passenger car trucks, when only a short time ago they would have ridiculed the proposition to use it, and the prophecy would seem to be a conservative one that at present progress it is only a question of a short time when the further endorsement of cast-steel by the most eminent engineers and practical railroad officers of the country will result in turning a great army of blacksmiths, carpenters and other similar artisans from their present occupation to the advanced and scientific manufacture and application of cast-steel in its various forms as used in car and locomotive construction.

Strengthening Ends of Postal Cars on the Seaboard Air Line.

The United States government is very particular in the matter of the specifications regarding the strength of the framing of the postal cars that are used upon the railroads of the country, and very insistent that these specifications shall be followed in the construction of the cars. In addition to the item of ease of riding and general strength, one of the most important points is that of strengthening the ends of the cars in order to insure as great an immunity as possible against telescoping in case of collision. For this it



Method of Stiffening Ends of Postal Cars on Seaboard Air Line.

is required that all new cars shall be especially stiffened at the ends, both at the corners and on either side of the door. These requirements have been extended to all cars whether new or old.

In order to avoid the scrapping or conversion of old postal cars to baggage or express service, the Seaboard Air Line is using a special form of door stiffening that meets all the requirements of the Post Office Department. The principal feature consists of laying a bulb iron against the outer face of the door posts and bolting it in position through the flanges. At the bottom the bulb and web are cut away and the flange extended down in front of the body end sill and between it and the buffer beam. At the top, the bulb and web are beveled back from the bottom of the hood to the top of the end plate. Additional stiffness is also obtained by the use of a ¾-in.

plate laid upon the top of the buffer beam, which serves as a base upon which the bulbs rest. As these project beyond the face of the car they are encased in wood so as to make a harmonious finish for the end, which thus appears to have a wooden post set outside each door post.

As a matter of fact, while the drawing shows the use of regular bulbs for this work, in actual practice old rails are used. These meet all the requirements as to strength, and are much cheaper, besides being quite as readily applied.

Proposed Railroad Legislation in Pennsylvania.

The following summary of railroad measures which have been brought before the legislature of Pennsylvania, a state long noted for its favorable treatment of corporations, is suggestive of the legislative regulation which railroads are meetings in all parts of the country. In Pennsylvania a new Governor, Edwin S. Stuart, began a four-year term on January 15, 1907. His inaugural address favored laws providing for a two cents a mile passenger rate on railroads, giving electric railways the right of eminent domain and the right to carry freight, the creation of a state railroad commission, and prohibiting common carriers from engaging in any other business than that for which they were chartered. The legislature is reported to be heartily in accord with this program. Already a joint resolution has been introduced providing for the appointment of a committee of seven to "investigate alleged violations of the constitution and laws of the state by railroad companies, their directors, officers, agents and employees." Under this resolution coal companies also are to be investigated. The committee, if appointed, is to hold sessions in Philadelphia, Pittsburg, Harrisburg, Scranton and other cities. The general object of this resolution is understood to be to carry further the investigation among officers of the Pennsylvania begun by the Interstate Commerce Commission last year. The following bills have already been introduced:

Providing for a new survey by the state of the 12,000 miles of railroad to secure a revision of distances between certain points and a consequent saving in fares. This bill appears to be aimed at reducing the mileage in cases where railroads have taken out curves and otherwise shortened their lines. It carries an appropriation of $100,000, a sum which it will take some time to save in passenger fares reduced from this cause.

Providing for a state board of railroad commissioners.

Providing for a maximum passenger charge of two cents a mile, tickets to be good until used.

Providing for proper sanitation of railroad cars.

Providing for regulation of freight rates and prohibiting discrimination in rates for long and short hauls.

Permitting electric railways to carry freight subject to the regulations of municipal councils.

Requiring railroads to publish their train schedules in at least three newspapers in each county entered by their lines.

Granting enlarged powers to courts of common pleas to decree forfeiture of rights and privileges of a railroad whenever such railroad shall have violated or failed to comply with all the terms imposed in the franchise granted it by any municipality or failure to perform any of the corporation functions for which it was incorporated. The bill provides that the court can either fix a time limit for complying with the provisions of the company's charter and franchises or decree their forfeiture.

Providing for taxation of corporations 10 mills on each dollar of actual value of the whole capital stock of all kinds; one-half of this revenue to go to the various counties for school purposes and relief of local taxes.

Providing that all persons in charge of signals, switches, locomotives, trains or telegraph offices at the time of an accident shall be deemed "vice principals," and that where any defect in arrangement or machinery is shown it shall be taken as *prima facie* evidence of neglect.

Requiring enclosed vestibules on all steam and electric passenger cars.

Milling-in-Transit With Variations.

The decision in the case of the Alabama & Vicksburg Railway Company against the Railroad Commission of Mississippi wherein the Supreme Court of the United States, affirming a ruling of the Supreme Court of Mississippi, has sustained the right of a state commission to enforce equality of intrastate rates has already been reported. The facts, as stated by Mr. Justice Brewer in announcing the opinion of the court, were that the company made what it called a "rebilling rate" of 3½ cents per 100 lbs. on grain products shipped from Vicksburg to Meridian, that rate, however, being applicable only on shipments coming to Vicksburg over the Vicksburg, Shreveport & Pacific. Instead of being used only as a rebilling rate, the Vicksburg merchant who received a carload of grain or grain products over the V., S. & P. road was permitted to either forward it to Meridian, or, at any time within 90 days, in lieu thereof, send a similar carload at the same rate, no matter whence received. The Mississippi Commission made an order directing that all grain products shipped from Vicksburg to Meridian should be at the same rate (3½ cents), so that merchants receiving over the V., S. & P. would have no advantage. The court said:

"It is unnecessary to inquire whether the order could be sustained if it appeared that the plaintiff received only 3½ cents as its share of a total rate on through shipments to Meridian from the northwest by the Shreveport road; for here, under the guise of a rebilling rate, the Vicksburg merchant who dealt with this western road was given a rate of 3½ cents on any grain that he might see fit to ship to Meridian. While it may be true that a local railroad's share of an interstate rate may not be a legitimate basis upon which a state railroad commission can establish and enforce a purely local rate, yet whenever, under the guise or pretence of a rebilling rate, some merchants are given a low local rate the commission is justified in making that rate the rate for all. It is not bound to inquire whether it furnishes adequate return to the railroad company, for the state may insist upon equality, to be enforced under the same conditions against all who perform a public or quasi public service. When voluntarily the A. & V. established a local rate of 3½ cents from Vicksburg to Meridian for those who had within 90 days made [received] a shipment over the Shreveport road, it estopped itself from complaining of an order making that rate applicable to all shipments, no matter whence they arose, and in favor of all merchants, whether those transporting over the Shreveport road or not. We are not unaware of our decision in Texas & Pacific vs. Interstate Commerce Commission, 162 U. S. 197, in which, on review of the interstate commerce act, we held that a mere inequality of rate was not always proof of undue discrimination; but we were passing upon an act of Congress and seeking to ascertain its intent and scope. There was no intimation that it was not within the power of Congress to prescribe an absolute equality of rate. In the present case we are not construing an act of the state of Mississippi or passing upon the powers which by it are given to the State Railroad Commission. Those matters are settled by the decision of the Supreme Court of the state, and the question we have to consider is the power of the state to enforce an equality of local rates as between all parties shipping for the same distance over the same road. That a state has such power cannot be doubted, and it cannot be thwarted by any action of a railroad company which does not involve an actual interstate shipment, although done with a view of promoting the business interests of the company. Even if a state may not compel a railroad company to do business at a loss, and conceding that a railroad company may insist, as against the power of the State, upon the right to establish such rates as will afford reasonable compensation for the services rendered, yet when it voluntarily establishes local rates for some shippers it cannot resist the power of the state to enforce the same rates for all. The state may insist upon equality as between all its citizens, and that equality cannot be defeated in respect to any local shipments by arrangements made with or to favor outside companies."

Shop Belting Practice on the Santa Fe.

In the articles on the shop betterment work on the Santa Fe, which appeared in our issues of Nov. 30 and Dec. 7, 1906, brief reference was made to the great improvement that had been made in the shop belting practice of that road. The comparative costs of maintenance before the work was begun and at the time the article was prepared were given, and it was stated that a book of rules and instructions for belt repairmen had been distributed, and a rigid set of specifications for belting had been drawn up by Mr. H. Emerson, in charge of the betterment work. Believing these specifications and the repairmen's rules and instructions to be of general interest to all shop men, we reproduce them herewith.

SPECIFICATIONS FOR BELTING.

Belting must be of the best oak tan, first quality leather, strictly short-lap stock, cut within 18 in. of the center of the hide and no piece running over 4 ft. 6 in. long; tanned under the long time process, absolutely free from acids or other ingredients for quickening the tannage or increasing the weight.

Belting must be of uniform thickness and width and will be inspected at destination. Any belting showing uneven thickness or width, or flabby soft spots, will be rejected and must be replaced at once without cost to the railroad company.

All belts must have a tensile strength of not less than 4,200 lbs. per square inch in either the leather or the splice, and show elongation of not over 12.5 per cent. in 2 in., 1 in. either side of the break, or less than 8 per cent. elongation at breaking strain.

Any double, triple or quadruple belt which starts to crack or give way between the layers comprising the belt before reaching

a tensile strength of 2,500 lbs. per square inch will be rejected. All belting will be furnished in three grades as below:

Heavy, weighing 17 to 19 oz. per sq. ft.
Medium, weighing 15½ to 16 oz. per sq. ft.
Light, weighing not less than 14 oz. per sq. ft.

The above weights are guaranteed to be more than 10 to 13 per cent. above the actual weights of the leather after treatment by gasolene or other process to remove any stuffing or filling.

All belting must bear the manufacturers' brand and name on every 10 ft. of belting.

All belting when received at destination will be laid out flat to its full length and must lie in a straight line from end to end, both edges of the belting lying flat upon the floor.

Guaranty.

If the belting as received does not in every particular comply with the above specifications, it will be rejected and replaced by the seller without expense to the railroad company. It is further guaranteed that the belting will run practically straight and not stretch to trouble where shafting and pulleys are right and care has been used in placing it upon the same.

RULES AND INSTRUCTIONS FOR BELT REPAIRMEN.

Width of Belting.—A pulley should be 25 per cent. wider than the belt running on it. This rule should be followed as closely as possible and especially with cone belts.

Tension and Thickness of Belts.—Belts should have a tension when at rest of about 100 lbs. per square inch of width of good double belting. If not practicable to measure tension on the belt, make the fit length 1 in. per 10 ft. less than the tape measured length over pulleys. A steel tape should be used. Great care should be used to prevent the running of too tight belts and consequent burning of bearings.

Double belts should not be run on pulleys less than 6 in. in diameter, and triple belts on pulleys less than 20 in. in diameter. Belts should sag onto pulleys and not away from them. Very short drives (belts under 20 ft. long), should be avoided. Whenever possible, run up-and-down belts on a slant so that belt will sag onto pulley.

For each horse-power to be transmitted, allow 80 sq. ft. of double belt to pass over the pulleys per minute; allow 160 sq. ft. of single belt, or 1,000 lineal feet of double 1-in. belt., or 2,000 lineal feet of single belt.

Kind of Lace to Use.—For general service, the Jackson lace should be used and new belts should have a 6-in. take-up piece

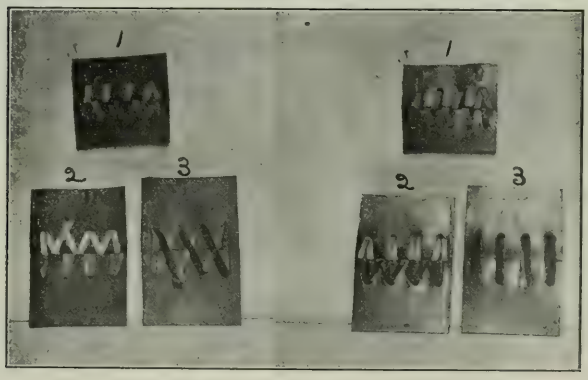


Fig. 1—Rawhide Laces.
Numbers correspond to paragraphs regarding these laces.

put in them to permit tightening of belt by putting in a shorter piece and thus avoiding the need of taking entire belt down. Belts with Jackson lace should have a take-up piece in them at all times. Pieces should be kept in stock in sufficient numbers to avoid the necessity of making one in an emergency. The lengths should be 6 in., 5 in., 4 in., 3 in., 2 in. and 1 in.

The Kerr lace may be used to hold very thick belts and small feed belts which the Jackson lace will not accommodate.

The rawhide lace may be found by trial to give better service on some wood-working machines than either the Jackson or Kerr laces, but it is generally best to make the belt endless if neither Kerr nor Jackson lace give satisfaction.

Endless Belts.—All machines furnished with any means of taking up the stretch should have endless belts. Large overhead drive belts (over 6 in. wide), should be made endless as soon as stretch is taken out. It is not advisable to make new belts endless at installation on account of the stretching. Wood-working machinery having belts which do not require too frequent tightening will run better with endless than laced belts. Side and bottom head belts on planers, matchers, etc., should be run endless.

Cleaning and Oiling.—Belts which have become too greasy and dirty should be cleaned in gasolene, then scraped and wiped with waste. In dry, dusty places it is well to brush them occasionally with a broom or stiff brush.

No rosin or belt "dope" should be used except fish oil and tallow mixed in equal parts. Apply hot with a brush when belt is running or dip belt in "dope" tank, then dry and wipe off any grease which may have hardened on belt. If applied while running, care should be taken not to get too much on belt, or it will cause it to slip. When properly applied, the mixture of fish oil and tallow will make belt pull better than any of the commercial dressings.

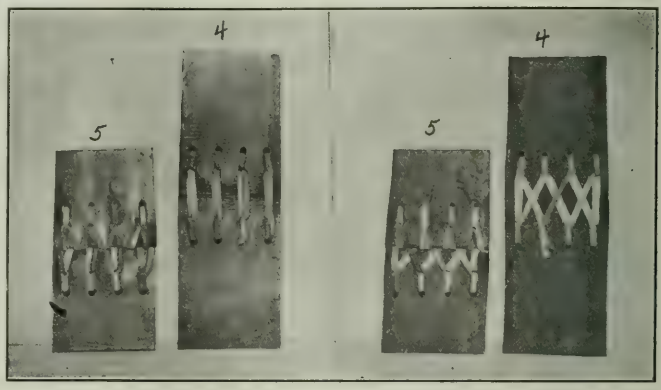


Fig. 2—Rawhide Laces.

No mineral oil should be allowed to come in contact with belt. New belts should be treated with fish oil and tallow before using, and any belt which becomes dry, hard and glossy in service should have an application of the dressing. This is especially true of belts in blacksmith shops. The oil will check to some extent the evil effects of the smoke, sulphur gases and dirt, and the life of the belt will thereby be lengthened.

Inspection of Belts.—Close attention should be given to condition of belting, to prevent damage to it and delay to machines. Such delays can be reduced to a minimum by making repairs as soon as weakness develops. Main drive and section belts should be watched very closely since a failure of one of them may shut down a number of machines for a considerable length of time.

Operation of Belts.—The most essential thing to successful operation of belts is that pulleys and shafting be properly lined and in good repair. It is bad practice to throw a pulley out of line to favor a bad belt. Belts should be run with the *hair* side to face of pulley. Run belts so that the outside point of splice trails. This will avoid opening of splice by action of the air. Belt should never be run twisted or cross-stepped on cones.

Keep pulleys clean and avoid having mineral oil or grease coming in contact with belts. If hard grease or dirt is allowed to pile up in corners of cones so as to form a fillet, the belt will be very likely to climb, turn over or twist. In turning faces of cones, a clearance should be cut in the corners. A drive pulley carrying a shafting belt should never have a crown. In throwing belts onto pulleys, first put belt on the driven pulley (loose if there is one), and then run it onto the driving pulley. Avoid accidents by stopping motor or engine and then run belt on while starting slowly.

Care should be taken never to run a belt off a moving pulley onto some part of shafting or machinery on which it might catch. If it is necessary to cut a belt down, care should be taken not to waste the leather.

A belt should never be dampened in order to open a splice. An awl should be used, gradually scratching or ripping splice apart.

It is good practice to remove tension from belts by lifting idlers, running off of pulleys, or removing from machine when convenient at quitting time. All cone and other machine belts should be run off of pulleys at quitting time on Sundays.

Jackson or Machine Lace.—Follow instructions accompanying machine carefully. Be sure to use a needle of the size specified for belt which is to be laced. Too small a needle will stall while too large a one will be spoiled by forcing through the rolls. Clamp belt lightly at first and tighter if needle sticks. Under no circum-

stances should the two set blocks in front of roll be set tight against rolls. They are merely a steady rest and will bend roll if set tight. After lacing, the wire should be flattened into the belt by squeezing and hammering.

Fasten ends of wire by cutting coil about ⅛ in. from belt bending into semi-circle and driving into leather. Use as large a rawhide pin as will go through the lacing. Cut off ends a little inside of edge of belt in order that pin will not catch the hands when belt is thrown or shifted.

A right and left-hand lace should always be mated together.

Material should be used with an eye to economy. Rawhide pins can often be used again when once removed. Blunt needles can be repointed with a file and coils of wire should be cut close to belt.

Rawhide Laces.—1. Single Hole, Single Hinge Lace.—Used in light grade single belts running over small pulleys (6 in. diameter or under), at high speed transmitting light power. In making this lace it is necessary to have an even number of holes in one end of the belt and an odd number in the other end so that the holes in one end will come opposite the spaces in the other end.

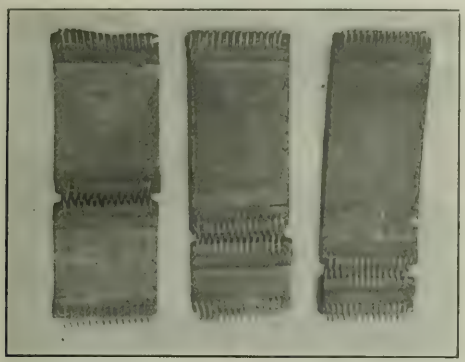


Fig. 3—Jackson Laces—Take-Up Pieces.

Bevel off the edges of the belt on both sides. The holes should be evenly spaced on a center line square with the edge of the belt and not less than ¾ in. from end. Use a No. 6 oval punch. Place long diameter of oval lengthwise of belt. Begin at the center hole and draw through until half is on each side of belt. Then pass one end down through between the belts and up through next hole towards edge. Repeat until edge is reached with both ends of lace. Cut a slit with knife back of last hole and fasten lace by passing through this slit and into another slit back of first slit and cut back into belt. Pull the laces as tight as possible. Either side of lace will run next to pulley.

2. Single Hole, Double Hinge Lace.—Used in medium and heavy grade single belts, running over small pulleys (6 in. diameter or under), at high speed transmitting heavy power.

In making this lace, the same number of holes is punched in each end of belt and they should be evenly spaced on a center line square with edge of belt and not less than ¾ in. from end. Use No. 6 oval punch. Place long diameter of oval lengthwise with belt. Bevel off the edges of belt on both sides. Begin at center and double lace. Pull lace through until half is on each side of belt. Pass lace through between belt ends and back through opposite hole, repeating this operation until edge is reached, then back to starting point in same manner. Fasten by doubling one end back through last hole and catch other end in loop. Cut off lace ¼ in. from belt and notch. Pull laces as tight as possible. Run either side of lace next to pulley.

3. Single Hole, Double Straight Lace.—Used in light and medium grade double belts in running over large pulleys (16 in. diameter or over), transmitting light power.

In making this lace the same number of holes are punched in each end of belt and they should be evenly spaced on center line square with edge of belt and not less than ¾ in. from end. Use No. 6 oval punch. Place long diameter of oval lengthwise of belt. Begin at center and double-lace, pulling lace through until half is on each side, then on pulley side go straight to opposite hole, through this across to hole next towards edge of the other side. Repeat until edge is reached, then lace back to starting hole in same manner and leave ends as in No. 2 (double hole, double hinge lace). Pull laces as tight as possible and run straight laced side next to pulley.

4. Double Hole, Double Straight Lace.—Used in light, medium and heavy grade *double belts* running over large pulleys (10 in. diameter or over), transmitting heavy power. This lace can also be used to advantage in a belt when the single hole lace has pulled out the holes.

In making this lace the same number of holes is punched in each end of belt. The holes are evenly spaced on center lines square with edge of belt, the first one not less than ¾ in. from end and the second one not less than ¾ in. from first one. Use No. 6 oval punch. Place long diameter of oval lengthwise of belt. Begin at center and double-lace as in No. 3 (single hole, double straight lace), except pass every other time through the second line of holes. Pull the laces as tight as possible. Run straight side next to pulley.

5. Double Hole, Double Hinge Lace. Used in medium and heavy grade single belts, and in light grade double belts, running over small pulleys (10 in. diameter or under), at high speed transmitting heavy power. This lace can also be used to advantage in a belt where the single-hole lace has pulled out the hole.

In making this lace the same number of holes is punched in each end of the belt. The holes should be evenly spaced on center lines square with edge of belt, the first one not less than ¾ in. from end and the second not less than ¾ in. from the first. Use a No. 6 oval punch and place long diameter of oval lengthwise of belt. Bevel off the edges of belt on both sides. Begin at center and double lace same as in No. 2 (double hole, double hinge lace), except pass every other time through second line of holes. Pull the laces as tight as possible and run either side of belt next to pulley.

Kerr Lace or Hand Wire Lace.—To be used in roundhouses and other small shops where there are not enough belts to necessitate a lacing machine; also to be used on small feed or pump belts or on belts over ½ in. thick which cannot be handled in machine. Follow directions on box. Groove belt for straight side of lace which should be run next to pulley. Care should be taken to cross none of the wires.

Cement Splices.—The first thing to be noted in making a cement splice is to see that the pieces put together are of about the same grade, width and thickness. See that the splices lie in same direction in the same belt. Splices should be made of the length given in table below:

Width of belt.	Length of splice.	Width of belt.	Length of splice.
1 in.	5 in.	6 in.	8 in.
2 in.	5 in.	7 in.	8 in.
3 in.	6 in.	8 in.	9 in.
4 in.	6 in.	9 in. to 18 in.	Same as width
5 in.	7 in.	Over 18 in.	18 in.

Splices should be worked down to a perfectly smooth even surface, square with edge of belt both at the point and back. Care should be taken that splice is no thicker than rest of belt. If splice is thick, belt will not run even. Square both ends of splice from the same edge of belt. Work on a perfectly smooth flat surface. After dressing ends for splice, place them together on a board 1 in. longer and ½ in. wider than splice. Place edge from which splices are squared in a perfectly straight line. Tack belt to board just back of splice. Open splice and spread on hot glue, place another board on top of splice and clamp tightly with hand clamps or in a press. (An old letter press makes an excellent belt press.) If press is used, ten minutes is long enough to keep pressure on belt, but if hand clamps are used they must be left on for three or four hours. In either case, the belt should not be put under tension for at least five hours after gluing. Paper placed between the boards and the belt will prevent belt from becoming glued to board.

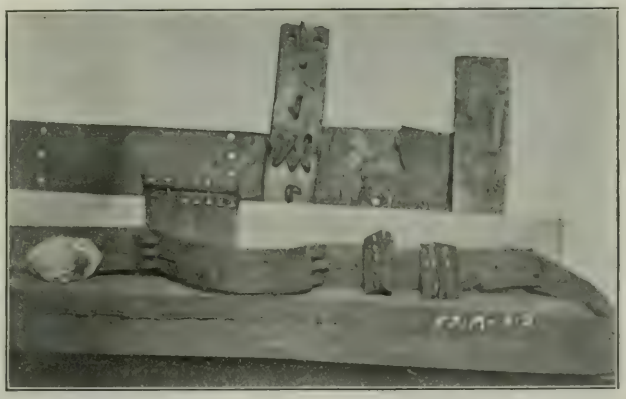


Fig. 4—Samples of Poor Joints and Belt Rotted by Rosin.

Greasy belts should be cleaned in gasolene before attempting to cement them. Any grease in belts or glue is liable to cause splice to fail. No rivets, wire, pegs, or any other fastenings aside from cement should be used in splicing belts. Ordinary furniture or pattern-maker's glue is satisfactory for belting.

Resolutions by the National Board of Trade.

The following resolutions were unanimously adopted by the National Board of Trade in convention at Washington, D. C., January 16:

INCREASE IN TERMINALS AND EQUIPMENT.

Whereas, The expansion of interstate traffic in recent years has been relatively greater than the increase in railroad equipment, resulting in great losses to the business interests generally; be it

Resolved, That the National Board of Trade urges upon the various transportation companies the necessity of relief from these conditions, and such increase in equipment and terminals as will most likely prevent a recurrence; prompt action on the part of the carriers will alone make it unnecessary for federal legislation on this subject; and further

Resolved, That a copy of these resolutions be sent to the officials of the trunk lines both East and West.

POOLING.

Whereas, Owing to the enormous increase in the railroad traffic of the United States involving the congestion of merchandise at points of shipment and expensive delays in transportation; and

Whereas, It is the judgment of large commercial bodies interested in more effective and less technical methods that these delays would be less frequent and less burdensome, and that the interests of interstate commerce would be better conserved by proper traffic arrangements between the various railroad companies; be it therefore

Resolved, That the National Board of Trade recommends to the Congress of the United States such amendments to the Interstate Commerce Act as will permit proper railroad traffic agreements, such agreements to be inoperative if disapproved by the Interstate Commerce Commission.

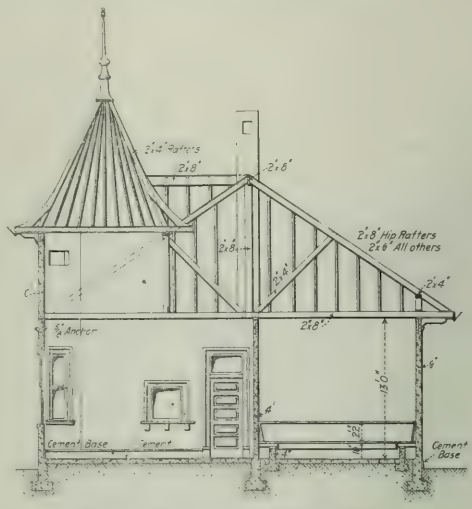
GOVERNMENT OWNERSHIP.

Resolved, That the National Board of Trade deems that it would be highly inexpedient for the Government, state or federal, to take under consideration at this time any proposition looking to the acquisition or operation of our railways.

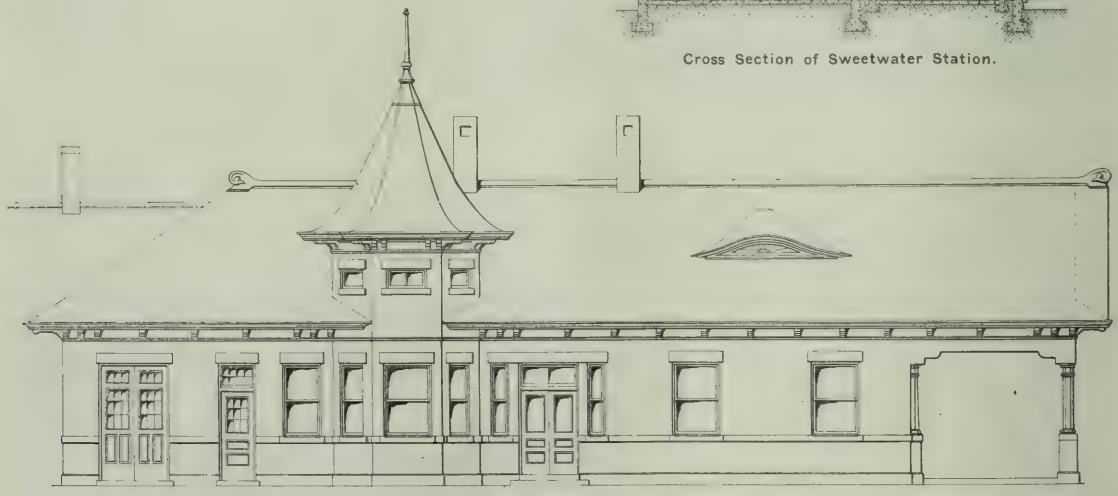
The Italian Minister of Public Works purposes to substitute electricity for steam locomotives on several lines of the State Railroads, among these the line from Milan northeast 32 miles to Lecco, which is the southern terminus of the line along the east shore of Lake Como, which was the first to adopt electricity for an ordinary mixed traffic; others are the railroad from Milan northwest to the southern entrance of the new Simplon Tunnel, and the line from Milan northward to Luino to connect with the Gotthard Railroad, the direct line over the Appenines between Florence and Bologna, the 33 miles between Naples and Salerno, and two long tunnels.

New Texas & Pacific Station at Sweetwater, Texas.

The Texas & Pacific has recently built at Sweetwater, Tex., a combination freight and passenger station, the walls of which are built of concrete. The accompanying photographs and drawings illustrate the station and the type of concrete construction used. The



Cross Section of Sweetwater Station.



General Elevation; Sweetwater Station of the Texas & Pacific.



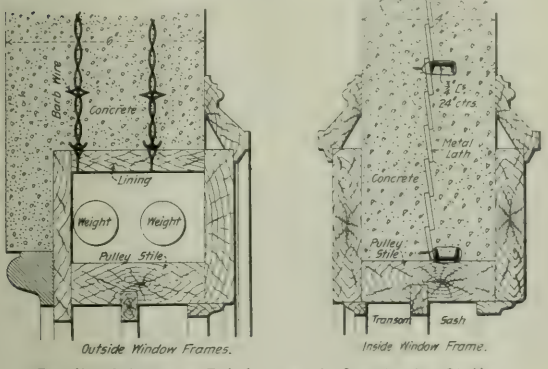
New Station Built of Concrete; Texas & Pacific at Sweetwater, Texas.



Method of Concrete Construction; Sweetwater Station of the Texas & Pacific.

concrete mixture is poured into galvanized forms, made in any length. This method has been devised by E. G. Kemper, of Burlington, Iowa. One of these forms is shown in one of the photographs where it is held up on end by a man. The outside walls of the station are 6 ft. thick. All partition walls are 4 ft. thick, reinforced with double twisted barbed wire, as shown in the sectional drawings.

In building by this method two layers of plates are necessary;



Details of Concrete Reinforcement; Sweetwater Station.

the concrete is poured into the plates, which in due time are removed and placed on the blocks thus formed. The concrete is then poured in again, a new layer of blocks is formed, the plates are removed, and so on until the wall is finished. The inside surface of the plates is grooved or shaped according to the desired pattern. Before the concrete is poured, the plates are plastered with a ¼-in. facing of cement and sand, which gives a finished appearance to the wall. The walls may be of any thickness desired, but are made hollow with a tin box as a core.

The new feature of this method is that galvanized iron instead of wooden molds are used. In this way a more finished appearance is given to the walls, saving the expense of plastering over and grooving the concrete after it comes out of the molds. Moreover, with wooden molds only a plain stone finish can be given.

The value of concrete as a building material has long been recognized, and various machines have been invented for the manufacture of concrete blocks. The machine-made blocks, it is claimed, are dry and absorb moisture readily, causing disintegration in course of time, besides rendering the walls of a house damp. The blocks of course, after being manufactured must be transported to the scene of building and put in place.

This station was poured, not built. No joists are used, all supports and partitions being of reinforced concrete. It is therefore fireproof. The hollow walls tend to make it cool in summer and warm in winter. As there are no mortar joints, water cannot get into the building, and the walls are not damp. This is the only



Pouring Concrete Into Forms; Sweetwater Station.



Part of Sweetwater Station Showing Concrete Facing; One of the Concrete Forms in Front of Door on Left.

station of this type built by the Texas & Pacific thus far. It has given general satisfaction both in appearance and strength, and it is believed to be in some cases cheaper than brick or frame construction.

For the information and drawings we are indebted to F. W. Kane, Architect of the Texas & Pacific.

Modifications of the Diversion Agreement.

A meeting of the railroads in the Diversion Agreement was held in Chicago on Friday, January 18, 1907. The general feeling was expressed by the representatives present that the Diversion Agreement had brought about good results and proved that the experiment thus far had been a success. It was decided to modify the agreement as affecting several of its requirements. One of the amendments provides that cars may be delivered empty to a connection for loading to the home road or home route, to be returned within ten days. Formerly the requirement was that the car must be returned within four days. The other amendments provided that the

diversion penalty will not apply to the delivery of loaded cars in switching service and that such deliveries shall be indicated on the junction report by the word "switch." It was also decided to add the destination of cars to the junction reports. The discussion developed the fact that an earnest effort is being made by the railroads in the agreement to properly handle foreign cars.

Timmis Smoke and Spark Consuming System.

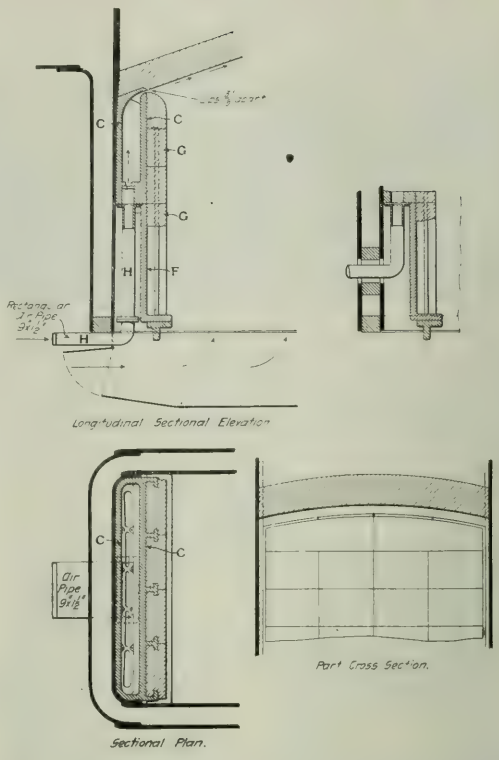
The beneficial results of smoke prevention by admitting air to the firebox above the fire are known. The users of the hollow stay-bolts cite this as among the chief advantages. Sometimes we find a number of tubes set in the back head through which comparatively large volumes of air can be admitted above the fire. All of these devices are efficient in a way, but are not efficient enough. Successful experiments have recently been made in England with a new device to accomplish this same purpose, and a saving in coal is said to have been effected. It has been designed by Major I. A. Timmis, of 2 Great George street, London, and consists of an apparatus for forcing air in the front end of the firebox immediately below the brick arch.

That portion of the apparatus in the firebox is shown in the illustration to be a hollow casting, C, coming close to and against the bottom of the brick arch, and having an elongated opening, turned to the rear, with lips $^3/_{16}$ in. apart. This casting is carried by a foot, F, that rests on a cross beam, the whole being protected by a wall of firebrick, G. The casting and the extra brickwork take up about 11 in. of room, so that the grate is shortened by that much. It is claimed, however, that this has no detrimental effect on the action of the engine because the improvement in combustion more than compensates for the decrease in grate area.

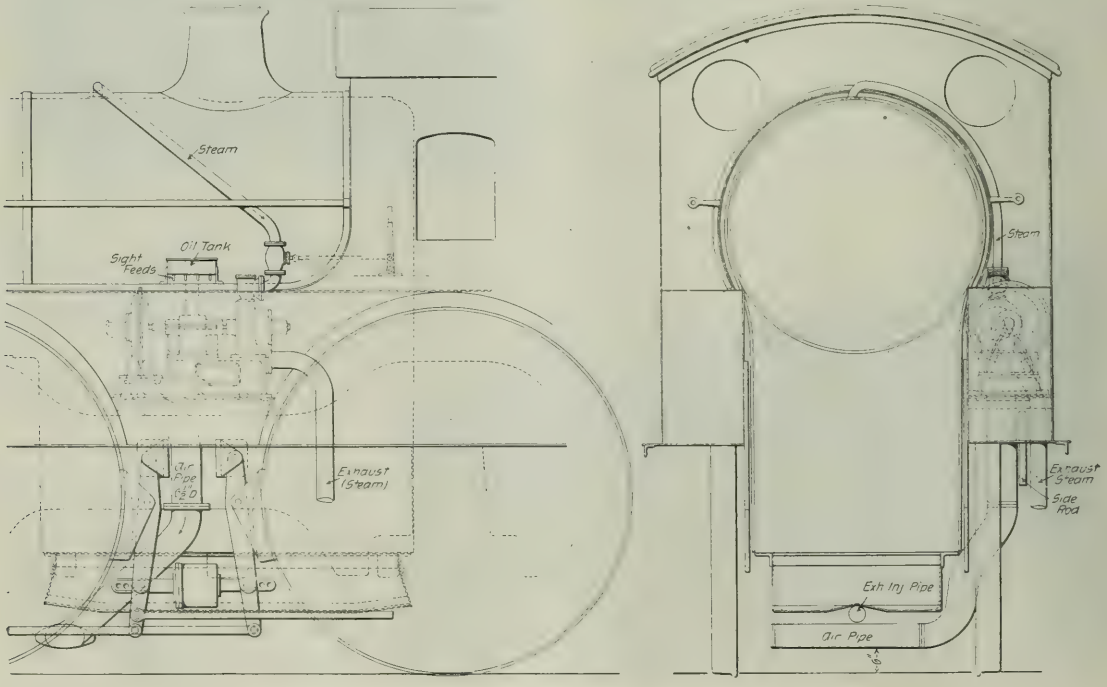
Air is forced in this casting, C, through the pipe, H, at a pressure sufficient to afford a somewhat stronger current than that coming through the fuel under the action of the exhaust.

This blast is made by a De Laval impulse steam turbine of about 3 horse-power, driving the fan direct. The whole combination of engine and fan is set under the running board, and the air is delivered to a pipe set across the firebox in front of the ashpan. In the illustrations the pipe, H, is brought in through the ashpan, although it is possible and perhaps preferable to cut an opening in the front water leg somewhat smaller, but of the same kind as the firedoor, and drive the air in that way. It is suggested that such an arrangement tends to increase the circulation through the cold water leg.

It will be seen that this stream of air is supplied in the form



Firebox Arrangement; Timmis Smoke and Spark Consuming System.



General Arrangement of Timmis Smoke and Spark Consuming System.

of a film at a point where it will be most efficient, as it passes over the edge of the arch and to the combustion chamber. It will be at a high temperature and in the best condition to complete the combustion of the gases and incandescent particles of fuel with which it comes in contact. In addition to this it has a cooling, and therefore preservative, action on the brick arch, while at the same time carrying a portion of its heat on to the tubes.

In the preliminary work that was done on an express locomotive, it was found that, while the device, as then applied, did reduce the sparks by about one-half it did not do away with them entirely. The area of the exhaust nozzle was then reduced with the result that the upward suction through the fuel was reduced and fewer sparks were torn from the fire, while those that were so loosened, as well as the smoke producing hydrocarbons, were consumed in the firebox.

The report of the performance of this locomotive says that the steam pressure is maintained much better than before, that the back pressure on the cylinders is reduced, and consequently the fuel consumption per mile run is much less. The advantages claimed are: The protection of the front tube sheet, the increase of life to the brick arch, the prevention of smoke, the saving of fuel, and the reduction of the back pressure in the cylinders.

Visible Supplies of Grain.

The following figures represent stocks of grain available at 62 of the principal points of accumulation east of the Rocky Mountains, stocks in Manitoba elevators, and stocks afloat on lakes and canals. Pacific coast stocks are shown only in the case of wheat.

Total Visible Supplies of Grain Available in the United States and Canada at the Dates Given, as Reported to Bradstreet's.

Dates.	Grain stocks east of Rocky Mountains. Wheat, bush.	Corn, bush.	Oats, bush.	Barley, bush.	Rye, bush.	Pac. Coast stocks. Wheat, bush.
1900, Jan. 1	89,265,000	19,024,000	12,004,000	3,122,000	1,806,000	9,022,000
1901, Jan. 1	87,911,000	14,313,000	15,861,000	5,395,000	1,651,000	8,686,000
1902, Jan. 1	94,900,000	16,825,000	8,680,000	4,380,000	3,257,000	7,186,000
1903, Jan. 1	80,769,000	9,345,000	8,794,000	4,389,000	2,454,000	4,992,000
1904, Jan. 1	61,827,000	9,547,000	13,785,000	6,907,000	1,833,000	3,282,000
1905, Jan. 1	61,240,000	15,351,000	31,343,000	10,403,000	2,504,000	3,458,000
1906, Jan. 1	69,867,000	17,830,000	39,301,000	10,657,000	2,990,000	5,511,000
Feb. 1	73,151,000	22,010,000	35,791,000	8,526,000	2,857,000	5,295,000
Mar. 1	70,530,000	24,531,000	31,726,000	7,686,000	2,723,000	4,898,000
Apr. 1	66,599,000	17,653,000	28,006,000	6,567,000	2,452,000	4,621,000
May 1	54,856,000	7,674,000	22,033,000	4,251,000	1,954,000	3,917,000
June 1	40,347,000	7,366,000	12,785,000	2,053,000	1,734,000	3,349,000
July 1	33,810,000	12,017,000	10,020,000	1,620,000	1,544,000	2,586,000
Aug. 1	39,633,000	9,655,000	7,607,000	1,814,000	1,480,000	1,898,000
Sept. 1	43,611,000	4,760,000	13,241,000	1,244,000	1,629,000	1,943,000
Oct. 1	56,967,000	7,843,000	15,969,000	3,520,000	1,793,000	3,431,000
Nov. 1	45,694,000	6,492,000	12,275,000	4,476,000	1,906,000	3,459,000
Dec. 1	51,862,000	5,133,000	20,011,000	5,156,000	1,891,000	2,689,000
Dec. 8	52,115,000	5,804,000	19,873,000	3,931,000	1,759,000	.....
Dec. 15	56,008,000	6,642,000	18,883,000	5,210,000	1,806,000	.....
Dec. 22	55,998,000	7,619,000	18,504,000	4,714,000	2,005,000	.....
1907, Jan. 1	56,137,000	8,404,000	19,766,000	4,698,000	2,038,000	2,647,000

Elimination of Grade Crossings in New York State.

The following information about the work done in doing away with grade crossings in New York state is taken from an advance proof of the 24th annual report of the Board of Railroad Commissioners:

The Grade Crossing law provides:

1. That "all steam surface railroads, hereafter built, except additional switches and sidings, must be so constructed as to avoid all public crossings at grade, whenever practicable so to do * * * and the Board of Railroad Commissioners shall determine whether such crossings shall be under or over the proposed railroad, except where the Board shall determine such method of crossing to be impracticable."

2. That no new street, avenue or highway shall be constructed across a steam railroad except in a manner to be determined by the Board.

3. In section 62, a method for abolishing existing grade crossings of steam railroads.

The provisions of the act also apply to "all existing or future steam surface railroads, on which, after the passage of this act, electricity or some other agency than steam shall be substituted as a motive power."

The cost of building new steam railroads at grade or over or under the grade of streets, avenues or highways must be borne by the company. The cost of building new street, avenue or highway crossings at grade or over or under the grade of steam railroads must be borne, half by the company and half by the municipality. The cost of abolishing existing street, avenue or highway grade crossings of steam railroads must be borne, 50 per cent. by the company, 25 per cent. by the state and 25 per cent. by the municipal corporation.

The law also provides that "all steam railroads hereafter constructed across the tracks of any other railroad and any street surface railroad hereafter constructed across a steam railroad shall be above, below or at grade of such existing railroad as the Board of Railroad Commissioners shall determine, and such Board shall, in such determination fix the proportion of expense of such crossing to be paid by each railroad." At many points in this state steam railroads cross each other at grade and while, under the railroad law, all trains and locomotives must come to a full stop before crossing unless the crossing is protected by an interlocking plant approved by the Board, still the dangers at such crossings where the interlocking plant does not exist are great. Even with interlocking there are dangers. This Board believes that section 36 should be amended by empowering this Board to order that in particular cases such crossings at grade of steam railroads must be changed from grade at the expense of the companies, this Board to apportion the expense between the companies.

In addition to the crossings changed from grade, under section 62 of the Grade Crossing law, crossings in Buffalo have been changed from grade under special acts applying to that city; crossings of the Long Island Railroad and of the Brooklyn Heights electric railroad in Brooklyn have been changed from grade under special acts; the Harlem River & Port Chester branch of the New York, New Haven & Hartford in its reconstruction has avoided grade crossings. There are now but two grade crossings of steam railroads left in Schenectady, the others having been changed to undercrossings, in the expense of which the state participates, and these two will be changed to undercrossings during the year. In the changing of its motive power to electricity, the New York Central & Hudson River contemplates the elimination of all grade crossings on its Hudson River division from Croton to New York and on its Harlem division from North White Plains to New York. The state is asked to participate in the cost of this work, and this Board has already made determinations under section 62 affecting the crossings in Yonkers. In the amendments to the good roads act of last winter, there is a provision as to the abolition of crossings where highways are to be improved, and while this amendment is indefinite in language it is at least a renewed determination by the state that grade crossings should be abolished.

The appropriations made by the state for the abolition of grade crossings began in 1898; in 1902 and 1903 no appropriations were made. Including a special appropriation of $75,000 for Schenectady, the total is $992,606.92. This is a comparatively small amount in view of the great number of crossings in the state, a table of which is published below this title. Massachusetts in 16 years has appropriated for this purpose $10,000,000. It would seem that the state of New York should be as forward at least as Massachusetts in this work.

Following will be found a statement of every determination where a crossing was to be closed or changed from grade—made by the Board between June 30, 1905, and January 14, 1907, the date of the report:

1906.

1. Changing the Peck and Nott streets grade crossings of the New York Central in Schenectady to undergrade crossing. Plans, some specifications and an estimate of expense for this work have been submitted and approved.

2. Closing and discontinuance of a highway grade crossing of the Central New England, immediately east of the Pleasant Valley station in the town of Pleasant Valley, Dutchess County, and the construction of a new piece of highway to an existing highway crossing, immediately west of the station. The work is practically completed. No settlement of the cost has yet been made.

3. Closing and discontinuance of the country road or Old Forge road highway grade crossing of the Long Island Railroad in the Town of Riverhead Suffolk County, and diverting travel by means of a new piece of highway to an overgrade crossing to be constructed at a point about 1,625 ft. east of the location of the existing grade crossing. A plan for this work has been approved and construction is now being prosecuted. There will be no expense to either the town or the state on account of this work.

4. Changing a highway grade crossing of the Delaware, Lackawanna & Western, in the town of Vestal, Broome County, to an undergrade crossing. Upon appeal, the courts of the state in an opinion reversed the order of the Board, the Board having determined that this work shouldd be done. A new petition by the company has been filed.

5. Changing the North Portage street grade crossing of the New York, Chicago & St. Louis, in the village of Westfield, Chautauqua County, to an overgrade crossing. A plan for this work has been submitted.

6. Changing a grade crossing of the Highland division of the New York, New Haven & Hartford, in the town of South East, Putnam County, at a point known as the first grade crossing west of bridge over the Croton River at Brewster, to an undergrade crossing. This work is completed. The total expense was $7,751.34. The state's proportion, which is in process of payment, was $1,937.84.

7. Closing the John Hulse road grade crossing of the Long Island Railroad in the town of Brookhaven, Suffolk County, and diverting travel by means of existing highways to an undergrade crossing to be constructed about 3,450 ft. westerly from the Medford station. Plans, specifications, estimate of expense and the proposal of a contractor for the superstructure have been approved by the Board. Work of construction has been begun.

8. Closing the Hooker avenue grade crossing of the Syracuse, Binghamton & New York (D., L. & W.), in the village of Homer, Cortland County, and constructing an overgrade crossing of the railroad with approaches, the over-

grade crossing to be located about 125 ft. south of the existing grade crossing. This work is nearly finished.

9. Closing and discontinuance of the Rockefeller road grade crossing, and a portion of the approaches thereto, of the Delaware & Hudson, in the town of Bethlehem, Albany County, and constructing an overgrade crossing with requisite approaches at the first cut west of the grade crossing. Plans and specifications and an estimate have been approved.

10. Changing the Old Westbury road highway grade crossing of the Long Island Railroad in the town of North Hempstead, Nassau County, to an undergrade crossing. Plans for this work are now being prepared.

11. Changing the New York avenue highway grade crossing of the Long Island Railroad in the town of Huntington, Suffolk County, to an undergrade crossing with approaches. Plans for this work are now in course of preparation.

12. Closing the Long Swamp road highway grade crossing of the Long Island Railroad in the town of Huntington, Suffolk County, and diverting travel from it to the undergrade crossing to be built at New York avenue (see preceding case) by means of a new highway. This work is involved with that to be done at New York avenue.

13. Closing the Fish or Thicket road highway grade crossing of the Long Island Railroad in the town of Brookhaven, Suffolk County, and diverting the traffic by means of a new highway to an undergrade crossing known as the Old Pine Neck road. Preliminary steps necessary to construct the new highway have been taken.

14. Closing the Horseblock road highway grade crossing of the Long Island Railroad in the town of Brookhaven, Suffolk County, and diverting the travel therefrom by existing highways to the next easterly grade crossing. This work has been completed without expense to either the state or the town.

15. Closing the River road highway grade crossing of the Long Island Railroad at Eastport in the town of Southampton, Suffolk County, and diverting the travel to an overgrade crossing to be constructed a short distance to the west of the present grade crossing. Plans, specifications and an estimate have been approved and construction has been begun.

16. Closing the West avenue grade crossing of the Erie, in the village of Livonia, Livingston County, and diverting the travel from it by means of existing and new highways to an overgrade crossing to be built about 800 ft. north of the present grade crossing. Plans, specifications and an estimate of expense have been approved.

17. Changing the Dock street, Wells avenue and Ashburton avenue grade crossings of the New York Central, in Yonkers, to undergrade crossings; the Pier and Fernbrook streets crossings to over-crossings; also changing the existing Main street overgrade crossing to an undergrade crossing and raising the existing Vark street and Babcock place overgrade crossings. Detail plans are now in course of preparation.

18. Changing the Canisteo street grade crossing of the Erie in the City of Hornell to an underground crossing and constructing the necessary approaches thereto. Plans and specifications have been submitted for approval.

19. Closing the Tyrrell road grade crossing of the Rome, Watertown & Ogdensburg (N. Y. C. & H. R.), in the village of Wolcott, Wayne County, and diverting the travel by means of a new highway to a highway known as the Eastport Bay Creek road, which crosses the railroad at grade. Plans, specifications and an estimate of the expense have been submitted.

20. Closing the Roslyn road and Glen Cove Back road grade crossings of the Long Island Railroad in the town of Oyster Bay, Nassau County, and diverting the traffic by means of a series of new highways to an undergrade crossing to be constructed about 500 ft. north of the Greenvale station of the railroad. Plans, specifications, estimate and a proposal of a contractor for the superstructure have been approved, and construction is now under way.

21. Closing the Moreland road grade crossing (known as Beer's crossing) of the New York Central, in the town of Dix, Schuyler County, and diverting the travel by means of a new piece of highway to a new grade crossing to be constructed at a point just north of the Beaver Dams station of the railroad. None of the expense of this work is to be borne by either the state or the town.

22. Closing the Clay Pit road highway grade crossing of the Long Island Railroad in the town of Southampton, Suffolk County, and diverting the travel from it by means of a new piece of highway to an undergrade crossing to be constructed at a point about 200 ft. west of the present grade crossing. None of the expense of this work is to be borne by either the state or the town.

23. Closing the crossing of the Long Island Railroad by a highway known at North highway or Cherry-Tree road in the town of Southampton, Suffolk County, and diverting the travel by means of new pieces of highway to an undergrade crossing to be built about 75 ft. east of the present grade crossing.

24. Closing the St. Andrews road highway grade crossing of the Long Island Railroad in the town of Southampton, Suffolk County, and diverting the travel by means of new pieces of highway to an undergrade crossing to be constructed at a point about 250 ft. east of the present grade crossing.

25. Changing the Culver road grade crossing of the New York Central, in Rochester, to an undergrade crossing. An estimate of the cost has been approved.

26. Changing the Grant avenue highway grade crossing of the Auburn branch of the New York Central in the town of Sennett, Cayuga County, to an overgrade crossing, constructing a new piece of highway from Grant avenue to the Phelps highway and closing the existing Phelps highway overgrade crossing.

27. Changing the New Scotland and Wolf Hill road grade crossing of the West Shore (N. Y. C. & H. R.), in the town of New Scotland, Albany County, to an undergrade crossing. Detail plans and specifications for this work are being prepared.

28. Changing the East Chemung street grade crossing of the Lehigh Valley in the village of Waverly to an overgrade crossing.

The following table shows the crossings of the various steam railroads in the state, with streets and highways, and how protected:

Steam Railroad Crossings with Streets, Avenues and Highways.

As shown by reports for the year ended June 30, 1906.

Name of road.	Total.	Protected by——, Unprotected.	Gates.	Flagmen.	Both gates & flagmen.	Crossing alarm and signals.	Overgrade.	Undergrade.
Albany & Hudson	35	..	1	..	..	..	..	..
Bath & Hammondsport	12	1	..	..	..	..	..	..
Boston & Maine	76	10	7	..	3	18	20	..
Brooklyn & Rockaway Beach	5	3	..	..	..	..	..	..
Buffalo, Attica & Arcade	27	..	..	..	..	..	..	1
Buffalo, Rochester & Pittsburg	180	..	15	1	7	7	14	..
Buffalo & Susquehanna	16	..	..	..	..	1	1	..
Campbell Hall Connecting	4	..	..	..	..	..	..	..
Catskill Mountain	21	..	1	..	..	3	..	..
Catskill & Tannersville	5	..	..	..	..	1	..	..
Central Dock & Terminal	..	..	..	..	..	..	..	1
Central New England	153	..	5	1	1	14	16	..
Champlain & St. Lawrence	1	..	..	..	..	..	..	..
Cranberry Lake	2	..	..	..	..	..	..	..
Dansville & Mount Morris	10	..	..	..	..	..	..	..
Delaware & Eastern	9	..	..	..	..	..	..	..
Delaware & Hudson	530	42	58	..	36	25	49	..
Delaware, Lackawanna & Western	305	44	56	..	62	30	41	..
Dunkirk, Allegheny Val. & Pittsburg	39	..	2	..	1	..	..	1
Elmira & Lake Ontario	124	2	5	..	..	1	11	..
Elmira & Williamsport	5	1	..	..	..	..	..	1
Erie	736	73	66	10	101	66	80	..
Fonda, Johnstown & Gloversville	41	..	4	..	..	..	1	..
Fulton Chain	4	..	..	..	..	..	..	..
Genesee & Wyoming	14	..	..	..	..	1	..	..
Glenfield & Western	11	..	..	..	..	1	..	..
Greenwich & Johnsonville	..	..	..	..	25	1	..	..
Jamestown, Chautauqua & Lake Erie	18	2	..	..	4	1	2	..
Kanona & Prattsburgh	12	..	..	..	..	..	..	..
Keeseville, Ausable Chasm & L. Champ.	3	..	..	..	..	..	..	..
Lake Champlain & Moriah	6	..	..	..	..	1	2	..
Lake Shore & Michigan Southern	55	..	13	10	2	10	9	..
Lehigh & Hudson River	18	1	..	..	..	2	1	..
Lehigh Valley	606	24	30	..	10	29	65	..
Little Falls & Dolgeville	5	..	..	..	..	2	..	..
Long Island	429	..	42	152	69	80	120	..
Lowville & Beaver River	13	..	..	..	..	..	..	..
Middleburgh & Schoharie	3	..	..	..	..	..	..	..
Middletown, Unionville & Water Gap	18	..	1	..	1	..	3	..
New Jersey & New York	24	..	1	..	4	3	1	..
New York Central & Hudson River	1,550	78	301	209	87	290	314	..
New York, Chicago & St. Louis	78	1	15	..	1	7	9	..
New York, New Haven & Hartford	11	13	1	..	1	37	35	..
New York, Ontario & Western	353	11	30	..	34	27	53	..
New York & Ottawa	34	..	..	..	..	1	1	..
New York & Pennsylvania	23	..	..	..	..	..	1	..
Niagara Junction	6	..	..	..	..	..	..	..
Norwood & St. Lawrence	5	..	..	..	..	..	..	..
Orange County	8	..	..	..	..	2	2	..
Otis	..	..	..	..	..	1	..	..
Owasco River	..	1	3	..	..	..	..	..
Pittsburg, Shawmut & Northern	85	..	..	..	..	..	10	..
Poughkeepsie & Eastern	14	..	4	..	..	3	..	..
Raquette Lake	4	..	..	..	..	..	..	..
Rochester, Charlotte & Manitou	4	..	..	..	..	..	..	..
Rutland	163	..	3	..	..	10	15	..
St. Lawrence & Adirondack	8	..	..	..	..	..	..	..
Schoharie Valley	1	..	..	..	..	1	..	..
Silver Lake	1	..	..	..	..	..	..	..
Skaneateles	6	..	..	..	..	..	..	..
South Buffalo	1	..	..	..	..	..	2	..
Staten Island	17	..	6	1	18	2	..	..
Staten Island Rapid Transit	3	3	10	11	14	3	5	..
Sterling Mountain	8	..	..	..	..	..	..	..
Syracuse, Binghamton & New York	45	7	19	..	17	5	6	..
Terminal of Buffalo	11	..	..	..	..	4	1	..
Ulster & Delaware	113	..	11	..	..	8	14	..
Unadilla Valley	12	..	..	..	..	..	..	..
United States & Canada	21	..	..	..	..	..	..	..
Western New York & Pennsylvania	322	3	12	2	3	16	24	..
Total	6,793	320	722	397	501	714	930	..

Foreign Railroad Notes.

The petroleum production of Galicia (Austrian Poland) has become so great that a special petroleum train has been put on between Cracow and Hamburg—almost into the jaws of the Standard Oil Company.

The Prussian State Railroads are prepared to contract for 15,800 freight cars to be delivered by the end of October next. Only those works which have heretofore supplied these railroads with cars, that is Prussian and Hessian works, are asked to bid.

The Baden State Railroads purpose next winter to establish classes of instruction in French and English for employees engaged in receiving and forwarding freight and for passenger conductors and guards.

What is doubtless the longest 2-ft. gage railroad in the world has been completed this year in German Southwest Africa from the Atlantic at Swakopmund (about 21 south latitude) northeast 358 miles to Tsumeb. It is known as the Otavi Railroad, Otavi being an important mining district about 150 miles from the coast. Tsumeb, the new terminus, has mines so important that an aqueduct 14 miles long has been built to bring water to them. The Arthur Koppel firm built the road, which was opened for traffic November 12.

Transatlantic Passenger Traffic in 1906.

The annual report of the landing agent at Ellis Island, New York City, shows that during 1906 the transatlantic steamship lines landed 1,159,551 passengers at New York, an increase of 167,486 over 1905. The proportion of aliens to United States citizens was as follows:

	Aliens		U.S. Citizens	
	1906.	1905.	1906.	1905.
Cabin	133,964	101,678	84,756	107,375
Steerage	910,558	754,346	30,273	25,666

The following table shows totals for the past six years:

		Cabin		
Year.	Trips.	First.	Second.	Steerage.
1906	1,097	84,435	134,285	940,831
1905	...	104,995	107,088	780,012
1904	967	68,704	93,085	572,798
1903	956	67,719	93,557	642,959
1902	922	.....	.....	574,276
1901	838	.....	.....	403,491

The traffic on individual lines was as follows:

	1906.	Cabin		
Line.	Trips.	First.	Second.	Steerage
American, Southampton	52	5,786	8,328	26,611
Anchor, Glasgow	50	2,903	12,407	33,642
Anchor, Mediterranean	26	263	.....	25,827
Atlantic Transport, London	48	3,490	25	102
AustroAmerican, Trieste	18	133	238	15,369
Cia. Trasatlantica, Mediterranean	12	390	561	6,518
Cunard, Liverpool	69	9,190	13,940	62,547
Cunard, Mediterranean	27	1,059	2,452	50,804
Fabre, Mediterranean	39	237	.....	33,165
French, Havre	79	5,884	9,028	62,311
Hamburg-American, Hamburg	104	13,494	16,018	128,811
Hamburg-American, Mediterranean	23	1,207	1,757	24,402
Holland-America, Rotterdam	45	3,868	10,215	42,981
Lamport & Holt, Santos	20	581	.....	1,312
La Veloce, Mediterranean	24	691	245	28,944
Nav. Gen. Italiana, Mediterranean	54	934	1,602	38,149
North-German Lloyd, Bremen	95	12,796	23,992	101,936
North-German Lloyd, Mediterranean	33	2,770	5,570	47,459
Prince, Mediterranean	16	91	5	16,051
Red Star, Antwerp	58	3,609	9,501	64,631
Scandinavian-American, Copenhagen	32	1,416	2,693	17,366
White Star, Liverpool	99	11,978	12,949	49,453
White Star, Mediterranean	15	1,285	2,893	25,966
Miscellaneous, various ports	50	908	70	4,947
Russian Volunteer Fleet, Libau	5	25	.....	5,207
Russian East Asiatic, Libau	5	142	106	2,563
Impresa Insulane, Lisbon	2	33	.....	750
Austro-Americana, Trieste:				
Richard & Co.	18	133	238	15,369
Phelps Bros. & Co.	25	220	290	14,356

Railroad Conditions in the South.

President Finley, of the Southern Railway, addressed the following circular, under date of January 16, to the public served by his company:

Realizing, from our own point of view and from public expression, the importance of the work of this company, especially in the South, and the fiduciary relationship which it bears to its patrons and to the public, I desire to make a brief statement of some of the conditions which confront it, and of the purposes and policy of its management. The management would not ignore the fact that at present railroad service generally, including that of the Southern, is far from satisfactory. If there was no adequate and justifying cause for this, these conditions would be unpardonable, but the fact is, they spring largely from causes which cannot for the moment be controlled. One exceedingly potential cause is the extraordinary industrial development of the South. In his last public address, the late President of the company, Mr. Samuel Spencer, referred to this development as follows:

"The South has entered upon a period of increased production in agriculture and in manufactures, and of general industrial and commercial activity, such as her best friends and most enthusiastic prophets had scarcely dreamed of fifteen years ago. Within that period the cash value of her cotton crop has doubled, the amount of pig iron produced at her furnaces has increased enormously, and the product of her coal mines has increased more than three-fold. Cotton factories have sprung up within her borders to the extent that more of her cotton crop is now manufactured on her own soil than in all the mills of New England. The total value of her annual manufactures now aggregates nearly eighteen hundred millions in value. The total value of her agricultural products is now over seventeen hundred millions per annum."

This increase is likewise indicated in the volume of traffic handled by this company. In 1895 the number of tons of freight carried one mile was 1,098,932,884, while in 1906 the number of tons carried one mile was 4,488,915,839, showing an increase of over 300 per cent., or, allowing for the increased mileage, an increase of over 138 per cent., while in 1895 the number of passengers hauled one mile was 178,015,925, as against 549,518,645 in 1906, showing an increase of over 200 per cent., or, allowing for the increased mileage, an increase per mile of road of over 80 per cent.

Nowhere in the United States, except in the two states of the extreme Northwest, Washington and Oregon, has there been such industrial development as in the South. It is perhaps not too much to claim that, outside of the energies and efforts of the people themselves, this company has been one of the chief factors in this development. Manifestly, the vast increase of traffic incident to this commercial awakening requires enormous increase in transportation facilities.

The management of the Southern Railway Company has not been unmindful of this fact, and did not wait for the coming of the development itself before attempting to increase to the most possible extent its transportation capacity. It must be remembered that this company has not been in existence more than about 12 years. It found those railroads of the South, now constituting a part of its system, of light and faulty construction, poorly equipped and utterly unprepared to handle any considerable traffic. They had been recently bankrupt and were without credit.

As soon as the new company came into existence, the management adopted a policy of betterment and improvement, and something of what it has done to prepare for the traffic of the South will appear from the following statement. It has spent:

In new, approved and heavier rail	$10,880,000
In double tracking, reducing grades and changing alignment	6,941,651
In new steel bridges for heavier power	2,578,540
In branches and spurs to industries	2,363,288
In side, passing and commercial tracks	3,148,806
In shops, tools and machinery	2,041,148
In additions and improvements to yards, real estate, roadway and structures and other improvements and additions	8,229,695
Or a total of	$36,184,018

It has spent or contracted to spend:

For new equipment	$49,322,569
For joint terminals complete (its proportion)	3,408,188
For terminals	823,401
For double tracking	6,744,769
Making a total of work done and contracted for to prepare to handle the traffic	$96,482,945

It has increased its rolling stock as follows:

Locomotives, from 623 to (received and contracted for), 1,544.
Freight train cars from 18,924 to (received and contracted for) 58,491.
Passenger train cars from 487 to (received and contracted for), 1,008

This does not indicate fully the increase made to its equipment by the company, because the increased power of the locomotives, and the increased tonnage capacity of the cars have added much more to the equipment capacity of the company than the number of added units would represent. For example, the average capacity of the freight cars has increased 28.38 per cent.

A fair consideration of these figures will demonstrate the fact that the management of this company has not been unmindful of its obligation to increase its facilities in anticipation of the increase in traffic.

It has been, and still is, hampered, however, by two conditions: One is the large amount of fresh capital required; and, the other, the difficulty of securing adequate and efficient labor, of promptly getting its construction work done, and of obtaining the rolling stock, rail and other material essential to improved facilities.

Delay incident to obtaining rolling stock will be illustrated by the following:

On November 1, 1905, contract was made for 38 locomotives and 1,806 freight cars to be delivered in February and March, 1906. There are still undelivered 177 freight cars.

On February 1, 1906, contract was made for 100 locomotives and 10,000 freight cars to be delivered on or before October, 1906. Still undelivered, 17 locomotives and 2,218 freight cars.

The disappointing delay in construction work will be illustrated by the following:

The double track work on the main line between Pomona and Spencer, N. C., was all let during the year 1905, and the last of it should have been completed by November 30, 1906. Part of this work is ten months late and the rest of it will be approximately five months late. This delay is due to the difficulty of the contractors in getting labor and material.

The contracts for the double track work between Knoxville and Morristown, Tenn., were let in September, 1905, and April, 1906. That part of the work which should have been completed to date is approximately 10 months late. This delay is due to the inability of the contractors to get labor promptly.

The double track work between Peyton and Austell, Ga., the contract for which was let in April, 1905, and which should have been completed in February, 1906, will be more than 14 months late in completion. This delay is due to scarcity of labor and material.

The prosecution of this double track work has necessarily caused some of the delay to the traffic of which the public complains, and necessarily results to the company in increased cost of operation. The fact that the company, in its effort to improve its facilities to handle the public business, has not been deterred from undertaking this work at a time when the cost of materials and labor is on such an unusually high plane should, I think, be accepted by the public as an earnest of the company's desire and purpose to put itself in a position to perform acceptably its public duties.

One of the greatest needs of the South is that its railroads should have additional track capacity. No matter how many locomotives and cars may be available, it is manifest that the number

which can be moved is limited by the track capacity. The work of providing the necessary additional track will require a vast input of capital. How it is to be provided, is everywhere a matter of grave concern to railroad managers. It cannot be obtained from the current operations of the properties. It must be borrowed.

Looking forward to the need for largely increased facilities, the management last spring authorized the creation of the company's development and general mortgage bonds to the amount of $200,000,000. Of these bonds, $20,000,000 were at once sold, and the proceeds are being spent as rapidly as the work can be done in adding to the existing facilities of the company. It is the intention of the management to pursue this policy and provide such of these additional facilities as may be required to meet the growing demands of business.

As bearing upon the capacity of the railroad companies to obtain the means to make necessary additions to their facilities and to provide the most approved safety appliances in operation, the public should give fair business consideration to the situation which confronts the carriers.

The present situation is:

An immense increase in all expenses, without any increase in rates—in fact, with the proposition almost universally made to decrease rates by legislative action.

The large increase in expenses may be illustrated as follows. Since 1898:

Bridge timber has increased from $9.36 to $20.52 per thousand feet.
Cross ties from 28 cents to 34.5 cents per tie.
Steel rails from $17.75 per ton to $28.00 per ton.

Since 1898, prices of equipment have increased as follows:

Locomotives from $11,392 to from $16,000 to $20,000.
Passenger coaches from $6,315 to $9,468.
Freight cars from $500.43 to $765.00.
Coal cars from $368.00 to $1,135.00.

The cost of labor has increased per mile of road from $1,621.67 in 1903, to $2,874.71 in 1906; and from $2,513.64 per mile of road in 1905 to $2,874.71.

Taxes of the Company per mile of road have since 1895, increased 63.41 per cent.

To this large increase of expense must be added the excessive verdicts of juries in personal injury cases. In addition to this there is a marked tendency on the part of many of the states to regard any failure of service as wilful, and to impose upon the carrier a heavy penalty therefor.

Inasmuch as adequate facilities for all are not in existence, the imposition of a penalty for failure to furnish cars under the above mentioned circumstances, if it has any effect other than merely to deplete the treasury of the carrier and to deprive it to that extent of the power to improve its transportation and service, must result simply in the withdrawal of the carrier's facilities from the service in respect to which there is no penalty, in order to use them in the service where there is a penalty. The logical result of this would be a race between the states to see which could inflict the highest penalty so as to obtain a preference for its own citizens.

The imposition of penalties will not build railroad tracks, supply equipment, or enlarge and simplify terminals, nor would it, under the circumstances mentioned, benefit the transportation service as a whole but, on the contrary, would tend to produce injustice and discrimination between persons and localities. Besides, this naturally would develop into a preference in favor of state commerce over interstate commerce. But the large interests of the shipping public of the South are in interstate commerce for the reason that their principal markets are the larger markets of the country, which are in other states.

That this condition is appreciated by the shipper will be apparent from the following quotation from a letter just received from a large shipper:

"Practically all our shipments go out of the state; therefore, we cannot use Form 41 (a form used for the purpose of availing of the penalty laws of the state), consequently orders for shipments within the state when shippers use Form 41 are given preference."

It is not to be wondered at that the large increase in the cost of materials, equipment and labor and other expenses above adverted to, and the increased difficulties in transportation are, as shown by its published reports, reflected in a large decrease of the net earnings of the company since July 1, 1906, notwithstanding its increased gross earnings.

With these greatly increased expenses for material, for labor, for taxes, for penalties and for damage claims, and with the just demands of the public for better facilities and greater safety of operation, it must be apparent that a reduction of revenues must conflict with the public interest in these larger questions of better facilities and greater safety.

I submit these facts to the candid consideration of those people who, in perfect good faith, desire a reduction of our freight rates and passenger fares. The public should be advised that, with decreased revenues, the railroads of the country will be utterly unable to pursue successfully their efforts to provide better facilities and greater safety of transportation.

The point is near where it may be absolutely necessary for the public to take the choice between better and safer facilities on the one hand and lower rates on the other. In the nature of things, it is impossible to provide both.

In view of the difficulty of meeting the just demands of the public for larger facilities and greater safety, with reduced revenues and increased expenses, I feel that I am justified in laying before our patrons and the public this plain statement of conditions.

W. W. FINLEY,
President.

Rotary Snow Plow for the Denver, North-Western & Pacific.

In the third of the winter already past, the difficulties of railroads in the Northwest on account of snow and ice have been the greatest in 10 years. Not that there have been tremendously heavy falls of snow; but a succession of severe snow storms following each other so closely that the lines have been blocked almost as soon as opened. In keeping the tracks open, rotary snow plows play a most important part. In the *Railroad Gazette* of Dec. 28, 1906, two photographs were shown of a rotary snow plow in use on the Denver, North-Western & Pacific. As this road by its present line crosses the continental divide west of Denver at 11,600 ft. above sea level, an altitude at which there is usually snow all the year around, there must be most powerful machines for attacking snow and ice during the winter months. The accompanying photograph shows more in detail another of the rotary snow plows built for the Moffat road by the American Locomotive Company at its Cooke works. These are the largest rotary snow plows ever built. One of the other photographs shows one of the plows at work and the other a cut made by one of these plows with the clear rail left behind the plow.



Rotary Snow Plow of the Denver, North-Western & Pacific.

Work of this sort used to be done by the wedge plow which, with six or seven locomotives behind it, bucked heavy drifts, forcing its way through by sheer force if possible. This was not always possible and was always dangerous to the men, among whom were many accidents. The rotary does the work without danger to equipment or men, and with uniform success. It will bore its way through drifts packed in a hard icy mass with perfect safety to those operating it. One or two heavy consolidation locomotives are all that are needed for pushing. The rotary for the Moffat road will clear a cut 13 ft. 4 in. wide. The wheel consists of 10 cone-shaped

scoops fitted with knives which adjust themselves automatically into cutting position. The wheel is encased in a drum, which is provided with a reversible hood, operated by an air cylinder, so that the hood may be turned to either side to suit the direction in which the wheel is turning. The boiler is of the locomotive type with Belpaire firebox. The engine consists of two horizontal cylinders with slide valves operated by the Walschaert valve gear. The plow is carried on a steel I-beam frame and is mounted on two 4-wheel steel frame trucks. To prevent derailment of the plow the front truck has ice cutters and flanges. The ice cutters are attached to a frame hung on the forward end of the front truck and operated by an air cylinder, so that it may be raised and lowered in crossing frogs or switches. The flanges are hung in the rear of the truck and connected to the axle, and are also operated by an air cylinder. With the ice cutter and flanger in perfect working order, it is impossible for the rotary to be derailed by ice or snow.



The Rotary Bucking a Deep Snow Drift in the Rockies.

The rotary has been used for the past 20 years, and successful operation in winter of many of the lines crossing the Rockies has depended on it for fighting the snow.



The Canyon of the Rotary.

Railroading in the Forties.

About the year 1840 the Housatonic Railroad (now part of the N. Y., N. H. & H.) was in operation from Bridgeport, Conn., to West Stockbridge, Mass., connecting with the Hudson & Berkshire for Hudson and Albany, and from Bridgeport to New York by steamboat. It is one of the oldest of our railroads, so old, in fact, that it goes back to the days of the strap rail; which, as older readers will remember, consisted of longitudinal sills of wood laid on ties, and to these sills iron straps with holes in their centers were spiked. Great care on part of the track gangs was needed, as the spikes were continually loosening, and when this occurred at the ends of the straps they curled up and formed what were called "Snake Heads." When a train struck one of these a derailment was generally the consequence, or if by good luck the engine passed safely, perhaps a car truck might strip the iron from the sill and force the iron through the floor of the car, so that it was thought to be unsafe to ride over the trucks; and to this day, so strong is tradition, that old-fashioned people prefer the middle seats in the coaches.

The rolling stock was of the simplest. The passenger cars were flat roofed, with small windows divided into four panes and only the lower half could be raised. The seats were covered with hair cloth, illumination was by candles, and link and pin couplings and hand-brakes were used. Those who saw the "John Bull" train at the Chicago Exposition in 1893 will recognize the type of cars. The trucks were built with wooden frames and cast-iron pedestals with a wheel base of about four feet, and frequently the springs were rubber blocks; about as comfortable as a "dead ex" wagon. Coaches of the English type were used on the Hudson & Berkshire as late as 1842-3, and the freight cars were of the four-wheeled type, like the English wagons of to-day. The engines were Rogers, Ketchum & Grosvenor make, small affairs of 15 to 20 tons weight, with outside cylinders 10 in. to 14 in. in diameter, mostly of the American type, though some had only one pair of drivers, and one (the "Berkshire") had the main rods coupled to the rear drivers. The boilers were all of the same construction, with dome topped round fire-boxes—wood burners of course—with stacks of all shapes, contrived so as to arrest, as far as possible, the escape of sparks, but this was only partially done, as the eye of many a traveler can testify. Valve gears were all of V hook variety generally with an auxiliary cut-off set at half stroke. Two of the freight engines had no cut-off and practically worked full stroke all the time.

Strange as these machines would seem to modern practice, they were far ahead of the Hinckly and Drury engines used at that time on the Western roads, which, with their complication of cam shafts, starting bars, cut-offs, etc., requiring some five or six levers in the cab to be handled, would certainly puzzle an engineman of to-day were he told to get aboard and do some switching. But these old worthies have all passed away; the last one the writer remembers was the "New Orleans," an ex-passenger engine doing service on a contractor's train on the Hoosac tunnel route about 1868. What a pity that some of these are not in our museums rather than in the scrap heaps. Fortunately we have the "John Bull" in Washington.

In those early days despatching was unknown; there was no telegraph and trains were run by dead reckoning. A meeting place was determined, and in case of failure of either train to arrive on time the train having the right of way would, after allowing five minutes for variation of watches, "proceed with care" till it met the

other train. In spite of the want of modern facilities, collisions were no more frequent than they are in these days of lap-orders and unheeded block signals.

About 1845 the telegraph came into use and the writer well remembers hearing an uncle announce "the Park Theatre in New York is burning at this moment and we, 160 miles away, know it—is it not wonderful?"

Previous to the telegraph the distribution of very important news, especially the President's messages, was made by running engines having the track cleared for them, with copies of the messages tied to wooden billets which were dropped at the station as the engines whizzed by at possibly 30 miles an hour. It was a red letter day for the gentlemen of leisure in the various towns to gather at the stations in larger force than usual to see the engines pass without stopping! There were no express trains then. All trains stopped at all stations and there were no complaints of discrimination.

Before 1850 the road was laid with T iron spiked to the ties and without splice-bars or any provision for securing good joints. Later this was corrected by using "chairs" at the joints, which introduced a new evil, the brooming of the rail ends.

About 1850 the Waterbury ventilator for passenger cars was put in use and continued for some years to be of service. Wings or scoops were built out on the sides of the tender tanks which forced the air back whence it passed down through the double roof of the baggage car and through the body of the train and out at the rear. Vestibules, practically same as now used, were provided on both baggage and other cars so that the train was virtually a tube through which the air was in circulation, so long as the train was in motion. For the short trains of those days, rarely more than three cars, the plan worked successfully. Why is it, with all our modern appliances for comfort, this matter of ventilation, or rather want of it, has received so little attention? Really we are not as well off as travelers of 50 years ago. Possibly the use of electric locomotives with their freedom from smoke and cinders may permit the introduction of pure air into our modern air-tight palace coaches. May we live to see that day. J. H. A.

Putting the Italian Railroads in Order.

The following translation from *L'Ingegneria Ferroviaria* discusses the efforts now being made in Italy to remedy the defects in railroad operation and administration. With the promulgation of the three decrees providing for urgent needs of construction and material, for regulation of the personnel and for buying in the railroads operated by the Southern Railway (Societa delle Meridionali), the life of the state railroad administration enters upon a new phase—that of regulation, or, to use a more familiar idiom, of putting in order. Last year may be considered as the transition period from the old to the new; a year in which the full effect was felt of the sudden and confused change. The transportation crisis which resulted, the bitter recriminations of the public, the unjust suspicions of obstructionism indulged in by the higher officials, eager to return to private ownership because of perquisites and dividends —these will certainly never recur, and we do not repent at all that we have been invariably optimistic.

All railroad officials, even those in the lower grades of the hierarchy, are in a position to appreciate the immense difficulties which have had to be overcome; and they must rejoice that, with the withdrawal of every outside obstacle, the period is beginning in which, under the tranquil conditions so much needed by the railroads and the public, the service may develop with the necessary regularity, and the administration may be definitely systematized. And it will be well to devote a few words to this task of systematization. The initiation of our state railroad management takes place during a great revival of business activity, and hence under favorable conditions for securing traffic. Nothing better can be wished than the chance to inaugurate an administration which, willy nilly, has abundance of business and fairly adequate resources. Yet we must not forget that, in general, lean years follow fat ones, and that the administration must be planned on a basis of medium traffic, not according to these exceptional years. The private companies were, to a greater or less degree, very expensively organized, perhaps because of the operation contracts, which necessitated superfluous office labor; this organic defect, which has probably been aggravated during its adoption in the new administration, is now being investigated. There have been too many superior officers and too much red tape. The government has also had to modify its original plan of department headquarters and a central headquarters, by depriving the former of much of the nominal independence which they enjoyed but seemed incapable, perhaps through lack of competent men, of exercising intelligently. It is too much to expect that administrative ability will be brought forth immediately; time and especially a campaign of education are needed, the state using for the latter the most solicitous care and stringent justice in making promotions, encouraging energy and rewarding ambition.

National Characteristics in Locomotive Building.

In the *Railroad Gazette*, July 6, 1906, a review was published of *La Locomotive Actuelle*, by Maurice Demoulin, in which a reference was made to the outline of the national characteristics of the locomotives in use in the several countries of the world. A translated abstract of this summary is here given:

Germany.—The design of German locomotives was practically stationary for a long period which offers little of interest except in an academic way. But the transformation, which has taken place in the past decade in nearly all countries, has been especially noticeable in certain states of the German Empire. This is particularly the case in Baden and Bavaria, and there are now a number of powerful types of locomotives in Germany that are of interest, in which American influence is frequently manifest, although the details have been worked out with a greater regard to lightness because of the limit of 15 tons which has been fixed for the weight that can be imposed on one axle.

The application of the compound principle to the locomotive, although originating in France, was developed in Germany in the two-cylinder type more rapidly than in France, where compounding made little progress until the introduction of the four-cylinder system on some of the main lines. This latter type has also been extensively applied in Germany, although, at the instigation of the Société Alsacienne, it has been modified and applied in a different form. At the present time, however, compounding, at least in Prussia, is no longer a dominant idea, but the use of superheated steam has become the question of the hour with the idea of revitalizing the simple engine in a country where, except in certain types of suburban locomotives, it had almost disappeared. The future will show whether such an evolution can be brought about, but it seems doubtful if superheating will altogether replace compounding.

The weight of trains has been very materially increased in Germany in recent years, but the speeds, in spite of the progress that has been made, are far from being as high, on the average throughout the country, as they are in France and England. The German time tables show only a few runs made at an average speed of 53 miles an hour.

The four-wheeled coupled (4-4-0) locomotive with a bogie, is extensively used and may be considered the standard type for Prussia. But they are notoriously insufficient for their work and the Atlantic (4-4-2) and ten-wheel (4-6-0) types are gradually supplanting them. The Atlantic type locomotives, with the exception of some recent engines built for the Bavarian State Railroads, have wide fireboxes. Some of them are very powerful. The locomotives of this type, belonging to the State Railways of Baden have a grate area, for example, of 41.64 sq. ft. These locomotives have a total weight of from 60 to 74 tons, while the weight on the driving wheels is only 32 tons. These may be compared with the Atlantic type locomotives of the Orleans Railway of France, which have a total weight in working order of 73 tons, with 36 tons on the drivers, or with the English locomotives of the same type which have a total weight of from 65 to 73 tons, of which from 37 to 40 tons is on the driving wheels.

The (4-6-0) type of six-coupled engine with bogie truck having driving wheels from 70 to 80 inches in diameter is the favorite one in Germany and is extensively used. The weight on the axles being limited to 16 tons, and the use of cars with a high tractive resistance makes the starting less easy than with the rolling stock used in France. The same type, with wheels 63 to 67 inches in diameter, will probably replace the mogul (2-6-0) type in the future and is already in use on the State Railroads of Prussia.

Freight trains are usually hauled by mogul (2-6-0) locomotives having wheels from 54 to 64 inches in diameter, those having the largest wheels really forming a class for mixed service, but sometimes used for heavy passenger trains. Eight-coupled engines are also used for freight trains. Suburban trains are hauled with engines having tenders and belonging to a great number of types.

Recent German locomotives are built for a boiler pressure of from 165 to 180 lbs. per sq. in. and are fitted with suspended fireboxes (the Belpaire firebox is only used upon a few locomotives built by the Société Alsacienne or from its plans) and cylindrical smokeboxes. Serve tubes have only been used in an experimental way, except in Alsace Lorraine. The extended firebox is being more and more extensively used and, in addition to its application on the Atlantic type locomotives of the Baden roads, it is used on the Palatinate and the Prussian State Railroads.

The cylinders and machinery are always on the outside; inside machinery being found only on the four-cylinder engines. The moving parts are usually light; the cranks are always hollowed. Piston valves are extensively used and exclusively so on locomotives with superheaters. Balanced flat valves are also frequently used. The valve motion is of the Walschaert type known as the Heusinger in Germany. The Joy gear is also used on some machines. The frames are always on the inside even for the bogie with the exception of some locomotives built by the Société Alsacienne. They

are usually strongly braced. The wheels are of cast steel and some axles are of nickel steel. Equalizers for suspension are in common use, but rarely for all of the axles.

Most of the locomotives on the main lines are of the compound type, with either two or four cylinders, with the exception of some recently built for the State Railroad of Prussia, a considerable number of which are furnished with the superheaters, that in most common use being of the Schmidt type. In 1898 the two-cylinder type of the Von Borries and Lindner systems with others of the same class were the only ones in use. Since that time many four cylinder locomotives have been built, most of them of the Battery type for the State Railroads of Prussia, Baden, Bavaria and the Palatinate; but the Société Alsacienne has built large numbers of the Du Glehn type or modifications of it, especially for the roads of Alsace-Lorraine.

The German types of four-cylinder compound locomotives have no arrangement for starting other than the introduction of live steam at a reduced pressure, into the intermediate receiver. In many cases this introduction is regulated by an automatic device formed by a cock attached to the lifting shaft so that it is open when the valve motion is at the end of its stroke for starting and is closed as it is hooked back into the running position. The German engines are fitted with bar throttles and inside dry pipes, with safety valves loaded direct and, for the past few years, with American pop valves. The brick arch is more and more extensively used. The variable exhaust is as yet found only on the engines of the Baden State Railway and those of Alsace-Lorraine. German builders are taking greater and greater care in the matter of general appearance of their engines. The Maffei and Borsig shops have both recently put out engines of remarkable symmetry and simplicity in external appearance.

Austria.—The Austrian locomotives that have been built during the past twelve years are all very similar to each other in appearance, whether they belong to the State Railway or the private companies, among which are, the Empereur Ferdinand, Nord-Quest, Sud de l'Autriche, etc. They are fitted with some special arrangements and belong to a school of their own. Although having characteristics common with other continental locomotives, they will be seen at first sight to be different. The locomotives of the Hungarian State Railroad are coming to show less and less decided differences when compared with those of the Austrian roads.

The design of these machines is controlled by the following considerations: to haul heavy trains, some of which are quite fast, over lines with a difficult profile, keeping the load on each driving axle between 14 tons and 15.5 tons at a maximum, according to the road, and the burning of an inferior fuel. This is frequently tan bark of local production or even lignites, which only give an evaporation of from four to five pounds of water per pound of fuel. Consequently large grates which rarely are less than 30 sq. ft. in area and which are often as large as 43 sq. ft. are in use. This frequently involves the use of extended fireboxes or at least those that are quite wide. This has also led to the development of locomotives with five axles and of the six-wheel coupled type for passenger trains and of the mogul, consolidation and ten-wheel coupled types for freight service or for use on grades. The 4-4-0 and 4-4-2 types are widely used for the level roads, although the weight on the drivers is seldom more than 29 tons. The limit of weight per axle is 15 tons and this often involves the use of unsymmetrical arrangements that do not create a good impression at first sight, as for example the rather unusual position given to the bogies in which they are set well to the rear in order to relieve the coupled wheels.

The boilers are built for pressures of from 158 to 170 lbs. per sq. in. They are fitted, almost without exception, with suspended fireboxes held by staybolts, with a flat crown sheet, and a cylindrical smokebox. Many of them are fitted with two domes connected by a large horizontal pipe. This arrangement, which was applied until recently to the locomotives of all types, was adopted to increase the steam space and to distribute the draft for the cylinders over two points some distance apart in the boiler. The continuance of this custom has not been possible with the high engines recently built on account of the limited clearances of the Austrian roads and has therefore been abandoned for more modern construction. Austria was the first European country in which the center of the boiler was raised to any great height, 9 ft. 2 in. being a common height, and even that is frequently exceeded. The Austrian locomotives, however, do not appear as high as they really are on account of the length to which they are obliged to limit the stacks because of the overhead clearance.

The outside frame formerly so extensively used has been abandoned. The advantages which it offered, such as the possible enlargement of the firebox, were offset by numerous disadvantages, the principal of which is the increase of the transverse distance from center to center of the outside cylinders. The trucks, whether articulated or with radial axles are always fitted with inside boxes even when the frames of the engine itself are on the outside.

The Golsdorf system of two-cylinder compounding is almost universally used. Lately, however, several types of four-cylinder engines have been built. The cylinders are outside save for a few exceptional types and the valve gear is always upon the outside and invariably of the Walschaert design. The machinery is well designed and exceedingly light. The main crank pin and the side rod pins are always hollow.

The throttle is of the goose neck type and is invariably placed in the forward dome and operated by a vertical lever whose shaft comes out of the dome on the right hand side and is attached to the reverse handle by a bell crank which sometimes also serves for operating it. The safety valves are frequently balanced and are placed on the dome, or, when the machine is very high, upon the pipe connecting the two domes. The most recent engines have directly loaded valves only, which are placed on the dome or at the rear of the back dome. American pop safety valves are occasionally used.

The stacks are either truncated cones or are cylinders, are frequently of cast iron, and are ordinarily bolted to a base riveted to the smokebox by means of a flange which gives an unsymmetrical appearance. The sand boxes are usually placed on the running board, on each side, but sometimes they are on the shell between the domes and are pierced by a steam pipe which holds them together and dries the sand.

The locomotives are usually provided with a variable exhaust. They are all provided with cabs made of sheet metal which are very complete, an item that the severity of the climate renders necessary.

Austrian locomotives are powerful and well built and were fitted with bogie and Bissel trucks before those of most of the countries of continental Europe. They represent the result of an effort toward constant and progressive improvement. Formerly, adverse criticism might have been made regarding the unsymmetrical appearance, the complication and the hard riding of Austrian locomotives, but the most recent Atlantic and Prairie type engines of the State Railroads have been so much improved in this respect that they are now among the most simple in appearance and most satisfactory in action of the locomotives of continental Europe.

Italy.—The Italian roads have rolling stock that is interesting, presenting, as it does, traces of foreign influence that are very marked, together with original characteristics which differentiate it at first sight from that of other nations. Italian rolling stock of the best type is quite modern; there will be found numerous examples of the genuine spirit of research and innovation and of a progress that has been very rapid. Furthermore, it must not be forgotten that Italy was the first country of continental Europe where the bogie truck was extensively used and where a six-wheel coupled locomotive was employed in high-speed service.

Recent Italian locomotives have boilers with a large capacity and Crampton fireboxes. They are frequently extended and are always somewhat widened at least. The two-cylinder compound system is the one commonly used; the Mediterranean system has a few three-cylinder engines and the Adriatic several of the four-cylinder type.

France.—General increase in power, standardization of types of locomotives and the extensive use of four-cylinder compounds constitute the most salient points of current French practice. The increase in power has been rapid and was brought about by the increase in tonnage and speed of trains. Although the limit of weight permitted on each axle, ranging as it does from 17 to 18 tons, according to the railroad, is somewhat higher than that allowed in other countries of continental Europe, it is not as high as in England, where it is from 19 to 20 tons, or in the United States, where it ranges from 24 to 26 tons. Still French builders are obliged to study their details carefully in order to keep within the limits imposed. The nominal speed of the fast trains in France is high, from 53 to 60 miles an hour on most of the systems, counting the time from terminal to terminal. Some trains on long sections without stops attain an average speed of 59 to 62 miles an hour, deducting the time for intermediate stops. The locomotives used for these services haul, under these conditions, from 200 to 300 tons behind the tender and sometimes 350 tons. The most powerful among them have hauled 350 net tons on a continuous grade of 0.8 per cent at a speed of 53 miles an hour.

The weight of freight trains has increased in the same proportion and their accelerations have been none the less remarkable. There are locomotives in use on some of the French lines that are capable of hauling a load of 250 tons on a grade of 2.5 per cent. at a speed of 15.5 miles an hour and from 600 to 800 tons up a grade of 1 per cent. One of the recent Northern Railroad locomotives of the Mallet type has hauled 1,000 tons up an adverse grade of 1 per cent. at a speed of 12 miles an hour.

The mixed six-coupled locomotive with driving wheels 69 in. to 71 in. in diameter and with a bogie in front has been extensively adopted, during the past few years. This type has an average adhesive weight of 50 tons, perfect stability at the highest speeds and high evaporative efficiency can be adapted to the most varied classes of service from the heaviest freight trains to passen-

ger trains, and, in case of necessity, even to high-speed express service.

The general increase in the power of locomotives in France is shown in the following table, which relates, however, only to high speed locomotives:

	Types in service or under construction								
	1896				1906				
	Type.	Grate area, sq.ft.	Heating surface, sq.ft.	Weight, in tons. Total.	Weight, in tons. On drvrs.	Type.	Grate area, sq.ft.	Heating surface, sq.ft.	Weight, in tons. Total.	Weight, in tons. On drvrs.
Ouest	4-4-0	21.52	1,327.59	45.50	28.50	4-6-0	26.36	2,162.22	65.30	46.00
Nord	4-4-0	21.95	1,670.78	47.80	30.50	4-4-2	29.48	2,323.81	66.50	33.00
Est	4-4-0	26.04	1,807.41	56.80	33.40	4-6-0	34.00	2,528.22	74.35	51.90
Paris, Lyons & Med	4-4-0	24.42	1,589.02	50.60	31.90	4-6-0	31.52	2,379.76	70.70	50.55
Paris-Orleans	4-4-2	18.72	1,494.34	48.30	28.80	4-4-2	33.35	2,575.56	72.90	35.60

The actual increase in power of recent locomotives is really greater than would arise from the mere increase in size of the several parts themselves. It is necessary to consider, in this connection, the different improvements which have served to increase the efficiency. Among these may be mentioned a better arrangement of the fireboxes, distribution of the stresses through four cranks and the general proportions adopted which have made it possible for the new locomotives to maintain a development of power nearer the limit of their capacity for a long time and with less strain on their several parts. The locomotives now in use in France develop from 50 to 60 indicated horsepower per sq. ft. of grate area.

The four-cylinder system of compounding, although it takes second place as compared with the increase of grate area, heating surface and weight, is none the less an important improvement. In France the four-cylinder compound was created and first developed and its advantages are now beginning to be appreciated even in those countries where the compound locomotive is looked upon with less favor. It is difficult to estimate the part played by this design, for it has only been applied to new locomotives that are a great improvement over the old in every point, and especially in the matter of the increase of power; but there is no doubt but that it has contributed essentially to the success of recent types of French locomotives.

The standardization of motive power is the result of different causes, but is especially due to the development of power. The nearer we approach the limit of weight and clearance the fewer will be the available number of solutions of the many problems and the better the type will be defined.

Independently of the general types, France is the country where locomotives of recent construction possess the greatest number of common characteristics as far as general arrangement and details are concerned. These characteristics may be summed up as follows:

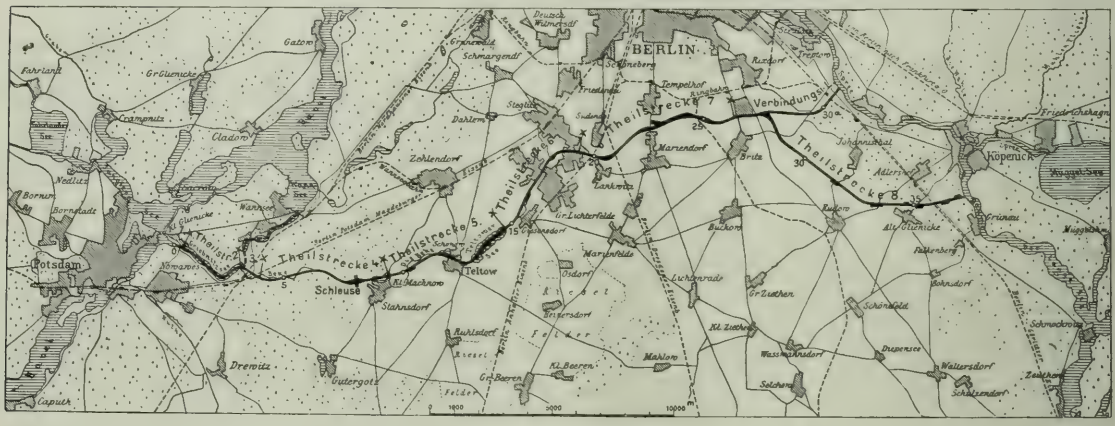
A boiler with a Belpaire firebox dropped down between the frames; Serve tubes; a boiler pressure of from 180 to 195 lbs.; an extended smokebox and stack slightly truncated; an inclined grate provided with a drop; a dome for the throttle set either at the center or somewhat to the front of the shell, containing a gridiron throttle, operated by an outside or inside bell crank, but with steam pipes almost always on the outside; the use of the bogie on most of the high-speed locomotives and on many freight locomotives; inside frames except with articulated trucks where they are frequently outside; the general or partial use of equalizing levers; the general use of the four-cylinder compound system with two outside cylinders driving the second coupled axle and two inside cylinders driving the forward coupled axle; independent valve gear of the Walschaert type; increasing use of piston valves; grate area varying from 35 to 38 sq. ft. and heating surface from 2,100 to 2,500 sq. ft.

(To be continued.)

The Teltow Canal.

BY REGINALD GORDON.

A publication recently issued by the Siemens-Schuckert electrical works of Berlin, Germany, gives a detailed description of the Teltow canal, lately completed, a waterway about 23 miles long, extending between the rivers Havel and Spree, just south of Berlin. It shortens the distance between these two rivers, and avoids a



Map of the Teltow Canal.



Electric Mule, Teltow Canal.

haul through the city itself. At the west end it begins at Klein Glienicke, on the Havel, and extends easterly to Grunau and Köpenick on the Spree, passing through Alt Glienicke, Marienderf, Gross Lichterfelde, Teltow and Stahnsdorf. Three lines of railroad had to be crossed, and a lock built at Mächnow, but otherwise the construction of the canal offered no great engineering difficulties. It is worthy of note, however, that electric towing locomotives are used, and appear to give entire satisfaction.

The cross section of the canal is designed for a waterway having a minimum depth of 8 ft. at the center, 65 ft. wide on the bottom, and the banks under water sloped 1:3. The barges used are 213 ft. long, 28 ft. beam, and draw 5 ft. of water, loaded. On those portions of the canal where the towing locomotives are employed, a track one meter gage (39.37 in.) is laid on the towpath, and a trolley wire is suspended 15 ft. 5 in. above it from brackets fastened to latticed steel poles set in concrete. The towing locomotive is mounted on six wheels, a single axle supporting one end of the frame on which the towing mast and its operating motor are mounted, while a four-wheel truck supports the other end. Each axle of this truck is driven by an 8 h.p. series wound, 550 volt, direct-current motor through double reduction gears. Current is collected from the trolley wire by a bow trolley of the type commonly used in Europe. In addition to the driving motors, a 3 h.p. motor raises and lowers the towing pole, besides which a 3 h.p. motor is installed on the locomotive for turning the rope winch. This winch is equipped with a clutch so arranged that in starting a boat from rest, if the tension on the towing rope exceeds 16,500



Towboat, Teltow Canal.

lbs., the rope is released and can run out a little until the extra strain is reduced, when the clutch again takes hold and the tractive force is applied once more. In those parts of the canal that are lakes, and where it was not practicable to employ locomotives on the towpath, towboats are used. One of these is an ordinary steam tug, but on one of the lakes an electric towing vessel is at present on trial. The boat has three screws, each one driven by an electric motor supplied with current by a trolley running on a wire suspended over the water parallel to and near the bank of the lake. Whether this will prove satisfactory remains to be shown by actual service.

The Russian authorities seriously contemplate building a railroad from the present eastern terminus of the Siberian Railroad at Srjetensk down the Amoor to Chabarovsk, the northern terminus of the Ussuri Railroad to Vladivostok, which was the route originally planned for the Siberian Railroad, and which was abandoned when the much more direct route of the Chinese Eastern Railroad was secured. This part of the Chinese Eastern is north of the line controlled by Japan, and economically should give much the best route to Vladivostok. There is now steamboat navigation all the way from Srjetensk to Chabarovsk; but only vessels of very light draft can navigate the upper channel. The government contemplates building on its own account 240 miles over a very difficult country to the point where the union of the Schilka and Argun rivers forms the Amoor. Thence for about 800 miles it is thought that a company may undertake the work.

Waterproofing Masonry and Concrete Structures.*

Two general methods have been tried for making concrete and masonry structures impervious to water—(1) treating the concrete with some foreign constituent, soda, alum, lye, etc., to make the mass impermeable and washing the surfaces with a cement paint or plaster, and (2) covering the masonry with a skin of some watertight material, pitch, felt, tar paper, etc. The first method may suffice for masonry which is sound and stable under all conditions, but it is absolutely useless if cracks develop due to contraction or settling. In ordinary concrete if a crack develops on the surface exposed to water moisture will be drawn up into the mass 15 ft. or 20 ft. and water will percolate through 20 ft. of concrete. It may take two or three years to do it, but water will come through it in time. When the concrete thus becomes damp, wet and saturated with moisture, it is impossible to get the moisture out. If the moisture freezes—expanding ten times its volume in so doing—the effect upon the concrete or masonry is disastrous.

The only correct way to make masonry waterproof is to provide a flexible, impervious, outer skin and prevent moisture from reaching the masonry even on the surface. The first efforts in this direction were to coat the surface to be waterproofed with hot coal-tar, pitch or asphalt, which, however, when set and cold, cracked and separated with any settling or cracking of the masonry. Burlap was subsequently used to reinforce the pitch or asphalt, without, however, preventing them from cracking, and the burlap, itself not being waterproof, did not give waterproofness. Later on, there came into use for this purpose tar paper, which, however, lacks pliability and tensile strength. Tar and tar paper have been extensively used for waterproofing in the past, simply because there was nothing else open to the profession. It was not until recent years that any serious effort was made to place waterproofing on a scientific basis, and to make materials specially adapted to the various conditions—materials which would not become brittle or be injuriously acted upon by water, the salts in the earth, alkali in cement, etc.

The best material is a strong, fibrous felt, made in one sheet, absolutely impervious to water by a process of saturation and coating with materials specially adapted to withstand the injurious action of water, and particularly all underground conditions. It is then practically an impervious membrane or skin through which, of course, in one sheet, water will not pass. As many layers thereof, as the conditions require, can be then cemented or veneered together with a waterproof bitumen-cement, not too weak, or hard and brittle, for the felt, but as strong and elastic as the felt. This forms a waterproof stratum so strong, tough and pliable, that, without injury, it can be readily pulled, bent, turned, twisted, etc. Whether in a building foundation, covering the floor of a bridge, or enveloping a tunnel, it readily conforms to the final conformation of the surface waterproofed, from which it is practically apart, and which it insulates and protects under all conditions—settlement, jars, shocks, cracks, expansion, contraction, heat, snow, ice, water, etc.

No waterproofing, especially for difficult and waterpressure work, should be undertaken when the temperature is below 25 deg. F. Fifty per cent. better work can be done when the weather is warm. In cold weather the felt sheets are difficult to handle, the hot bitumen-cement chills and congeals too quickly, especially when it comes in contact with a cold wall, and it is difficult to obtain the perfect cohesion of the different felt layers. Allow sufficient time, room and accommodations in which to properly apply the materials.

Thoroughly protect the waterproofing during and after application. The average laborer is no respecter of waterproofing, especially an elastic waterproofing, and will walk on some, roll wheelbarrows over it, throw tools, lumber, brick, stones, cement and debris thereon to its serious damage. After arches are waterproofed it is a common mistake in placing the fill to not begin same at the base of the arch but to dump the fill on the crown. The fill thus often breaks through the brick or cement protection on the waterproofing, and tears or strips the waterproofing from the arch surface. It is false economy to not always permanently protect waterproofing with a layer of brick or cement mortar.

The best method of applying the felt, especially on flat surfaces, is to roll the felt after the mop spreads on the hot cement. Rolling presses out air bubbles and insures better sticking. A workman follows, rubbing and pressing the felt over the entire surface to insure

*Extract from a paper by Edward W. DeKnight, Manager, Hydrex Felt & Engineering Co., before the Western Society of Engineers, Nov. 21, 1906.

thorough adhesion to the under layer. The usual method of doing such work with the old-school materialsl is to first lay out, shingle fashion, all the felt, then turn back one sheet at a time, rapidly run a mop full of pitch over the edge of the under sheet, let the lifted sheet fall in place, and walk on it. This is quick and cheap work for the contractor, usually a roofer—but it is not waterproofing.

Induced Draft and Heating Equipment of the Erie Railroad Roundhouse at Susquehanna, Pa.

The Erie Railroad has recently completed a new 29-stall frame roundhouse, machine shop and power house at Susquehanna, Pa., in which the principal features of interest are the heating and ventilating arrangements and the installation of induced draft apparatus for the boilers. The buildings are all of the standard type adopted by the Erie for intermediate engine terminals, of which an illustrated description was published in the *Railroad Gazette* June 15, 1906. The arrangement of the buildings at Susquehanna, shown in the accompanying illustration, is different from the terminal at Hammond previously described. As will be seen, the machine shop is between the power house and the roundhouse, and one of the difficulties met with in designing the heating system was to pass the main air duct through machine shop without encroaching on the limited head room of 19 ft. This was done by making the duct of the same cross-section—diamond shaped—as the middle panels of the roof trusses.

The power house at Susquehanna contains two 400-h.p. Babcock & Wilcox boilers in one room, and pumps, air compressors and ventilating fan, heater coils, etc., in the adjoining room. Draft for the boilers is created by a 120-in. induced draft fan mounted on a steel framework about 21 ft. above the floor and exhausting into a 52-in. steel stack 20 ft. high extending up through the roof. The fan is of the full housing type, with a blast wheel 85 in. in diameter and 33¼ in. wide at the periphery. It is driven by a direct-connected 7-in. x 7-in. Buffalo vertical engine. The speed is controlled by a throttle governor operated by the steam pressure carried by the boilers and adjusted to maintain any desired draft and steam pressure. The fan bearings next to the fan are water-cooled to prevent overheating by contact with the hot gases passing through. A fan of this size will handle 33,300 cu. ft. of gas per minute under a pressure of 1 ounce at 230 r.p.m. and requires about 14 h.p.

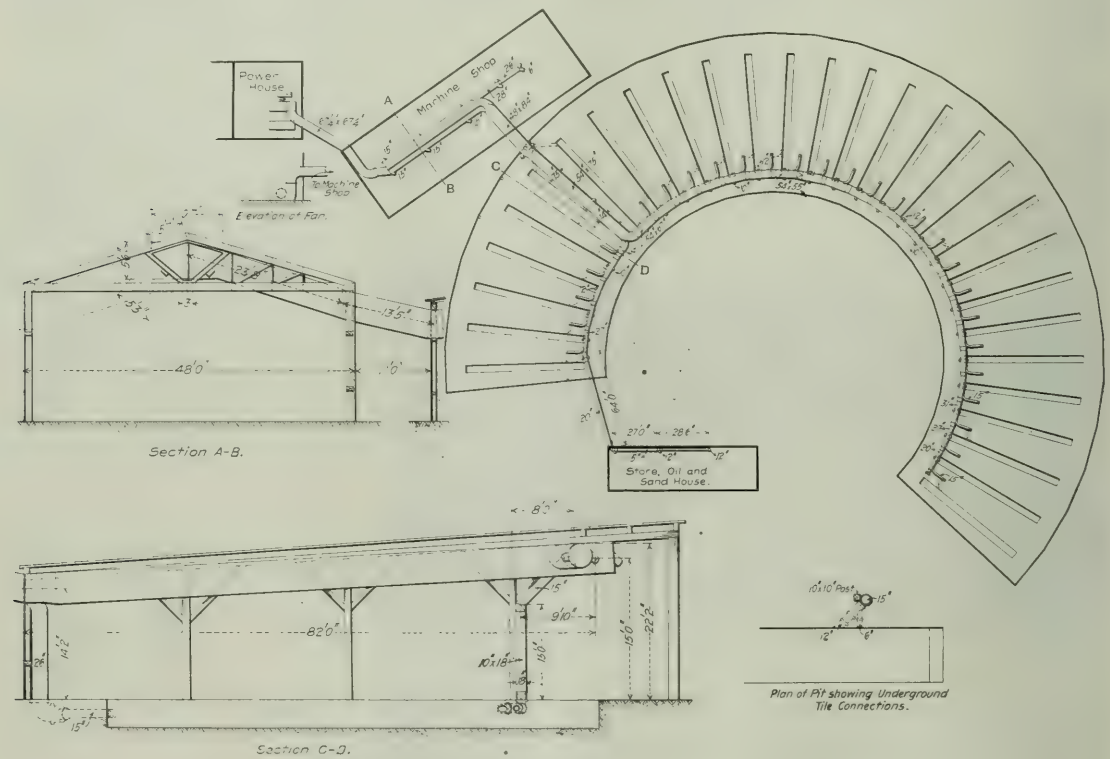
The blast for the heating system is supplied by a 210-in. three-quarter housing, up-blast type fan running at 160 r.p.m. The lower quarter of the housing is formed in the foundation, which also supports a 9-in. x 14-in. horizontal side crank engine, direct connected to the fan wheel shaft. The blast wheel is 127 in. in diameter and 51 in wide at the periphery, with wings or fan blades carried on a double spider. The fan draws in air over a heater bank of 24 sections of two rows of 1-in. pipe. Each section is 7 ft. x 8 ft. 4 in. and contains 480 lineal feet, or a total of 11,520 lineal feet. Separate steam supply and drip connections are provided for each section, giving perfect control over the temperature of the blast. The heater bank is enclosed in a sheet steel casing which forms the intake duct to the fan.

The buildings to be ventilated contain 1,430,000 cu. ft., and to insure proper ventilation 78,000 cu. ft. of air per minute was provided for, giving a complete change of air about every 20 minutes. The air leaves the fan at a velocity of 2,230 ft. per minute. In zero weather the heater bank can be made to heat the intake air to 130 deg. Fahr., which will maintain a temperature of from 60 to 65 degs. in the buildings.

The distributing system of ducts required over 20 tons of galvanized iron besides the tile ducts in the engine pits. The main duct from the fan, 67¼ in. x 67¼ in., enters the machine shop under the eaves at one end and is carried up under the roof to the ridge, where it changes to the diamond-shaped duct in the roof trusses. A little beyond the center of the building it is turned to one side and run out again under the eaves across to the roundhouse. An extension 28 in. in diameter carries warm air to the far end of shop.

In the roundhouse the main duct runs through to the inner circle under the roof and then branches to each side, continuing on around to the end pits. In addition to the 10-in. and 12-in. outlets from the main duct under the roof, a 15-in. pipe is carried down the post between each pit and connects at the bottom to two tile ducts leading into the engine pits. Warm air is thus introduced and evenly distributed under an engine standing over the pit and quickly thaws out ice and snow. In connection with the large smoke jacks employed (see *Railroad Gazette*, June 15, 1906), this system of ventilation keeps the house free from smoke and always supplied with fresh clean air.

The entire equipment for induced draft and heating and ventilating was designed, built and installed by the Buffalo Forge Co.



Heating and Ventilating System for the Erie Railroad Roundhouse at Susquehanna, Pa.

GENERAL NEWS SECTION

NOTES.

The coal pier at Baltimore of the Northern Central was burned on January 22.

According to press despatches the cotton congestion at Galveston has now been removed.

It is understood that there is to be a general reorganization of all the fast freight lines on the Vanderbilt roads.

The railroads of Illinois are reported to be granting passes good only within the state to members of the state legislature.

The Georgia Car Works, three miles from Savannah, Ga., were destroyed by fire January 17, with a loss estimated at $300,000.

The Great Northern is said to be bringing negroes from Missouri for work on its lines in Washington to take the place of Japanese labor.

It is reported that the Wabash has agreed to exchange transportation good only within the state of Missouri for newspaper advertising.

It is reported that the Burlington will make a traffic arrangement with the Kansas City, Mexico & Orient for carrying Mexican traffic.

The Hudson Navigation Company, one of the Morse steamship companies, has increased its capital stock from $4,000,000 to $8,000,000.

A car of powder on the Big Four exploded while standing on a siding at Sandford, Ind., January 19, wrecking a westbound passenger train.

Great Northern train No. 4, from Seattle, arrived in St. Paul on January 17, 10 days late, after having been snowbound in Montana and North Dakota.

The Pennsylvania has finished a stone and steel bridge nearly a mile long across the Susquehanna river between Havre de Grace, Pa., and Perryville.

The Chicago, Indianapolis & Louisville (Monon) has receded from its position that it will issue interstate transportation in exchange for newspaper advertising.

The Atlantic Coast Line announces a general increase in the salaries of clerks, agents, trainmasters, despatchers and section masters that will cost the road about $250,000 a year.

To provide against the congested hotels of New Orleans during the Mardi Gras, the Illinois Central will run a special train in which the passengers will eat and sleep while in the city.

The Omaha Post Office has been informed by the Government that on and after January 24 the Chicago, Rock Island & Pacific will carry the fast mail between Chicago and Omaha. For 20 years the Burlington has held this contract.

The Atlantic County, N. J., grand jury, which completed its sittings on January 17, found no indictments in regard to the Meadow Thoroughfare wreck near Atlantic City last October, but censured the railroad company for faulty construction of the bridge.

Switchmen of the Chicago & North-Western, at Janesville, Wis., an important division point, have had their workday cut from 11 to 10 hours. While the pay is lessened, the switchmen receive a little more money, comparatively, than they did under the 11-hour day.

Announcement is made that the railroads of Ohio have decided to restore the party rates which were declared off when the 2-cent law went into effect. This is construed to mean that hereafter special rates will be granted to conventions within the state as well as outside.

The New York, Chicago & St. Louis is reported to have withdrawn from the Cleveland Car Association on the ground that the association has served its purpose, which was to insure fair treatment of shippers, and that this is now gained under the operation of the rate law.

The Santa Fe has been indicted at Los Angeles for granting rebates and concessions on freight shipments in 76 cases, to John L. Shirm and the Grand Canon Lime & Cement Co., in the shipment of lime from Nelson, Ariz., to southern California points. The cement company has also been indicted for accepting them.

In February the Toledo, St. Louis & Western (Clover Leaf) will withdraw its reduced grain rates from St. Louis to Toledo, which restores the old rate adjustment between St. Louis and Chicago. The proposed proceeding against the road before the Interstate Commerce Commission by the grain interests of Chicago will in consequence be dropped.

William A. Martin, of the Pittsburg City Council, has been convicted of soliciting a bribe from President C. S. Cameron of the Pittsburg & Tube City Railroad Company in order to secure the passage of an ordinance in City Councils giving the railroad company the right to extend its tracks into the city. Cameron, the briber, has also been convicted of larceny and contempt of court.

The New York, New Haven & Hartford has issued an order to yardmasters, engineers, yard foremen, shop foremen and others, to the effect that employees having supervision over other employees will be held strictly accountable if they do not protect such employees from injuries due to the negligence of those in control. Foremen must take every precaution against any carelessness or negligence on their part which may result in injuries to those under them.

Elevated Railroad to be Built in Brazil.

A 70-year franchise has been granted to Carlos Schmidt and others of Rio de Janeiro for construction of an elevated railroad to serve the city of Rio de Janeiro and its suburbs. This franchise was obtained for an American company. It represents a purely American enterprise, and present plans are that all the equipment will be purchased in the United States. Charles E. Browne, of New York City, is president of the company. It is planned to send engineers and technical experts to Rio de Janeiro in January to begin preliminary work. Within four years 1⅝ miles must be in operation. Plans call for about 60 miles of right of way, which is to be double tracked throughout. The third rail electric system will be used, motive power to be derived from its own plant or from one of the two great concerns now preparing to develop water power in the mountains near Rio de Janeiro. For its privileges the company holding the concession must pay the municipality $16,666 for the first year, $20,000 per annum for the next 30 years, and $23,333 per annum for the following 30 years.—*Consular Reports.*

Annual Dinner of the Transportation Club of New York.

The Eleventh Annual Dinner of the Transportation Club of New York was held at the club rooms in the Hotel Manhattan on Tuesday evening, January 22. Senator Chauncey M. Depew presided and spoke at some length of the development of railroad interests during the 40 years in which he had been connected with the railroad business. He recalled that when he entered the railroad service the three railroad magnates of the day, and the only three, were Commodore Vanderbilt, Thomas A. Scott and John W. Garrett. At that time there were 30,000 miles of railroad, mostly single track, in the country. W. H. Boardman, Editor of the *Railroad Gazette*, reviewed the progress made during the 10 years' life of the club in various branches of the railroad world. Logan G. McPherson, lecturer on transportation at Johns Hopkins University and author of "The Working of the Railroads," referred to the hostility to the railroads to-day as partly a survival of the bitterness with which those whose business was hurt by the building of railroads regarded the new transportation in the early days. He urged that the public should be educated to understand the grave problems which railroad managements have constantly to face. Julius M. Mayer, who retired on January 1 as Attorney General of New York State, argued that the man in the street should not be left in the dark as to the reasons for vexations which he might suffer in railroad service, but that railroad officials should make it a point to make the public understand the reasons for such happenings, in which case he believed that they could be depended on to be reasonable in their demands. He also urged that an "automatic and mathematic" system of uniform taxation for railroads should be adopted. The last speaker of the evening was George H. Daniels, the veteran of the New York Central service. His subject was the humorous side of railroading, which he succeeded admirably in bringing out. He contended that the railroad business was the most honestly managed business in the world and in proof of this statement called attention to the fact that if he went into a drug store and asked for a special preparation the clerk was almost sure to offer him several things "just as good," but he defied anyone to mention a case where a man had gone to the ticket window of a railroad and asked for a ticket to Buffalo and the ticket agent had tried to persuade him that what he wanted was a ticket to Montreal. He also dwelt upon the Erie canal as adding to the gaiety of nations.

The Transportation Club, of which Chauncey M. Depew is Presi-

dent and John Carstensen, Vice-President of the New York Central, is Vice-President, has a membership of between 400 and 500 resident and the same number of non-resident members.

New Mileage in New York State.

The New York State Railroad Commissioner's report for the year ended June 30, 1906, shows the increases and decreases in the steam railroad mileage in New York state during the year as follows:

Increases.		
Delaware & Eastern	13.67	
Glenfield & Western	3.60	
Long Island: Brooklyn & Jamaica	.08	
Lowville & Beaver River	10.41	
New York & Ottawa	.87	
Pitts., Shawmut & Nor.; Roch., Hornellsvl. & Lack.	.09	
Port Chester Terminal	.41	
		29.16
Decreases.		
Buffalo & Susquehanna: Addison & Susquehanna	.27	
Erie	2.35	
Lehigh Valley	.51	
New York Central & Hudson River	1.94	
Spuyten Duyvil & Port Morris	.73	
New York, Ontario & Western:		
Port Jervis, Monticello & Summitville	2.53	
Pittsburg, Shawmut & Northern	.67	
		9.00
Net increase		20.16

In addition the following has been constructed since June 30 and up to January 1, 1907:

Delaware & Eastern, 23.85 miles in addition to amount shown above, which addition was opened November 17, 1906.

Buffalo, Thousand Islands & Portland, less than one mile. This has been constructed for some time previous to this year.

Buffalo & Susquehanna, 87.45 miles.

Carthage & Copenhagen, 8.75 miles.

Erie & Jersey, grading, 37½ per cent.; masonry, 45 per cent.; tunnels, 47 per cent. No track has been laid.

New York, Auburn & Lansing, 19.50 miles. Has been operated partially for freight purposes, the construction trains carrying freight for the accommodation of the shippers along the road.

Tunnesassa & Bradford, five miles, opened September 1, 1906.

Adirondack & St. Lawrence, 3.61 miles. This road was formally opened on January 1, 1907.

Eleventh Avenue Committee.

Alexander E. Orr, President of the New York Rapid Transit Commission, has appointed Morris K. Jesup, Mayor McClellan and Charles Stewart Smith a special committee of the Commission to consider the request of William H. Newman, president of the New York Central, that the company be allowed to build an elevated freight structure in the marginal street along the North River, instead of being compelled to put its Eleventh avenue tracks into a subway, as required by the Saxe law. At a meeting next week Mr. Newman's request will be considered by the committee.

J. J. Hill on Car Movement.

The following is from a speech of the President of the Great Northern before the National Lumbermen's Association:

I want to say to you in all candor that I am totally unable to see how business can be handled and how there will be a full supply of cars and facilities to handle it as it should be handled, possibly within 10 years. The problem is so large that people do not realize what it means. The figures from the reports of the Interstate Commerce Commission show that the increase of business in the United States from 1895 to 1905 was 118 per cent., or nearly 12 per cent. a year. The increased railroad mileage during that time was 2 per cent. a year; the increase of locomotives about 35 or 37 per cent., and in freight cars about 45 per cent. But the increase in tons hauled by each locomotive was 58 per cent. And notwithstanding all that, the country stands to-day in front of a condition that is practically slow paralysis. During the last twelve months the great Northern railroad added 100 locomotives and over 6,000 freight cars. This year we have ordered 150 locomotives and between 6,500 and 7,000 freight cars. In two years that would be of cars and engines about 115 miles, and still we have not been able to move the business. I will tell you why. Seven or eight years ago we used to get 45 to 48 miles a day out of a freight car. We are now getting on the Great Northern about 28, and I dare say now, during the period of storms, we are not getting 15. But when there is a fair opportunity to move, as in the month of October, we are getting 28 miles a day. The average of the United States is less than 25 miles a day, and you know how freight trains move. You know they move from 12 to 15 miles an hour. That means a car is moving one-twelfth of the time and standing still eleven-twelfths. The reason for that is a want of trackage, largely terminals, but a want of trackage; the business has outgrown the facilities.

I want to ask your most earnest attention and to urge on you that there will be no relief for the movement of lumber without delay from the Pacific coast, with the long distance it has to travel, until there can be more tracks on which to move cars. There are cars enough to-day if they could move. In place of 24, if they could move 50 miles a day where they now move four hours out of the 24, or one-sixth of the time, there would be cars enough to-day to move a great deal more lumber than you want to buy. But without tracks and terminal facilities they cannot be moved and it will not be moved, and the great famine will continue until these facilities and appliances are furnished.

New York Railroad Club to Move.

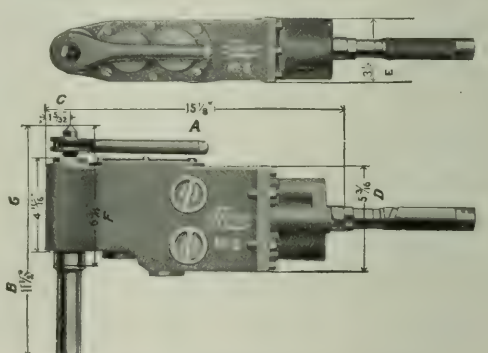
At the January meeting of the New York Railroad Club held last Friday evening at Carnegie Hall, the President of the club announced the successful conclusion of negotiations for the use of the Engineering Societies, 29 West Thirty-ninth street, for the regular monthly meetings, the change to be effective with the next meeting, February 15. The members expressed approval of the action of the officers by a unanimous vote of thanks for their promptness in taking advantage of the opportunity to secure the new quarters, in every way so much better suited to the club's present requirements.

New Offices for Morse Steamship Company.

The passenger departments of the Morse steamship lines, including the Clyde Steamship Company, Mallory Steamship Company, Metropolitan Steamship Company, Eastern Steamship Company, People's Line and Citizens' Line, now have offices together at 290 Broadway, corner of Reade street.

A New Close-Quarter Air Drill.

The Independent Pneumatic Tool Co., Chicago, has placed on the market a new air drill styled "Thor" No. 8 close-quarter piston air drill, which is illustrated herewith. It is intended for drilling in close quarters and corners where an ordinary drill cannot be used. Many points of superiority are claimed for the device. It is capable of drilling up 2½ in. in diameter in any kind of metal, has no delicate mechanism and is easily handled and operated. Its



"Thor" No. 8. Close-Quarter Piston Air Drill.

dimensions are: Distance from throttle connection to outside of spindle case, 15⅛ in.; distance from point of feed screw to end of socket, 11½ in.; radius from center of feed screw to outside of case, 1$^{3}/_{32}$ in.; width of case at cylinder flanges, 5$^{3}/_{16}$ in.; thickness of outside of cases, 3½ in.; distance from point of feed screw to end of spindle, 6¾ in.; width of case at spindle, 4$^{11}/_{16}$ in. The company will send the drill on approval to anyone wishing to make a test of it.

Output of Baldwin Locomotive Works.

The number of locomotives manufactured by the Baldwin Locomotive Works during the calender year 1906 was larger by about 18 per cent. than in 1905. Of the total of 2,652, 201 were electric and 2,451 steam locomotives. The annual output of both steam and electric locomotives during recent years is as follows:

	1906.	1905.	1904.	1903.	1902.	1901.
No. of locomotives	2,652	2,250	1,485	2,022	1,533	1,375

First Rate Under New Law.

The Interstate Commerce Commission has just promulgated its first decision under the new Rate law, in which use is made of its rate-making power. The decision is that a rate of $2.75 per ton is a fair figure for carrying bricks from Frederick, Md., to Elberon, N. J. Prior to December of last year, the regular rate for such shipment was the sixth-class rate of $3.80 per ton. The sixth class applies to all traffic of rough character, such as stone, cement, lime, lumber, etc., and the $3.80 rate has applied to such shipments from Frederick, Md., ever since the official classification was established.

The Frederick Brick Company, desiring to make certain shipments over the Pennsylvania Railroad, asked for a special commodity rate. The Pennsylvania, which has not heretofore enjoyed the patronage of the Frederick Brick Company, that concern being

local to the Baltimore & Ohio, set about making the rate in the ordinary way and quoted, subject to acceptance in time for publication upon statutory notice, a rate of $3.10 from Frederick to Elberon. The rate was not accepted, and a shipment being made, the company charged at the old rate of $3.80 per ton. Against this the brick company protested, contending that a rate of $1.85 be established as a fair one for such shipments. Meanwhile the Pennsylvania, in its regular process of developing traffic, again took up the matter and fixed upon $2.75 as a rate between those points, which could be made without serious disturbance to other rates, and published that as its regular rate.

The complaint of the brick company coming before the Interstate Commerce Commission, the railroad company expressed its willingness to refund to the brick company the difference between the $3.80 and the $2.75 rate, providing the approval of the Commission could be secured. The Commission, after a full hearing, indorsed the rate which the railroad had made in the regular course of business and ruled that the $1.85 rate contended for by the brick company would be an unreasonably low one, and ordered that shipments made under the $3.80 rate prior to the issuing and filing of the $2.75 rate should be corrected on that basis and the necessary refund made to the Frederick Brick Company.

New Hamburg Liner.

It is said that the Hamburg-American Steamship Company has ordered of Harland & Wolff, of Belfast, Ireland, a steamer to exceed in size the "Amerika" and the "Kaiserin Auguste Victoria." The new boat is to carry 4,250 passengers in addition to a crew of 500, and to make 19 knots an hour.

New Erie Ferry Boats.

The Erie has ordered a new double-decked ferryboat, a duplicate of the "Goshen," for the service between Manhattan and Jersey City. The new boat, having a steel hull, will be 224 feet long, and will be the fifth new double-decked vessel, the others being the "Goshen," "Tuxedo," "Arlington" and "Chautauqua."

Grade Crossing Removal Annulled.

The New York Railroad Commissioners announced January 21 that they had annulled their determinations of May 24, 1899, and July 11, 1900, to eliminate grade crossings of the Long Island Railroad at Smith Road, in the town of Hempstead; Lake View avenue, in the town of Jamaica, and Lawrence street, in the town of Flushing. These annulments are made, the Board explains, because of the failure of the local authorities to secure the necessary land, and the board feels that the state money appropriated for the abolition of these crossings "should be expended in other communities that want the benefits which the grade crossing law contemplates."

The Price of Cars.

The following testimony was brought out at a car shortage hearing at Seattle, January 22.

Charles E. Patton, president of the Reliance Lumber Company, gave some figures showing apparent discrimination in the distribution of cars among the mills.

"How do you account for this discrimination?" asked Commissioner Lane.

"Only that somebody was buying cars," replied the witness.

"What is the common salutation among lumbermen?" asked Austin E. Griffith, who was conducting the examination for the lumbermen.

"What is the price of cars to-day?" said Mr. Patton. "The price of cars runs from $1 to $5 a car, paid to railroad employees."

"How common is that salutation among the lumbermen?" queried Commissioner Lane.

"Oh, very common," replied the witness. "It is almost a joke. Some weeks ago the superintendent of our mill saw a very large car being switched about and asked if we were going to get that car. The conductor asked him how much it was worth to him. I have given strict orders that we are not to buy any cars, and the superintendent said that while we wanted the car pretty badly we were not going to pay for it. The conductor said that it was worth $10 to him and we did not get that car."

Philadelphia's Traction Troubles.

Philadelphia, like every other big city, has its traction problem. There is no cry in Philadelphia for municipal ownership, no agitation for lower fares. There has been no determined fight against the traction company such as has been carried on in Chicago and Cleveland, where new franchises were persistently refused to the street railway companies. The Philadelphia Rapid Transit Company has received all of the franchises it wants and received them free, even in these days when there is elsewhere general opposition to such municipal generosity. It is crying out to be saved from the results of its own methods. It needs succor. George H. Earle, Jr., of the Board of Directors of the Rapid Transit Company, says that to bring the system up to the city's needs $10,000,000, perhaps even $20,000,000, must be spent each year. He advocates a plan by which the city should lend its credit to the transit company, being represented on its Board of Directors and sharing in its profits. In this way it is thought the company might be enabled to carry out the needed improvements which it has undertaken. The Rapid Transit Company has so exhausted its credit that it is unable to make the extensions of its system which the city needs. If it surrenders or is deprived of the valuable franchises which it has failed to carry out, it opens the field to a rival. George W. Norris, a banker of Philadelphia, has presented figures to show that there is $76,750,000 of water in a total capitalization of $165,000,000. The result is that, owing to the terms of the leases of underlying companies, the Rapid Transit Company has to pay 5 per cent. interest on about twice the capital put into its plant, without allowance for depreciation. The amount of "water" in the stock of the company has made it an uninviting business proposition to private capital. Meanwhile the public is becoming more impatient and more insistent that something be done.—*New York Tribune.*

Passenger Traffic Between New York and Chicago.

W. J. Lynch, Passenger Traffic Manager of the New York Central Lines, is quoted in the *Wall Street Journal* as follows:

"Travel in our territory averages 8 per cent. heavier than that of a year ago. It is the heaviest on record. The increase is about equally divided between local and through travel and is spread proportionately in all directions. The increase in travel offsets about 50 per cent. of the decline in rates last year, caused principally by the two cent fare law in Ohio. What the effect of the decline in rates is depends on the density of population. In thickly settled communities we have gained some travel at the expense of the trolley lines. That travel, however, belonged to us originally. Little new travel has been created by the reduction in fares. Nor has the abolition of passes helped much since the new rate law took effect. Our attention is directed mostly to the two cent fare legislation proposed in Illinois and Indiana. Even if both measures are passed, on top of the Ohio law, the through rates between Chicago and New York would not be affected. The average rate between Chicago and New York is only 2.19 cents per mile. This is figured on the basis of $20 applied to the short route via the Pennsylvania. The $20 rate was not made on a mileage basis. It was selected arbitrarily as being a round sum fairly remunerative to the railroads, and satisfactory to the public."

The Pennsylvania's Bituminous Tonnage in 1906.

The total tonnage of bituminous coal and coke originating on the Pennsylvania Lines East of Pittsburg and Erie during the calendar year 1906 shows an increase of 8 per cent. over the figures for 1905, as compared with an increase of 17 per cent. of the 1905 shipments over those in 1904. The tonnage figures are as follows:

	1906.	1905.	1904.	1903.
Bituminous coal	32,398,081	30,386,521	27,046,243	27,780,425
Coke	12,782,989	11,327,153	8,685,619	9,028,349

Phoebe Snow on Her Travels.

The following yarn is going the rounds of the street, but I cannot vouch for its accuracy. Some days ago President W. H. Truesdale, of the Lackawanna Railroad, and President Underwood, of the Erie System, chanced to meet on Broadway. Their short conversation soon developed into "shop," and when Cortlandt street was reached, Truesdale abruptly excused himself, and walking across the street, spoke to a young lady who had been going in the opposite direction. Underwood, while tapping his foot impatiently on the curbstone, noticed the damsel was dressed in black from head to foot and was a brunette of the most pronounced type.

Mr. Truesdale returned to his companion shortly, however, and Mr. Underwood sarcastically remarked: "Huh! Must be a person of some importance. Thought her a creole or a Spaniard." "That's Phoebe Snow," responded Truesdale. "What!" exclaimed Underwood. "Yes," retorted Truesdale, "that's Phoebe Snow. She just arrived in New York from Buffalo over the Erie Railroad."—*Boston News Bureau.*

Additional Electrical Equipment for the West Jersey & Seashore.

Because of the increased traffic on the Camden-Atlantic City electric trunk-line, it has become necessary to add to the present rolling stock 21 cars. Both the new cars and the generating apparatus necessary to care for the extra load are similar to the present equipment. Each of the cars will be driven by a GE-69 (200 h.p.) double motor equipment and will be fitted with the Sprague-General Electric Type M control.

At the Westville power house a fourth 2,000-kilowatt, 6,600-volt, 25-cycle, three-phase, Curtis steam turbo-generator will be installed. Additional boiler capacity with the necessary condenser and feed pumps, switchboards, etc., will also form a part of the new equipment, as well as a 75-kilowatt, 125-volt, horizontal Curtis steam turbo-generator for excitation purposes. Three extra 700-kilowatt, air-blast transformers will step up the generator voltage to 33,000 volts for transmission.

Six 1,000-kilowatt rotary converters will be distributed in the sub-stations; one each at South Camden, Glassboro, Newfield, Miz-

pah, Atlantic City, and one at the Westville power house. The accompanying air-blast transformers for these machines have a capacity of 370 kilowatts each, three being installed with each of these rotaries. The Pennsylvania Railroad has ordered all the additional apparatus from the General Electric Company, which also furnished and installed the initial equipment.

Manufacturing and Business.

James H. Baker, Vice-President and General Manager of the Solid Steel Tool & Forge Co., has been elected President of that company.

The Buckeye Jack Manufacturing Co., Louisville, Ky., has shipped a carload of "Buckeye" jacks to the Isthmian Canal Commission to be used in the construction of the Panama canal.

Robert M. Burns & Co., Chicago, have sold to the Condon-Lane Boom & Lumber Co. ten 60,000-lb. flat cars; to M. C. Peters Mill Co. two tank cars, and to the American Bridge Co. one 60,000-lb. flat car.

Nathaniel Haven, at one time President of the Baltimore Bridge Co., died in New York City January 15. He was born in 1863 and was for many years connected with the Union Bridge, becoming an officer of the American Bridge Co. later and then going to the Baltimore Bridge Co. as President.

The third annual dinner of the M. H. Treadwell Company, 95 Liberty street, New York City, was given at Rector's, Jan. 12. Covers were laid for 32. This is an annual courtesy extended by the company to its office employees, superintendents and foremen, to assist in promoting sociability and good fellowship. Toasts were responded to by J. H. Killinger, President; H. N. Dougherty, Vice-President; M. H. Treadwell, Treasurer; A. F. Colling, Purchasing Agent; A. H. Stein, Assistant Secretary; W. E. Farrell, Manager of Lebanon plant, and R. McCarty, Manager of Myerstown plant.

The sales of "Thor" pneumatic tools and appliances during 1906 increased 50 per cent. over 1905, and the Independent Pneumatic Tool Co. is now several months behind in its orders. The company has purchased a large four-story brick building adjoining its plant at Aurora, Ill., which will give it approximately 100,000 sq. ft. of additional floor space, and there will be installed there about $65,000 worth of additional machinery. The company expects to double its output this year. A. B. Holmes, Secretary of the company, has also been elected Treasurer, effective January 16th. The Board of Directors at a recent meeting declared a regular quarterly dividend of 3 per cent.

The Southern Steel Co. is to erect a plant at Gadsden, Ala., to build pressed steel cars. The wire and nail mill of the Southern Steel Co. is using only about one-half of the output of steel, amounting to about 400 tons per day, and the remainder is to be used in the manufacture of cars. It is the first plant of this kind to be erected in the south. The company has an authorized capital stock of $16,000,000, including $6,000,000 preferred and $10,000,000 common. It was incorporated in Alabama in 1905 as a consolidation of the Alabama Steel & Wire Company and the Underwood Coal & Iron Company. The President is Everett T. Schuler. Among the directors are R. B. Van Cortlandt, Moses Taylor, John Bindley, C. Van Camp, Harrison B. Schuyler and George H. Shuler.

The DuBois Iron Works, DuBois, Pa., has taken over the entire business of the Lazier Engine Mfg. Co., Buffalo, N. Y. The DuBois Iron Works has been manufacturing gas and gasolene engines for a number of years under the patents of Arthur A. Lazier, former Vice-President and General Manager of the Lazier Engine Mfg. Co., who has sold out his interests and retires from the business management and company. Numerous improvements and changes will be made in the "DuBois" engines (the name they will be sold under), and they will be built to operate on natural, illuminating and coke oven gas, gasolene, alcohol, distillate, crude oil and kerosene in sizes ranging from 5 h.p. to 300 h.p. Peter Eyermann, one of the foremost gas engine designers and engineers in Germany, is chief of the engineering department, and under his supervision the improved "DuBois" engines will be produced. The company will continue to manufacture the Simplex steam pump. The officers of the company are: John E. DuBois, President; W. C. Pentz, Vice-President; E. A. Badger, Secretary and Treasurer; I. N. Hamilton, General Manager. The sales and advertising department will be in the hands of Mr. C. E. Stuart. The head office will be at DuBois, Pa., and at Buffalo a branch office will be retained, together with branches in the principal cities throughout the country.

Iron and Steel.

The Coeur d'Alene & Spokane has ordered 6,000 tons of rails.

The Edmonton (Alberta) city council has ordered 470 tons of 80-lb. rails for the municipal street railway system from the Carnegie Steel Company, Pittsburg.

The Chesapeake & Ohio has ordered 1,000 tons of rails, the Aberdeen & Rockfish 3,000 tons, the Jersey Central Traction 1,200 tons; about 3,000 tons more have been ordered by other companies.

The Chicago, Milwaukee & St. Paul has ordered steel for three bridges over the Missouri river, which call for 6,600 tons. The Great Northern and Lehigh Valley have also ordered structural steel.

The New York, Ontario & Western has given an order to the Baltimore Bridge Company for 140 tons of steel. Other bridge contracts include the Youngstown & Ohio River, 350 tons; Lake Erie & Pittsburg, 250 tons, and Cleveland Short Line, 1,300 tons.

The Atlantic & Birmingham Construction Company has given an order for 2,500 tons and the Louisville & Nashville for 800 tons of bridge material to the American Bridge Company. The Westinghouse Electric & Mfg. Company is in the market for 2,500 tons to be used on an addition to its buildings.

OBITUARY NOTICES.

James W. Musson, who was from 1885 to 1892 General Traffic Manager of the West Shore and more recently General Superintendent of the Car Department of the Merchants Despatch Transportation Company, died recently at Rochester, N. Y. He was 75 years old, a Canadian, and had had an extensive railroad service.

Major Charles Frederick Livermore, a former Treasurer of the Michigan Central, who was connected with the Detroit & Mackinac, died recently at Detroit at the age of 77. He was born in Cambridge, Mass., on March 18, 1830, and graduated from Harvard College in the class of 1853, and from the Lawrence Scientific School of Harvard University in 1856.

Mrs. A. E. Mitchell died of pneumonia at her home, No. 430 Seneca street, Bethlehem, Pa., on Tuesday morning, January 22, after a short illness. Mr. Mitchell, late Superintendent of Motive Power of the Lehigh Valley Railroad, has for years been among the best known and highly esteemed members of the Master Mechanics' Association and of the other engineering associations to which he belongs. His many reports, papers and discussions at the conventions have given him high standing, while his manly qualities make people like him. Mrs. Mitchell usually accompanied him where ladies were invited, and her qualities, both as hostess and guest, gave pleasure to her husband's friends.

A. R. Eldridge, Assistant Bridge Engineer of the Chicago, Burlington & Quincy, Chicago, was killed on January 17 by the accidental discharge of a pistol which he was cleaning. Mr. Eldridge was born in Americus, Ga., in September, 1867. He graduated from Rensselaer Polytechnic Institute, Troy, N. Y., when he was 20 years old and started as locating engineer on the Louisville Southern Ry. He worked in the mines at Shamokin, Pa., for a short time, and in 1889 was in the maintenance of way department of the Alabama Midland R. R. His successive services were: Engineer in the bridge department of the Chicago Board of Public Works; Assistant Engineer of Maintenance of Way of the Savannah, Americus & Montgomery R. R.; City Engineer of Saratoga Springs, N. Y.; four years owner and editor of the *Americus Evening Herald*, and Assistant Bridge Engineer of the Chicago, Burlington & Quincy in September, 1905. He was a member of the American Society of Civil Engineers, Western Society of Engineers and the Franklin Institute.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Railway Club of Pittsburg.

At a meeting of this club to be held at the Monongahela House, January 25, James P. Wilson will present a paper on the liability for personal injuries between employer and employee.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Baltimore & Ohio.—David C. Green, Assistant Secretary of the Baltimore & Ohio and of the Long Island, has resigned, effective February 1.

Cleveland, Akron & Columbus.—Joseph Wood, First Vice-President of the Pennsylvania Lines West, has been elected President, succeeding James McCrea.

Delaware & Eastern.—Joseph J. Jermyn and Joseph Holmes have been elected additional directors. Frank L. Phillips has been elected Vice-President.

Fonda, Johnstown & Gloversville.—Chauncey M. Depew, Chairman of the Board of Directors of the New York Central & Hudson River, has resigned as a Director.

Grand Rapids & Indiana.—Joseph Wood, First Vice-President of the Pennsylvania Lines West, has been elected President, succeeding James McCrea, resigned.

Interborough-Metropolitan Company.—Theodore P. Shonts, Chair-

man of the Isthmian Canal Commission, has been elected President of the Interborough-Metropolitan, succeeding August Belmont. See Interborough Rapid Transit Company.

Interborough Rapid Transit Company.—August Belmont, President of this company and of the Interborough-Metropolitan Company, has been elected Chairman of the Board of Directors of the Interborough Rapid Transit. E. P. Bryan, Vice-President, succeeds Mr. Belmont as President of the Interborough Rapid Transit. John B. McDonald has been elected Vice-President, with general supervision of construction of new subways.

Isthmian Canal Commission.—Theodore P. Shonts, Chairman of the Isthmian Canal Commission, has resigned. See Interborough-Metropolitan Company.

Kansas City Southern.—R. J. McCarty, Assistant Secretary and Auditor, has been appointed Vice-President and Auditor, with office at Kansas City, Missouri.

Long Island.—See Baltimore & Ohio.

Midland Valley.—The jurisdiction of J. F. Holden, Vice-President of the Midland Valley, has been extended over the operating department, with title of Vice-President and General Manager; office at Muskogee, Ind. T.

Norfolk & Western.—Joseph Wood, First Vice-President of the Pennsylvania Lines West, has been elected a Director, succeeding James McCrea, resigned.

Pennsylvania.—Charles E. Ingersoll has been elected a Director, succeeding James McCrea, now President.

Pennsylvania Lines West.—Edward B. Taylor, who is now Third Vice-President of the Pennsylvania Company and the Pittsburg, Cincinnati, Chicago & St. Louis, and Second Vice-President of the Vandalia, was born on February 6, 1850, near Riverton, New Jersey. He graduated from Haverford College in 1869 as a Bachelor of Arts, and from the Polytechnic College of the state of Pennsylvania in 1870, as a Bachelor of Civil Engineering. On July 25, 1870, he entered railroad service with the Pennsylvania at Harrisburg as a rodman and clerk in the Superintendent's office of the Middle division. In September, 1871, he was made supervisor, and in 1872 Assistant Engineer in charge of Maintenance of Way of the Middle division. In January, 1875, he became Assistant Engineer of the Pittsburg division, and in July 24, 1876, Superintendent of the Lewistown division. Two and a half years later, on January 1, 1879, he was transferred to the Western Pennsylvania division, and again on April 1, 1881, to his present territory on the Lines West as Superintendent on the Pittsburg, Cincinnati, Chicago & St. Louis. He was appointed General Superintendent of the Northwest System of the Pennsylvania Lines West in April, 1888, and on March 1, 1890, General Superintendent of Transportation of all the Lines West. This position he held for over 10 years. On January 1, 1902, he was elected Fourth Vice-President of the two most important companies of the Western system, and also became President of a number of the subsidiary lines. His election as Third Vice-President came on January 9, 1907, and as Second Vice-President of the Vandalia on January 14 of the present year. His headquarters are at Pittsburg.



E. B. Taylor.

D. T. McCabe, who has been appointed Fourth Vice-President of the Pennsylvania Lines West, in charge of traffic, and a Director and Member of the Executive Committee of the two important underlying corporations, as well as Third Vice-President of the Vandalia, was born at Abingdon, Va., on November 25, 1849. He began work for one of the companies of which he is now Fourth Vice-President, the Pittsburg, Cincinnati & St. Louis, when he was 21 years old, as clerk in the Auditor's office at Columbus, and was soon made claim clerk in the general office of the road. In April, 1872, he was made chief clerk in the general freight office, and in 1876 division freight agent in charge of the Second and Third divisions of the Columbus, Chicago & Indiana Central. In April, 1883, when that road passed into the control of the Pittsburg, Cincinnati, Chicago & St. Louis, Mr. McCabe was made General Freight Agent at Chicago. One year later he became western freight agent and division freight agent of the Second, Third and Fourth divisions of the consolidated road. Next he was Assistant General Freight Agent of the Pittsburg, Cincinnati, Chicago & St. Louis, and the Chicago, St. Louis & Pittsburg at Columbus. He became General Freight Agent in 1892, and in 1897 he was appointed Freight Traffic Manager of the Pennsylvania Lines West, from which he was promoted to his present executive post.

Wiscasset, Waterville & Farmington.—Carson C. Peck, 280 Broadway, New York, has been elected President of the reorganized company; William D. Patterson, who has been Receiver, Treasurer, and Samuel J. Sewall, who has been Superintendent, General Manager.

Operating Officers.

Canadian Northern Ontario.—Fred M. Spaidal, who has been appointed General Superintendent of the Canadian Northern Ontario, with headquarters at Toronto, was born on November 13, 1858, at Gananoque, Canada. After a high school education he entered railroad service in June, 1876, on the Grand Trunk, where he was operator, agent and despatcher until 1883; he then went to the Union Pacific, where he served in the same capacities, and two years later to the Canadian Pacific as despatcher, chief despatcher, Trainmaster and Superintendent. He leaves the position of Superintendent on the Canadian Pacific to become General Superintendent of the Canadian Northern line.

Canadian Pacific.—D. E. Brown has been appointed General Superintendent of the Pacific service, with headquarters at Vancouver, British Columbia.

Chicago & North-Western.—S. M. Braden, Superintendent at Chicago, has been appointed General Superintendent of the lines west of the Missouri river, with headquarters at Norfolk, Neb., succeeding C. C. Hughes, resigned.

Chicago, Rock Island & Pacific.—Garrett Davis, District Engineer at Cedar Rapids, Iowa, has been appointed Superintendent of the Minnesota division, with headquarters at Cedar Rapids. This is one of the new divisions.

M. McKernan has been appointed Superintendent of the new Fort Worth division, with headquarters at Fort Worth, Tex. U. S. Rea, Trainmaster at Oklahoma City, has been appointed Trainmaster of the division, with headquarters at Fort Worth, succeeding L. D. Hess, resigned.

Cincinnati Southern.—W. P. Caldwell, formerly Superintendent of Terminals of the St. Louis, Iron Mountain & Southern at Little Rock, Ark., has been appointed Inspector of Transportation.

Colorado & Southern.—Alfred Pardoe, who has been appointed Car Accountant, with office at Denver, Colo., was born on May 17, 1878, at Roca, Nebraska. He was educated in the public schools of Ulysess and Lincoln, Neb., and Denver, Colo., and began railroad work in October, 1895, as a messenger on the Union Pacific. In 1897 he was made inspector of the Colorado Car Service Association, and in 1898 clerk in the Auditor's office of the Colorado Midland. In May, 1899, he went to the Colorado & Southern as clerk in the Car Accountant's office, becoming chief clerk in December, 1904, from which he has been promoted to his present post of Car Accountant.

Deepwater.—See Tidewater.

Erie.—Robert S. Parsons, Engineer of Maintenance of Way, with headquarters at Cleveland, Ohio, has been appointed Assistant General Superintendent of the Ohio division, and of the Chicago & Erie, with office at Cleveland. The office of Engineer of Maintenance of Way has been abolished.

J. C. Tucker, Superintendent of the Allegheny & Bradford divisions, has been appointed Superintendent of the Rochester division, succeeding George W. Dowe, transferred to be General Agent at Port Jervis, N. Y. E. I. Bowen, Trainmaster of the Allegheny & Bradford divisions, has been appointed Superintendent, succeeding Mr. Tucker.

F. M. Hawley has been appointed Trainmaster of the Allegheny and Bradford divisions, succeeding E. I. Bowen, promoted.

Galveston, Houston & Henderson.—J. H. Lister has been appointed Acting Manager, in the absence of J. H. Hill. W. F. McClure, General Freight and Passenger Agent, has been appointed also Assistant to the Manager.

Georgia, Florida & Alabama.—W. B. Denham, General Manager of the Georgia, Florida & Alabama and the Carrabelle, Tallahassee & Georgia, has resigned, effective February 1, to take charge of the Tampa Northern, building from Tampa, Fla., to Atlanta.

Grand Trunk.—W. R. Tiffin, Superintendent of the Northern division, has been granted a leave of absence. P. J. Lynch, Assistant Superintendent, will have full charge of the division during Mr. Tiffin's absence, with headquarters at Allandale, Ontario.

Missouri, Kansas & Texas of Texas.—T. A. Wilson, Trainmaster of the M., K. & T., with headquarters at Denison, Tex., has been appointed Superintendent of the Missouri, Kansas & Texas of Texas, with headquarters at Smithville, Tex., succeeding J. H. Davisson, resigned on account of ill health.

Missouri Pacific.—P. A. Buck, Chief Clerk to Vice-President Clarke, has been appointed Superintendent of the Illinois division, with headquarters at Chester, Ill., succeeding B. G. Fallis, resigned.

Pacific & Idaho Northern.—C. M. Hunt has been appointed Superintendent of the Pacific & Idaho Northern, with headquarters at Weiser, Idaho.

Raleigh & Charleston.—L. E. Boyd has been appointed General Manager, with headquarters at Marion, S. C., succeeding J. M. Turner, resigned to accept service with another company.

Sonora Railway.—Epes Randolph, President of the Gila Valley, Globe & Northern and other Southern Pacific allied lines in Arizona and Mexico, has been appointed General Manager, with headquarters at Tucson, Ariz., succeeding E. E. Calvin, resigned on account of pressure of other duties.

Southern Pacific.—See Sonora Railway.

Tidewater.—H. P. Reigart, Purchasing Agent, has been appointed Assistant General Manager of the Tidewater and Deepwater railways. He will also continue to act as Purchasing Agent.

Union Pacific.—E. W. Botsford, Trainmaster at Salt Lake City, has been appointed Assistant Superintendent of the Utah division of the Oregon Short Line, with headquarters at Ogden, Utah, succeeding J. K. Roth, resigned.

Illinois Central.—Frank B. Harriman, who has been appointed General Manager of the Illinois Central, succeeding I. G. Rawn, was born on December 23, 1861, at Nora, Illinois. He was educated in the public schools of Dubuque, Iowa, and began railroad work in 1879. All of his service has been on the Illinois Central. For eleven years he was in the engineering department, four years as an apprentice, three years as assistant roadmaster and three years as construction engineer on branch lines. In 1890 he was appointed Trainmaster on the Cherokee and Freeport divisions, and on August 1, 1892, Superintendent of the Freeport division. On January 1, 1895, he was made also Superintendent of the Dubuque division, and in 1903 Superintendent of the Chicago division. He was promoted in 1905 to be General Superintendent of the lines north of the Ohio river, a post which he leaves to become General Manager of the whole road.



F. B. Harriman.

Traffic Officers.

Alabama Great Southern.—See Cincinnati, New Orleans & Texas Pacific.

Canadian Pacific.—C. E. E. Ussher, General Passenger Agent of the Eastern lines, has been appointed Assistant Passenger Traffic Manager of the western lines, with office at Winnipeg, Manitoba. William Stitt, General Passenger Agent of the Canadian-Australian Line at Sydney, N. S. W., has been appointed General Passenger Agent of the Eastern lines, succeeding Mr. Ussher.

Central of New Jersey.—Arthur Tomalin, news editor of the *Newark Evening News*, has been appointed General Advertising Manager of the Central of New Jersey, and editor of its monthly magazine, *The Suburbanite*, with office at New York.

Chicago, Milwaukee & St. Paul.—E. C. Nettles, Division Freight and Passenger Agent at Des Moines, Iowa, has been appointed Assistant General Freight Agent, with headquarters at Chicago.

Cleveland, Akron & Columbus.—See Vandalia.

Delaware & Hudson.—Ira H. Shoemaker has been appointed Industrial Agent, with headquarters at Albany, N. Y., succeeding W. A. Moyer, deceased.

New York, New Haven & Hartford.—F. C. Coley, Assistant General Passenger Agent, has been appointed General Passenger Agent of the New England Navigation Company, controlling the Sound steamboat lines of the New York, New Haven & Hartford, with office at Pier 10, North river, New York City.

Cincinnati, New Orleans & Texas Pacific.—George P. Biles, who has been appointed Freight Traffic Manager of the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern, was born in Dorset County, England, on July 18, 1859, where he received a common school education. His railroad service was begun in England in May, 1874, as ticket clerk on the London, Brighton & South Coast Railway. He came to this country in September, 1883, and became rate clerk in the general freight department of the Alabama Great Southern at Chattanooga, Tenn. On January 1, 1884, he was transferred to the headquarters of the Queen & Crescent System at Cincinnati, being chief rate clerk from July, 1886, to May, 1888. In 1888 he was made Assistant General Freight Agent. From October, 1895, when the Queen & Crescent System was dissolved, up to January 1, of the present year, he was General Freight Agent of the Cincinnati, New Orleans & Texas Pacific, from which position he has been promoted to Freight Traffic Manager of the two northern roads in the Queen & Crescent Route.



George P. Biles.

Pennsylvania Lines West.—William Hodgdon, Freight Traffic Manager of the Vandalia, has been appointed Freight Traffic Manager of the Pennsylvania Lines West, succeeding D. T. McCabe, now Fourth Vice-President.

Trinity & Brazos Valley.—W. C. Connor, Commercial Agent of the St. Louis & San Francisco at Houston, Tex., has been appointed General Freight Agent, with headquarters at Fort Worth.

Vandalia.—George W. Davis, General Freight Agent of the Cleveland, Akron & Columbus, and Commercial Agent of the Pennsylvania Lines West at Columbus, has been appointed General Freight Agent, succeeding William Hodgdon, who has been appointed Freight Traffic Manager of the Pennsylvania Lines West. Frederick E. Sawyer, division freight agent of the P., C., C. & St. L., at Louisville, Ky., succeeds Mr. Davis.

Engineering and Rolling Stock Officers.

Alabama Great Southern.—See Cincinnati, New Orleans & Texas Pacific.

Atchison, Topeka & Santa Fe Coast Lines.—F. S. Guinn has been appointed Road Foreman of Engines of the First district, and Walter Reid, Road Foreman of Engines of the Second district, both with headquarters at Needles, Cal.

Baltimore & Ohio.—E. J. Lander, Engineer of the New Castle division, has been appointed Engineer of Maintenance of Way of the Pittsburg system, including the New Castle, Pittsburg and Connellsville divisions, with headquarters at Pittsburg, succeeding H. H. Temple, recently appointed Superintendent of the New Castle division. A. M. Funk, Assistant Engineer of the New Castle division, succeeds Mr. Lander, with headquarters at New Castle, Pennsylvania.

Baltimore & Ohio.—William Trapnell, Division Engineer of the Philadelphia division, has been appointed Division Engineer of the Baltimore division, succeeding V. K. Hendricks, resigned to go to another road. Mr. Trapnell was born on May 22, 1876, at Charleston, W. Va., and is a graduate of Purdue University. He began railroad work in 1897 as chainman on an engineering corps in the maintenance of way department of the Atchison, Topeka & Santa Fe. In 1901 he went to the Baltimore & Ohio as transitman on third track work near Rowlesburg, W. Va., and was later made Assistant Engineer of Maintenance of Way at Cumberland, Md. In June, 1903, he became Assistant Division Engineer at Philadelphia; from June, 1903, to December, 1904, he was Assistant Engineer of the Shenandoah division, and was made Division Engineer at Philadelphia in 1904. Mr. Trapnell is succeeded at Philadelphia by A. A. Miller.

Mr. Miller is a graduate of Ohio State University, and all of his railroad work has been on the Baltimore & Ohio. He was with the Cleveland, Lorain & Wheeling during the summer of 1900, and with the Ohio & Little Kanawha for three months in 1901. During the summer of 1902 he was Assistant Engineer

of the Wheeling division, thence being transferred to the Cleveland division, where he remained until January, 1903, when he was put in charge of the track inspection car, with headquarters in the office of the Chief Engineer of Maintenance of Way. He leaves this post to become Engineer of the Philadelphia division.

Cincinnati, New Orleans & Texas Pacific.—Charles Dougherty, Superintendent of the Springfield division of the Illinois Central, has been appointed Assistant Chief Engineer of the C., N. O. & T. P., and the Alabama Great Southern, with headquarters at Cincinnati, Ohio, effective February 1. See Seaboard Air Line.

Erie.—See Erie under Operating Officers.

Grand Trunk.—George R. MacLeod, chief clerk to the Fourth Vice-President, has been appointed Resident Engineer, with headquarters at Toronto, Ont., succeeding F. L. Somerville, resigned.

Illinois Central.—Charles Dougherty, Superintendent of the Springfield division, has resigned, effective February 1.

New York Central & Hudson River.—The headquarters of D. L. Sommerville, Division Engineer, are to be changed from Buffalo to Syracuse, effective February 1.

St. Louis & San Francisco.—W. W. Thomas has been appointed Master Mechanic of the St. Louis, Memphis & Southeastern, with headquarters at Cape Girardeau, Mo., succeeding William Henry, who has been appointed Assistant Master Mechanic of the Southwestern division, with headquarters at Memphis, Tennessee.

San Antonio & Aransas Pass.—J. S. Peter, formerly Chief Engineer of the Chicago, Rock Island & Gulf, has been appointed Engineer of Maintenance of Way, succeeding W. Berry, resigned.

Seaboard Air Line.—J. C. Nelson, Assistant Chief Engineer of the Queen & Crescent Route, has been appointed to the new office of Engineer of Maintenance of Way.

Wheeling & Lake Erie.—Robert Blickensderfer, Consulting Engineer, has resigned.

Purchasing Agents.

Atchison, Topeka & Santa Fe.—F. E. Connors, Chief Clerk in the Purchasing Department, has been appointed Assistant General Purchasing Agent.

Chicago, Indiana & Southern.—William McMasters has been appointed Assistant Purchasing Agent of the Chicago, Indiana & Southern and the Indiana Harbor (Indiana Harbor Belt).

Cincinnati, New Orleans & Texas Pacific.—S. L. Yerkes has been appointed Fuel Agent, succeeding C. H. Dent, resigned.

Mississippi Central.—C. F. Larson, General Storekeeper, has been appointed Purchasing Agent, with office at Hattiesburg, Miss.

LOCOMOTIVE BUILDING.

The Hocking Valley has asked bids on 26 locomotives.

The Long Island Railroad has asked bids on five locomotives.

The Western Pacific is rumored in the market for 10 locomotives.

The Chicago, Milwaukee & St. Paul has asked bids on 50 locomotives.

The Northern Pacific is in the market for 25 switching (0-6-0) locomotives.

The Delaware & Hudson has asked bids on eight locomotives for its lines in Canada.

The Southern Railway will have one special exhibition locomotive built to be shown at the Jamestown Exhibition this summer.

The Santa Clara Raw Sugar Company will shortly be in the market for narrow-gage locomotives for a 30-mile plantation railroad in Cuba.

The Evansville & Terre Haute denies having ordered eight locomotives from the Baldwin Locomotive Works, as reported in our issue of January 18.

The Chesapeake & Ohio has ordered one special exhibition locomotive from the American Locomotive Company, to be shown at the Jamestown Exhibition.

The Atlantic Coast Line, as reported in our issue of December 28, has ordered 80 locomotives from the Baldwin Locomotive Works, and it is rumored that this order will shortly be increased to 100 locomotives.

The Canadian Pacific is having 85 locomotives built by the American Locomotive Company, Montreal Works, and has ordered 25 locomotives from the Richmond Works of the same company. It has also ordered 25 locomotives from the Baldwin Locomotive Works.

The South Manchuria Railway will shortly be in the market for several locomotives. The contracts will probably be placed through one or more of the following firms in New York: Mitsui & Co., Takata & Co., Frazar & Sale and Okura & Company.

The Chicago, Milwaukee & St. Paul, as reported in our issue of January 18, will build 45 simple consolidation (2-8-0) and 18 simple ten-wheel (4-6-0) locomotives at its own shops. The specifications are as follows:

Specifications.

	Consolidation.	Ten-wheel.
Type	Consolidation	Ten-wheel
Total weight	177 000 lbs.	178 000 lbs.
Weight on drivers	156 000 lbs.	131 000 lbs.
Diameter of drivers	56 in.	73 in.
Cylinders	22 in. x 28 in.	20½ in. x 26 in.
Type of boiler	Straight	Extd. wagon top
Boiler, wkg. stm. pressure	200 lbs.	
" number of tubes	321	300
" diameter of tubes	2 in.	
" length of tubes	14 ft. 6 in.	15 ft.
Firebox, length	9 ft. 3½ in.	8 ft. 11⅛ in.
" width	3 ft. 5½ in.	3 ft. 5½ in.
" grate area	171½ sq. ft.	26.6 sq. ft.
Heating surface	2,608 sq. ft.	2,578 "
Tank capacity	7,000 gals.	
Coal capacity	10 tons.	

The special equipment for both is as follows:

Bell ringer	Ordway
Boiler lagging	Sectional magnesia
Brake beams	Monarch
Couplers	Miner
Headlights	Adams & Westlake
Injector	Nathan and Simplex
Piston rod packing	Edwards' metallic
Valve rod packing	Edwards' metallic
Sanding devices	Leach
Sight-feed lubricators	Nathan bull's-eye
Steam gages	Ashton
Driving wheel tires	Latrobe
Truck wheel tires	McKee Pullet
Tender wheel tires	McKee Pullet

CAR BUILDING.

The Chicago Union Traction is said to be about to order cars.

The Great Northern is reported to be figuring on 40 cabooses.

The Chicago & Milwaukee (Electric) is in the market for 10 motor cars.

The Louisiana & Arkansas has ordered 503 freight cars from Barney & Smith.

The St. Louis & San Francisco is reported to be in the market for 5,000 or 6,000 cars.

The South & Western is figuring on 100 steel underframe flat cars of 100,000 lbs. capacity.

The Kingan Refrigerator Line, Indianapolis, Ind., is in the market for 50 refrigerator cars.

The Nashville, Chattanooga & St. Louis is asking prices on specialties for 25 refrigerator cars.

The Cedar Rapids Refrigerator Express, Cedar Rapids, Iowa, is in the market for 35 refrigerator cars.

The New York, New Haven & Hartford is reported to be in the market for from 3,000 to 9,000 freight cars.

The Chesapeake & Ohio is reported to have ordered 1,000 hopper cars from the American Car & Foundry Company.

The Louisville & Nashville is reported to be about to build 500 refrigerator cars at the company's shops at Decatur, Ala.

The Chicago, Rock Island & Pacific is negotiating for about 300 cars, largely box and furniture cars, for replacement.

The Santa Clara Raw Sugar Company will soon be in the market for a number of narrow gage cars for a 30-mile road in Cuba.

The New York, Ontario & Western has ordered for immediate delivery 50 Hart convertible cars from the Rodger Ballast Car Company.

The Colorado & Southern has ordered 50 standard Hart convertible cars from the Rodger Ballast Car Co., and will shortly place an order for 33 passenger cars with the Pullman Co.

The South Manchuria Railway will shortly be in the market for a large number of cars. The contracts will probably be placed through one or more of the following firms having offices in New York: Mitsui & Co., Takata & Co., Frazar & Sale, and Okura & Company.

The National Railroad of Mexico has ordered 400 wooden box cars, 50 wooden flat cars and 50 wooden stock cars, all of 80,000 lbs. capacity, from the American Car & Foundry Co.; and 200 Otis steel underframe dump gondola cars of 100,000 lbs. capacity from the National Dump Car Co., to be built by the American Car & Foundry Co.

The Mexican International has ordered 200 wooden box cars, 50 wooden flat cars and 50 wooden stock cars, all of 80,000 lbs.

capacity, from the American Car & Foundry Co.; and 300 Otis steel underframe dump gondola cars of 100,000 lbs. capacity from the National Dump Car Co., to be built by the American Car & Foundry Co.

The East St. Louis & Suburban has ordered 200 wooden gondola cars of 80,000 lbs. capacity from the Inter-State Car Co., for September delivery. These cars will weigh 31,000 lbs., and measure 35 ft. 7 in. long, 9 ft. 4 in. wide and 3 ft. 6¾ in. high, inside measurements. The special equipment includes:

Bolsters	American Steel Foundries
Brake-beams	Damascus
Brakes	Westinghouse
Couplers	Climax
Draft rigging	Miner
Journal boxes	Symington
Springs	Railway Steel Spring Co.

The Delaware & Hudson, as reported in our issue of January 11, has ordered 1,500 steel underframe box cars, 1,500 steel underframe hopper cars, and 1,000 steel underframe flat cars with coal sides, from the American Car & Foundry Co. The box cars will be of 60,000 lbs. capacity, 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The hopper cars will be of 85,000 lbs. capacity, 32 ft. long inside and 8 ft. 11 in. wide inside. The flat cars will be of 85,000 lbs. capacity, 34 ft. 2¼ in. long and 9 ft. 4 in. wide. The special equipment for all cars includes:

Axles	Cambria
Brake-beams	Damascus
Brake-shoes	Diamond "S"
Brakes	New York
Draft rigging	Miner

The Atchison, Topeka & Santa Fe has increased a recent order with the National Dump Car Co. for 500 combination stock and coke cars to 2,500 steel underframe Caswell stock and coke cars of 80,000 lbs. capacity, delivery from May to August. These cars will weigh about 46,500 lbs., and will measure 40 ft. long, 8 ft. 8 in. wide and 8 ft. high, inside measurements. The special equipment includes the following:

Brake-beams	Kewanee
Brake-shoes	Am. Brake Shoe & Fdy.
Brakes	Westinghouse
Brasses	Hewitt
Couplers	Janney
Draft rigging	Miner
Dust guards	Soule
Journal boxes	Franklin
Springs	Simplex
Wheels	American Car & Foundry

The Great Northern, as reported in our issue of January 18, has ordered 500 steel hopper cars of 100,000 lbs. capacity, and 30 express refrigerator cars of 40,000 lbs. capacity, from the American Car & Foundry Company, for June delivery. The hopper cars will weigh 29,000 lbs. and measure 23 ft. 9 in. long, 8 ft. 11 in. wide over all, and 9 ft. 5⅝ in. high from rail to top of side. The refrigerator cars will be 35 ft. 7½ in. long inside clear of ice box, 8 ft. 11 in. wide and 7 ft. 11 in. high, inside measurement. The special equipment for both includes the following:

	Hopper cars.	Refrigerator cars.
Bolsters	Commonwealth	Commonwealth.
Brake-beams	Haskell & Barker	National Hollow.
Couplers	Tower	Tower.
Door fastenings		La Flare.
Draft rigging	Farlow	Haskell & Barker.
Dust guards	Harrison	Harrison.
Paint		Flood & Conklin.
Springs	Simplex	Simplex.
Trucks	Andrews	

The Chicago, Milwaukee & St. Paul, as reported in our issue of January 18, is building 1,000 Haskell & Barker ballast cars of 80,000 lbs. capacity at its Milwaukee shops. These will be followed by 1,000 standard stock cars of 60,000 lbs. capacity, to be followed by 1,000 steel underframe box cars of 80,000 lbs. capacity. The ballast cars will weigh 33,500 lbs. and will be 37 ft. 5 in. long, 8 ft. 6 in. wide and 3 ft. high, inside measurements. The stock cars will weigh 20,300 lbs., and will measure 36 ft. 1¾ in. long, 8 ft. 6¾ in. wide and 7 ft. 5¼ in. high, inside measurements. The box cars will be 41 ft. long, 8 ft. 6 in. wide and 8 ft. 8½ in. high, inside measurements. The special equipment includes the following:

	Box.	Ballast.	Stock.
Bolsters	Bettendorf		
Brake-shoes	Congdon	Congdon	Congdon
Brasses	Hewitt	Hewitt	Hewitt
Couplers	Major	Major	Major
Doors	Security		
Door fastenings	Western	Haskell & Barker	Climax
Draft rigging	Westinghouse	Miner.	Hennessey.
Roofs	Chicago Improved		
	Winslow.		
Trucks	Bettendorf	Bettendorf	Diamond

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Black Mountain.—Contracts have been given by this company to the Callahan Construction Company, of Knoxville, Tenn., for building from Pennington Junction, Va., to Imboden, 17½ miles; also for spurs to coal mines, 5½ miles. E. S. Fraser, Chief Engineer, Bristol, Tenn. (See Construction Record.)

Buffalo & Lake Erie Traction.—This new company is a consolidation of the Buffalo, Dunkirk & Western, the Lake Erie Electric Traction, and the Dunkirk & Fredonia, previously consolidated with the Hamburg Railway and later consolidated with the Erie Rapid Transit Company. Plans are being made by the new company to complete an electric line from Buffalo to Erie, Pa. Joseph B. Mayer, of New York, is President.

Buffalo Creek & Gauley.—This company, which built three miles of road last year in West Virginia, is about to let contracts for an extension of two miles. The company has projected an additional 37 miles, for which surveys have been made from the present end of track to Camden-on-Gauley. Address William D. Janney, Clay, W. Va. (See Construction Record.)

Burbs Ferry, Browndel & Chester.—An officer writes that this company, which last year completed about eight miles of road in Texas is making surveys for building an extension from Aldridge, Tex., east to Browndel, 20 miles. A. A. Brooks, Auditor, Houston, Tex. (Nov. 30, p. 152.)

Duluth, Rainy Lake & Winnipeg.—This road now runs from Virginia, Minn., northwest to the Canadian boundary at Rainier, where connection is made with the Canadian Northern. At its southern terminus connection is made with the Duluth, Missabe & Northern and the Duluth & Iron Range. The road now has 100 miles of main line and 60 miles of branches, spurs and sidings, with terminals, forming with its connections the shortest route by 80 miles between Duluth and Winnipeg. It will have a large tonnage of lumber.

Eastern Sierra & Pacific.—This company, recently incorporated under the name of the Sierra Pacific, has consolidated with two other companies and has increased its capital stock from $5,000,000 to $15,000,000. Construction work is to begin near Walker Pass, Cal., from which place the main line is to be built to San Luis Obispo. The work will be let in sections of about 40 miles each. The officers of the consolidated company are: Otto Bashore, President, Porterville, Cal; C. B. Reas, Second Vice-President, of Success; George D. Avery, Secretary; J. W. Davis, Treasurer, and G. B. Mitchell, General Manager, all of Porterville. (Nov. 23, p. 146.)

Galveston Terminal Company.—President Sweeney, of this company, and Vice-President and General Manager of the Trinity & Brazos Valley, is quoted as saying that work on extensive terminals for the Yoakum roads in Galveston will soon be started. The company owns 14 blocks of land in Galveston which will be used as a site for the proposed terminals. In addition the Rock Island has water front property, which is to be improved for the joint use of that company and the Frisco, and will form part of the extensive port improvements. The plans call for the expenditure of about $1,000,000 by the Galveston Terminal Company.

Geneva, Phelps & Newark (Electric).—This company was recently granted a certificate of necessity to build an electric line from Geneva, Ontario County, N. Y., north through Phelps, to Newark, Wayne County, 15 miles.

Grand Trunk.—Application, it is said, is being made by this company for permission to build a new line from Port Union along the shore of Lake Ontario into Toronto, about 20 miles.

Greenwich & Johnsonville.—An officer writes that an extension is to be built by the company's men from Greenwich, N. Y., to Salem, 12 miles. A. A. Parker is Superintendent of Construction.

Gulf, Brownwood & Cisco.—An officer writes that this company expects to build during 1907 a line from Brownwood, Tex., to Cisco, 50 miles. Address G. H. Connell, Fort Worth, Tex.

Gulf, Colorado & Santa Fe.—Contracts have been given to the Grigsby Construction Company, of De Ridder, La., for extending the Jasper & Eastern from Cravens, La., to Oakdale, 25 miles.

Harbor Springs.—Surveys are being made for an extension from Indian Garden, Mich., to Dutch Church, two miles.

Indianapolis, Chicago & Logansport.—An officer writes that work is to be started early this year. Surveys have been made and rights of way secured from Indianapolis, Ind., north to Logansport, about 80 miles. Walter A. Osmer, Chief Engineer, Logansport, Ind.

Jasper & Eastern.—See Gulf, Colorado & Santa Fe.

Johnson City Southern.—See Southern.

Mexican National.—It is reported in Mexico City, that this company will build its extension to the Port of Tuxpan, Mex., 156 miles, this year. Surveys are now being made, and grading is to be started this month. The work includes a number of tunnels and several drawbridges. It is said that the Government will also make extensive improvements at Tuxpan to make that place a deepwater harbor.

New London & East Lyme Street Railway.—Application will

be made to the Connecticut Legislature for permission to extend this road from Niantic to the Connecticut river.

NEW YORK, NEW HAVEN & HARTFORD.—The contract for six-tracking the Harlem River branch of this road from Harlem river to New Rochelle, N. Y., previously let to the New York Contracting & Trucking Co., has been let to Daly & Holbrook.

NORTH NEW MEXICO & GULF.—This company is building a line from Espanola, N. Mex., to Abiquin, 25 miles, and is making surveys for an additional 10 miles from Abiquin. (See Construction Record.)

PHILIPSBURG RAILROAD.—Incorporated in Pennsylvania with $250,000 capital to build from Chester Hill, Pa., to Jaynesville, 18 miles. David F. Kreb, Clearfield, is President.

PITTSBURG & LAKE ERIE.—According to reports from Pittsburg, this road is to be extended from Youngstown, Ohio, to Cleveland, 70 miles. The road at present runs from Pittsburg, Pa., to Youngstown, Ohio, 68 miles, from which point it uses the tracks of the Erie to Cleveland.

RICHMOND & CHESAPEAKE BAY (ELECTRIC).—An officer writes that this company has completed nine miles of its proposed line from Richmond, Va., north to Ashland, and that work is under way on the remaining six miles. The company has projected an extension from the proposed northern terminus at Ashland to Toppohannock, an additional 42 miles.

ROGERS SOUTHWESTERN.—This company, which last year built 22 miles of road in Arkansas from Rogers to Springtown, has given contracts to the W. R. Felker Construction Co., of Rogers, Ark., for extending its road from Springtown, Ark., to Siloam Springs, 10 miles.

ST. LOUIS & SAN FRANCISCO.—Plans are being made for building a line from Paris, Tex., to a connection with the Trinity & Brazos Valley at a point south of Palestine, and surveys have been completed. This is thought to be a project of the Frisco, to give a direct connection from its Paris-St. Louis lines to the Trinity & Brazos Valley, which is controlled jointly by the Colorado & Southern and the Rock Island Company.

ST. LOUIS, VANDALIA, TERRE HAUTE & EASTERN TRACTION.—An officer writes that this proposed electric line has been surveyed from Terre Haute, Ill., to Dexter, 80 miles, and will soon be transferred to a new company. P. Chase, Decatur, Ill., is interested.

SAVANNAH, AUGUSTA & NORTHERN.—Incorporated in Georgia with $8,000,000 capital to build from Savannah, Ga., to Rossville, on the Georgia-Tennessee state line south of Chattanooga. The names of the incorporators are not given.

SIERRA PACIFIC.—See Eastern Sierra & Pacific.

SOUTHERN.—An officer writes that work has been suspended on the Johnson City Southern, projected from Marion, N. C., to Johnson City, 80 miles. Part of the grading is finished.

TRINITY & BRAZOS VALLEY.—The following announcement has been issued in regard to the new lines under construction:

> Portions of the new line are still under construction, but we now expect to open the line between Fort Worth and Houston on January 28, 1907, when local daylight passenger service will be begun in each direction between those terminals. A couple of months later we expect to open the Dallas division, when similar service will be established between Dallas and Houston in each direction. It is the intention to thoroughly ballast the new roadbed and get the track in perfect condition for quick and punctual schedules before inaugurating through sleeping car and coach service on night trains between Fort Worth, Dallas and Houston and Galveston in both directions, and the general interchange of through passenger traffic with connecting lines. The ballasting and surfacing of the new track will require several months yet.

UTICA SOUTHERN (ELECTRIC).—This company has been incorporated in New York with $600,000 capital to build 26 miles of electric road in Oneida and Madison Counties, New York. The directors include M. W. Terry, of Waterville; F. K. Baxter, of Utica, and W. M. West, of Hamilton.

VIRGINIA & SOUTHWESTERN.—Contracts let to the Callahan Construction Co., of Knoxville, Tenn., for extending this road from Moccasin Gap, Va., to Persia, Tenn., 37½ miles. E. S. Fraser, Bristol, Tenn., is interested.

WASHINGTON, WESTMINSTER & GETTYSBURG.—An officer writes that this company has made a contract with Ira Taylor, 20 Broad street, New York, for building its line from Washington, Va., northeast to Gettysburg, Pa., 90 miles. I. B. Colegram, President, Sterling, Va.

WESTERN PACIFIC.—The land department of the Central Pacific has announced that an agreement has been made by which the Central Pacific is to sell a right of way 280 miles long through Nevada to the Western Pacific, disputes to be settled by arbitration. This right of way is mostly on land granted to the Central Pacific by the United States Government. Following is an official statement of the present progress of the Western Pacific construction work:

> Of the 122 miles of the road in Utah over 100 miles have been completed and construction trains are being operated. The property for the terminals in Salt Lake City has been purchased and work upon the building will soon commence. In Nevada the eastern 101 miles have been let by contract and work proceeds. The remaining 326 miles will be let in December. In California the entire 280 miles have been under contract for a year and 120 miles of grading have been finished at various parts.

YOUNGSTOWN & OHIO RIVER.—Contracts let to Cleveland Construction Co., of Salem, Ohio, for extending this road from Leetonia, Ohio, to West Point, 14 miles, and from Washington, Ohio, to Leetonia, 1½ miles. The road is projected from West Point to East Liverpool an additional 16 miles.

YREKA RAILWAY.—An officer writes that this company is making preliminary surveys for an extension from Yreka, Cal., to Etna, 40 miles.

RAILROAD CORPORATION NEWS.

ASTORIA & COLUMBIA RIVER.—It is reported from Portland, Ore., that this 110-mile road has been sold to the Hill interests at a price said to be about $5,000,000.

ATCHISON, TOPEKA & SANTA FE.—In explanation to the Kansas Railroad Commissioners of the uses which the company is to make of its proposed issue of $98,000,000 bonds or stock, officers of the Santa Fe stated that the company is planning to finish the double track from Kansas City to Chicago, and ballast about 400 miles of track in Kansas. A block-signal system is to be put in on the double-track lines in Kansas, from Kansas City to Newton, counting the Ottawa cut-off as a part of the double-track system in Kansas. One of the plans now under way is a cut-off from Texico, N. Mex., to Brownwood, Texas. This is to be about 300 miles long, connecting with the Panhandle branch of the system, and when trains are started over the Belen cut-off all freight from California for southern points or for export for Galveston will be diverted over this route instead of being sent around by Newton, Kansas. The survey for the new line has been made and the company expects to begin construction in a short time.

ATLANTIC COAST LINE.—This company has sold $4,500,000 4 per cent. serial one to ten-year car trust certificates to Brown Brothers & Company.

BALTIMORE & OHIO.—Gross earnings for the six months ended December 31, 1906, were $41,771,197, an increase of $3,160,789 over 1905. Net earnings were $14,943,093, a gain of $755,353.

BENNINGTON & NORTH ADAMS (ELECTRIC).—The Bennington & Hoosic Valley, an electric road which runs from Bennington, Vt., to Hoosic Falls, control of which was recently bought by the Consolidated Railway, was on January 9 consolidated with the Bennington & North Adams Electric Railroad, the new company having $650,000 capital stock, and Charles S. Mellen, President of the New York, New Haven & Hartford being President. An extension to Troy, N. Y., is reported to be under consideration.

CAPE BRETON COAL, IRON & RAILWAY COMPANY.—This company, which operates 31 miles of road in Nova Scotia, has defaulted interest on its bonds.

CHICAGO & ALTON.—An issue of $6,000,000 five-year 5 per cent. notes dated January 1, 1907, has been made. Of this issue $5,250,000 is to be used for refunding notes maturing next July, and $750,000 has been sold to Speyer & Company.

CHICAGO & WESTERN INDIANA.—An issue of $5,000,000, three-year 5 per cent. guaranteed, collateral trust notes has been sold. The funds thus obtained cost the road about 7 per cent. Part of the money is probably needed to cover expenditures for track elevation, which have been heavy during recent years. These notes are being offered at 98 and interest, yielding 5¾ per cent.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—Gross earnings for the year ended December 31, 1906, were $24,594,900, a gain of over $2,000,000 over 1905; expenses increased $1,500,000, leaving a gain of $5,504,000 in net earnings. The surplus over dividend requirements (5 per cent. on the preferred and 4 per cent. on the common stock) was $79,800, an increase of $38,300 over 1905.

CONSOLIDATED RAILWAY.—See Bennington & North Adams.

ERIE.—Application has been made to list $12,000,000 additional general mortgage 4 per cent. bonds of 1953, series B, on the New York Stock Exchange.

EVANSVILLE & SOUTHERN INDIANA TRACTION.—The Evansville & Southern Indiana Traction Company, recently incorporated with $4,500,000 capital stock, has taken over the Evansville, Princeton & Vincennes and the Evansville Electric Railway. The Northern Indiana Railway of South Bend, Ind., is reported to

have been acquired in the interest of those in control of the new company.

Fort Dodge, Des Moines & Southern (Electric).—See Newton & Northwestern.

George's Creek & Cumberland.—See Western Maryland.

Great Northern.—The Great Northern was on January 23 temporarily enjoined from making its new issue of $60,000,000 stock.

Macon, Dublin & Savannah.—This company, recently bought by the Seaboard Air Line, has filed a mortgage securing $1,840,000 5 per cent. bonds.

Minneapolis, St. Paul & Sault Ste. Marie.—A recent estimate of earnings published by this company reflects clearly the recent difficulties of railroad operation in the Northwest. Although gross earnings for the six months and two weeks from July 1, 1906, to January 14, 1907, increased 8 per cent., estimated earnings for the first two weeks of January decreased 22½ per cent., and for the week ended January 14 decreased from $217,952 in 1906 to $145,986 in 1907, a falling off of 33 per cent., or approximately one-third.

Newton & Northwestern.—This steam railroad, operating 102 miles of line between Newton, Iowa, and Rockwell City, has made an arrangement with the Fort Dodge, Des Moines & Southern (Electric), by which that road is to have trackage rights over 40 miles of the line of the Newton & Northwestern between Gowrie and Kelley, which has been equipped for electric operation.

New York Central Lines.—Gross earnings for the month of December and for the year ended December 31, 1906, are as follows:

December, 1906.

New York Central & Hudson River	$7,752,776.99	Inc.,	$6,636.52
Lake Shore & Michigan Southern	3,562,379.34	Inc.,	13,238.88
Lake Erie & Western	415,053.71	Dec.,	42,187.57
Chicago, Indiana & Southern	234,207.92	Inc.,	48,327.57
New York, Chicago & St. Louis	930,711.18	Inc.,	48,463.57
Michigan Central	2,311,321.27	Inc.,	285,189.54
Cleve., Cin., Chicago & St. Louis	2,160,739.10	Inc.,	127,723.38
Peoria & Western	269,017.57	Dec.,	33,416.21
Cincinnati Northern	82,624.63	Inc.,	7,949.00
Pittsburg & Lake Erie	1,129,165.09	Inc.,	13,420.85
Rutland	220,007.62	Inc.,	4,760.38

Year Ended Dec. 31, 1906.

New York Central & Hudson River	$92,989,768.77	Inc.,	$5,994,166.75
Lake Shore & Michigan Southern	42,544,378.28	"	3,943,568.68
Lake Erie & Western	5,212,811.80	"	155,516.95
Chicago, Indiana & Southern	2,732,731.74	"	217,687.23
New York, Chicago & St. Louis	9,902,208.97	"	795,478.97
Michigan Central	26,275,588.13	"	2,991,719.89
Cleve., Cin., Chicago & St. Louis	24,594,915.82	"	2,077,152.56
Peoria & Western	3,059,281.28	"	98,554.06
Cincinnati Northern	1,027,728.00	"	180,498.22
Pittsburg & Lake Erie	14,481,495.48	"	1,643,759.65
Rutland	2,799,209.50	"	237,120.74

New York, New Haven & Hartford.—There have been $3,000,000 short term notes recently sold in addition to the $23,000,000 already reported in the *Railroad Gazette*. To this $26,000,000 is to be added $40,000,000, which is to be received as payment for an issue of about $25,000,000 new stock to be offered to shareholders within the next few months at about $150 per share. Of the total $66,000,000 of new funds thus obtained, $21,500,000 will, according to an official statement recently issued, be used for buying new equipment, $4,000,000 for new steamboats, and about $20,000,000 for general requirements of the electric lines in Connecticut, Rhode Island and Massachusetts for extensions, improvements, and, in particular, for new equipment; of the balance of $28,500,000, much is to be used for refunding short term notes maturing in July.

A report from Portland, Me., is to the effect that the New York, New Haven & Hartford, instead of Charles W. Morse, has bought the Maine Steamship Company, which has a line of steamboats running between New York and Portland.

It is reported that the New Haven proposes to spend several million dollars on Boston freight terminals. The Park Square station has been offered to the Boston & Albany at a price said to be $5,000,000.

See Western Massachusetts (Electric).

Northern Pacific.—See Astoria & Columbia River.

Pennsylvania.—The Pennsylvania Railroad has offered to exchange its stock share for share for the common stock of the Philadelphia & Erie which it does not own, or to pay $136 for each $100 par in Philadelphia & Erie stock. The proposal will be submitted to the stockholders of the Philadelphia & Erie at the annual meeting on February 11. There is $7,500,000 common stock, of which the Pennsylvania owns $3,500,000.

Pennsylvania Railroad.—This company has executed 24 leases of $1,000,000 each with the Pennsylvania Rolling Stock Trust and the Pennsylvania Equipment Improvement Trust to provide for new freight equipment to the number of 19,537 cars. The railroad company is to pay one-tenth of the value of the cars each year as rental. The Pennsylvania Freight Equipment Trust, with a capital of $100,000,000, organized last April, has filed articles of incorporation, but has not yet recorded any leases with the Pennsylvania Railroad for new equipment.

Peoria & Pekin Terminal.—This road is to be sold at foreclosure on February 1. It operates 29 miles of line, by steam for freight, and by electricity for passengers, between Peoria and Pekin, Illinois. It is reported that new securities will be issued to take place of the $977,000 bonds on which interest was defaulted last year. It is reported that the new securities will be guaranteed by the Chicago & Alton and the Chicago, Rock Island & Pacific jointly. The Rock Island, it is understood, controls half, and the Alton probably the other half of the $600,000 stock. (Nov. 30, 1906.)

Philadelphia & Erie.—See Pennsylvania.

Pittsburg & Lake Erie.—A special meeting will be held on February 28 to increase the capital stock from $10,000,000 to $30,000,000.

The following table shows the principal statistics of operation for the years ended December 31, 1906 and 1905:

	1906.	1905.
From freight traffic	$13,051,880.22	$11,576,738.21
From passenger traffic	1,287,565.21	1,137,817.33
Total earnings	$14,481,495.48	$12,837,735.83
Expenses of operation	11,193,983.16	9,887,624.14
Net earnings	$3,287,507.32	$2,950,111.69
Per cent. of operation	77.30	77.02

Pittsburg, Cincinnati, Chicago & St. Louis.—Estimated earnings for the year ended December 31, 1906, increased $2,742,446. Against this operating expenses increased $2,213,269, leaving an increase of $529,177 in net earnings. During the month of December net earnings decreased $175,181.

Seaboard Air Line.—A new mortgage has been authorized to secure $18,000,000 bonds, of which about $7,000,000 are to be offered to security holders at 90. A little over $5,000,000 of this amount is for refunding.

Southern.—J. P. Morgan & Co. have bought from the Southern Railway $15,000,000 three-year, 5 per cent. notes, which have all been sold by the bankers at about 97. The funds thus secured probably cost the railroad company between 6½ and 7 per cent., and are being offered to the public to net 6 per cent. on the investment. The proceeds are to be used for general improvements and for new properties previously acquired, expenditures which will ultimately be provided for by the development and general mortgage bonds. Just previous to the announcement of this issue of notes, there was a sharp decline in the market price of the Southern Railway preferred and common stocks.

Toledo & Western (Electric).—This company, which operates 80 miles of line from Toledo to Fayette and Pioneer, with a branch to Adrian, Mich., has been in the hands of a receiver since July 2, 1906. Arrangements have now been made for rehabilitating the company, which is to have $2,000,000 stock and $2,000,000 bonds. Of the bonds $1,250,000 are a first mortgage on the Toledo & Western proper and $250,000 a first mortgage on the Toledo, Fayette & Western, a subsidiary road, controlling 14 miles of the line. The other bonds are second mortgage bonds on the combined properties.

Western Maryland.—The Western Maryland has bought the capital stock of the George's Creek & Cumberland, a coal freight road with about 20 miles of line and 33 miles of track. The George's Creek & Cumberland had a contract under which it delivered most of its freight to the Baltimore & Ohio and the Pennsylvania at Cumberland. This traffic will now go to the Western Maryland. Besides this advantage, the road could be used as part of a connection between the Western Maryland and the Wabash lines. Through the Cumberland Narrows, a narrow gap in the mountains, the Baltimore & Ohio is on one side of the river and the George's Creek & Cumberland is on the other. The Western Maryland secured over 1,000 freight cars as part of the purchase. Of the $1,000,000 capital stock of the acquired railroad the American Coal Company owned 61 per cent., and the rest was mainly held by other coal companies.

Western Massachusetts (Electric).—The management of this road, controlled by the New York, New Haven & Hartford interests, has applied to the Massachusetts Railroad Commission for authority to merge the Western Massachusetts Railway and the Woronco Street Railway through purchase of the Woronco company by the Western Massachusetts by exchange of stock at par.

Wiscasset, Waterville & Farmington Railway.—This company has been incorporated with $100,000 common stock and $200,000 5 per cent. non-cumulative preferred stock, as successor of the Wiscasset, Waterville & Farmington *Railroad* sold at foreclosure on December 4, 1906.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:

Wholesale Electrification 131
Paying Attention to Belts 131
Railroad Taxation 132
Short-Term Notes Again 132
Comparative Use of Working Statistics in Two Countries 132
December Accidents 134

ILLUSTRATED:

A New Method of Car Recording at Local Stations 136
Balanced Pacific Type Locomotive for the National of Mexico 140
Atmospheric Railroad Traction 144
Four-Cylinder Compound Locomotive for the Italian State Railroads 147
The Teredo in South Africa 151

MISCELLANEOUS:

Substitution of the Electric Motor for the Steam Locomotive 134
First Report of the Interstate Commerce Commission on the Coal Traffic 137
Harriman and Hill Operating Methods Compared 141
Watching Freight Traffic by Daily Returns 142
Shortage of Cars in Germany 144
Train Accidents in the U. S. in December 145
The Protected Third-Rail on the Milan-Varese Railroad 151
Interurban Freight and Express 154
Foreign Railroad Notes 145
Growth of Traffic in Germany 141
New French Coal Tariff 154

GENERAL NEWS SECTION:

Notes 155
Trade Catalogues 159
Obituary 160
Meetings and Announcements 160
Elections and Appointments 160
Locomotive Building 161
Car Building 161
Railroad Structures 162
Railroad Construction 162
Railroad Corporation News 163

VOL. XLII., No. 5. FRIDAY, FEBRUARY 1, 1907.

It would seem to a listener, last week at the American Institute of Electrical Engineers, to the interesting paper, "The Electrification of Steam Railways," and the discussion on the paper, which is printed in this issue, that the days of the steam locomotive are quickly to be numbered. During this one evening the discussion centered solely on the comparative amount of economy and good service to be got by electric traction, not alone in special cases where conditions require the elimination of products of combusion, or where additional economies can be had by the elimination of any type of locomotive and the use of motor cars. It seemed to be assumed that the substitution of electric for steam power on all railroads is economical. The authors and speakers went far beyond calculations for specific installations and entered the comprehensive field of the entire railroad mileage of the United States, from which they drew staggering totals. It seemed to be apparent that if the railroads would only make haste to get 2½ billions of new capital they could save 250 millions each year in operating expenses. We have before quoted the statement at the International Railway Congress made by Mr. Aspinall, of the Lancashire & Yorkshire Railway in England, to the effect that he did not electrify his Liverpool & Southport line for the purpose of saving money, but that it was in the hope of making money—at a high traction cost. His statement has been confirmed in his own experience and by many other experiences. Moreover, 2½ billion dollars is something like 30 years' world production of gold at the present rate of output. It is well to remember also that the rough estimate of the capital requirements of the railroads of the United States for the next five years is something like a billion dollars a year, in order to provide track, yards, cars, signals and the other necessary appliances for making transportation keep pace with the growing industries. It is not intended in calling attention to these costs to in any way dampen the enthusiasm of electrical engineers; it is rather to suggest that they continue to go ahead as they have done so rapidly during the past 10 years in finding the safest and most reliable methods of using electricity for heavy traction without diverting their attention to the larger problems which require a knowledge of a different set of facts. It has been said before this that the person who has observed but a few facts can make up his mind with great definiteness. A child who pressed her nose against the window pane reported her observations and deductions as follows: "The ash man is coming; he has stopped in front of our house; he has picked up something from the gutter; O! mamma, he has thrown in the ash heap a perfectly good cat!"

A reduction from $1,000 to $250 a month in the cost of belt maintenance for a single large railroad shop plant, and of over 80 per cent. in the monthly average number of belt failures, is a noteworthy achievement in shop betterment; for besides the saving on the belting, which alone is a substantial annual item, the improved operating efficiency due to better belt conditions, and the cutting down of time lost by machines from belt failures, means an additional and much greater saving, which reduced to dollars would make a most respectable sum. The figures given last week represent an actual performance—the shops being those of the Atchison, Topeka & Santa Fe at Topeka—and the figure for the present monthly maintenance cost represents not an isolated month's performance but the average for 12 months. Of course, the practice prior to the application of the improved methods was admittedly bad and extravagant, though probably representative of the practice obtaining in the average similar plant throughout the country. Ignorance or disregard of right principles—comparatively few and simple though they be—was characteristic of the belting installations and maintenance in far too many such shops, and still is to a much greater extent than it should be, though modern methods recognize the importance of maximum efficiency in this regard. In view of the excellent results obtained at Topeka, and believing a detailed presentation of the methods in vogue there would be of interest and value to all who have to do with belting in any capacity, we printed in our issue of Jan. 25 a copy of the rigid specifications covering the supply of this material to the Santa Fe, and the rules and instructions issued to repairmen for its installation and maintenance. As mentioned in the articles published several weeks ago describing the Santa Fe shop betterment work, the results obtained in revising the belting system and methods at the Topeka shops were secured by the use of the best quality of material only, and by entrusting its installation and maintenance during the transition period to a specialist whose primary object was to *prevent* failures, not remedy them. The cost

of maintaining belts, including material, labor and supplies, should average yearly about 14 per cent. of the first cost, as illustrated by the diagram published in the articles above referred to. This figure has just about been attained at Topeka, furnishing practical proof of the high efficiency of the methods there used.

American railroads in the various States of the Union have been the objects of about every kind of taxation known to civilized man. There has been local taxation and state taxation, taxation of stock, of bonds, of revenue, gross and net, mixed taxation, with some forms of railroad property under local purview, and others under state purview. In some states the municipality or other taxing district collects the tax directly, in other states the state itself collects either for the state treasury or for local redistribution. Amid all these multiplied and hybrid forms of impost, legislation by a number of states to shift the burden of taxation to the railroads has led to the strong impression that general railroad taxation has increased. But the recent comparative returns of all the railroad corporations of the country for the fiscal year ended June 30, 1905, show no such increase. As compared with 1904, mileage in single track rose from 293,937 to 301,331; capital stock from $6,447,045,374 to $6,741,956,825; bonded debt from $7,462,091,455 to $7,821,243,106; gross earnings from $1,977,638,713 to $2,112,197,770, and net earnings from operation from $639,240,027 to $685,464,488; yet taxes remained almost stationary at $54,325,856 in 1904, as compared with $54,553,620 in 1905. It is even more expressive if we compare this practical equation of taxes with a rise of railroad dividends on stock from $188,386,093 in 1904 to $193,753,869 in 1905, or nearly 4 per cent. But a showing, which seems on the face of the returns anomalous, is much less so when analyzed and qualified. The figures go back to actual periods of assessment two and three years ago, and recede to a time antedating considerably the later legislation taxing railroads more heavily. Undoubtedly, also, the railroads in some commonwealths during the periods referred to profited by the general prosperity which, especially with the decrease or extinction of state debts, has lowered the state tax rate. Obviously the time for real comparison will be the two years hence when the railroad taxation of 1907 can be compared with 1906 or earlier. We shall then obtain some instructive figures throwing sidelights not only on the size and results of the new railroad taxation movement, but also on the relative values, civic, economic and corporate, of the various systems, for example, the "realty tax" scheme on the one hand and stock and debt or earning power plans on the other. As now, so then, it will be difficult, if not impossible, to go much into local details of the tangled systems and methods of the many states which have given us the striking tax equation of 1904 and 1905. But we have little doubt that results will indicate that the general scheme of taxing stock on a sliding scale of market values and of taxing debt, including bonds, on more fixed valuations at or near par, will prove to be, on the whole, the system most practical and fair.

SHORT-TERM NOTES AGAIN.

These are hard times for railroads which need money; and this, it appears, is only another way of saying for all railroads. We are experiencing the disadvantages of prosperity. There is so much traffic that the railroads, most of them, cannot anywhere nearly carry it, and even where they are managing to handle it with reasonable satisfaction at present, a new and higher normal level of traffic has been established for which they must provide by increased facilities of every sort—not only cars and locomotives but, as Mr. Hill reiterates, side tracks and terminal facilities. More than this, railroads have been expanding their influence, and consequently their capital needs in other directions during these recent prosperous years. The New York, New Haven & Hartford, for instance, now controls with unimportant exceptions the whole trolley systems of Connecticut and Rhode Island and indirectly a number of valuable electric properties in Massachusetts. The Michigan Central, which is beginning work on the long deferred tunnel under the Detroit river, is another example. New capital is imperatively demanded, but at present, just when the demand is keenest, the possibilities of raising capital in the usual way—by bond issues—are worse than almost ever before. Issues of bonds already outstanding are a drug on the market, and it is out of the question to think of issuing new long-term bonds at the high rates now prevailing which would have to be paid during their life. Railroad companies like those in the Northwest, whose stock sells at a premium, four of which have recently arranged to raise new capital by issues to stockholders at par, have a way open before them, unsatisfactory as it may be under present conditions, since it both seriously lowers the market price of the securities and brings down condemnation from overzealous state officers. The New York, New Haven & Hartford also plans to raise funds in this way, we understand, by an issue of new stock some time in the spring at 150 to holders of its shares and convertible bonds, but it is also adopting another method to meet immediate needs. Within the past month this company has issued $26,000,000 five-year, 5 per cent. notes, which have met a ready sale.

The advantage of financing by notes rather than by bonds under present conditions is clear. Although the road pays well over 5 per cent. for its funds, the charge is not a long-term one. Unless the bond market shows no improvement during the next five years, it will be possible to refund these notes at a lower rate. Other companies are also adopting this way around pressing money needs in an unresponsive market. The Boston & Maine has sold $3,000,000 short-term notes and the Chicago & Alton has made an issue of $6,000,000, most of which, it is worth noting, are to refund similar short-term notes, thus showing that the company has been disappointed in the fact that there is not yet a better market for bonds. A month ago the Erie sold the last $1,000,000 of an issue of $7,000,000 six months 6 per cent. notes. The Chicago & Western Indiana has issued $5,000,000 notes, for which it pays nearly 7 per cent., and the Southern Railway, which last year drew up a $200,000,000 development and general mortgage, securing 5 per cent. bonds, has been compelled, instead of selling these bonds, to make an issue of $15,000,000 5 per cent. notes, which were sold at such a price that the money costs this company also nearly 7 per cent. Largest of all the note issues was the sale announced last Saturday of $50,000,000 5 per cent. three-year notes by three of the New York Central Lines—$25,000,000 by the New York Central, $15,000,000 by the Lake Shore and $10,000,000 by the Michigan Central.

Issuing short-term notes in a bad bond market is not a new device. It was much used in 1903 to tide over the necessities of a period when bonds could not be sold, and was at that time in the main successful. In 1904 and 1905 it was possible to refund the notes with long-term bonds sold at an advantageous price. As things stand to-day the railroads are for the moment in a tight place. Their need for money is as much greater than in 1903 as the traffic of the last two years is than the traffic of 1902 and 1903. Now, too, the railroads are being attacked right and left for failure to properly perform their duties to the public. In order to give the service which is demanded they must have new funds; the necessities of expansion caused by the tremendous growth of traffic cannot be met out of earnings. But those who could supply these funds are frightened away by this very clamor of attack against the roads. Thus the same facts which make it necessary for the railroads to secure funds make it next to impossible for them to do so. There is no doubt but that this condition of affairs is partly the railroads' own fault. The present hostility to corporations has not come upon us by chance or without just causes of complaint behind it. There has been injustice and, more important than that in causing dissatisfaction, misunderstanding, which the railroads have in general not taken the trouble to clear up. As the case stands to-day frank statements by those in authority, like that of Mr. Finley published last week, of the needs of the roads and the reasons for these needs, are necessary to bring the public into the market for railroad stocks and bonds.

COMPARATIVE USE OF WORKING STATISTICS IN TWO COUNTRIES.

To compare the respective use made of actual working statistics (not public statistics) in Great Britain and America, there is presented in this issue an incomplete but, we believe, sufficiently indicative description of the methods in use on one important British railroad and one important American railroad.

In comparing these two it will probably occur to the reader, as it does to us, that on a skilfully managed road, the average length of haul, which is about six times as long in America as it is in Great Britain, is not a condition to be so seriously considered as is commonly believed. The terminal cost is the constant and the length of haul is the variable. The terminal cost can be watched, and to some extent reduced, both by observation and by statistics, as is clearly shown by the article on British railroads. On the other

hand, the variable cost of hauling is directly in proportion to the mileage, and, as appears from both the English and American descriptions, statistics only can give the operating officer the information he wants.

There is one generally prevailing difference in condition between British and American working, and this is that in America an overwhelming proportion of the smaller parcels is carried by express companies, which contract with the railroad companies for haulage on cars adapted for the purpose attached to passenger trains, while in England a comparatively small porportion of this traffic is carried in the passenger vans. The result is that American merchandise freight trains move at a slower and an economic speed, while British goods trains move at something like passenger train speed. Perishable freight, fish, fruits and the like, are moved swiftly in England and moved comparatively slowly in America. The slower movement is made possible by the use of refrigerator cars. The swift movement of goods trains in England seems to be due primarily to the fact that dealers do not keep large stocks of goods on hand, and rely on the use of letters or telegrams, with the result of having their needs met by a fulfilment of their orders early the following morning. This custom has the result that the British railroad company practically furnishes capital to the provincial manufacturer and dealer (on which the manufacturer pays interest in the form of high rates), for the handling of small parcels and conveyance at high speed enormously increases the cost of transportation. There is one other reason for this costly high speed of goods trains. The density of traffic on most British lines is such that in order to do their work the trains must not occupy the line any longer than is necessary. The cost of hauling passenger trains in England and in America is quite alike, while the enormously increased comparative cost of high-speed freight in England consists largely of a contribution to the capital of the trader and the manufacturer.

The reading of the two articles referred to is suggestive in several other respects. It is shown that at least on this one British railroad, the daily statistical returns of car loading and train loading aim to secure, and do secure, quite as quickly and as efficiently as in America, the information needed in order to secure full loading and to prevent the waste of movement by special trains; but we note this difference, that the British divisional officer is limited in his train loading by the power of an engine furnished to him by an entirely independent department. Neither the district superintendent, nor the general superintendent, nor the goods manager may ask for and get, except within narrow limits, the kind of engine which he knows, from his own study of the art of making money by selling transportation, will be most efficient or economical for that purpose. On the other hand, the American operating officers are the ones who decide, not on the design of the engine, but upon its capacity; that can ask for and get engines of prescribed drawbar pull, or of certain maintained speeds hauling certain loads, and the superintendent of motive power furnishes this in his own way. That is to say, he is bound to furnish to that department of the road which earns money a machine capable of doing what it wants. This statement is only partially true. It is the result of the divisional organization, and also of a mixture of departmental and divisional organizations, which obtains quite generally among the best managed American roads, as against a characteristically departmental organization in Great Britain.

It is apparent that the cartage and delivery system adds much to the work of the division officer, but it has distinct advantages. Having control of the whole movement, from the shipper to the receiver, the carting to the receiving platforms can be made much more uniform and, due to this, the goods can be handled at the receiving stations with economy. The idle time of the laborers on the platform is reduced by as much as this receipt of goods is uniform. At the receiving stations the company can make deliveries with like uniformity and avoid congestion such as frequently occurs in American freight stations. This is a subject which is now being studied rather carefully here by a few companies, with a view to its adoption.

On the other hand, the company carting and receiving system is said to have a distinct disadvantage. When manufacturers and traders did their own carting they sent their carts to the station as fully loaded as possible, the inducement being economy in carting. When the company's carts call for goods, the manufacturer or trader delivers his parcels as fast as they are ready for shipment and necessarily in smaller lots. His inducement is to get them out of his way as fast as possible. This is said to tend toward lower wagon loading, at least it makes full wagon loading somewhat more difficult and often increases the number of entries in an invoice, and to some extent separates into different wagons consignments to the same station, for in the hurry of handling goods on the platform, and in the undertaking to secure full loading, full loads to each destination become difficult.

In the northern United States and in Canada the climatic conditions are entirely different from those in Great Britain, where changes in temperature are comparatively slight, and, moreover, the methods of drainage have been brought to such a state of perfection as to be the cause of admiration by all visiting engineers. On the other hand, fogs, with their dangers, delays and costs, are rare in America and common in Great Britain.

Another physical limiting condition which has an important bearing on the use of heavier engines and larger capacity cars in Great Britain, is the limits due to the loading gage. It is not, however, believable that engine power and wagon capacity have yet been developed up to the point where the loading gage interferes and prevents increase.

Another variant in the condition is due to the relative proportion of revenue derived from freight trains and from passenger trains. In America the passenger revenue is comparatively small. We know of no road of any importance whose passenger revenue equals its freight revenue. This varies, too, largely on English roads. For example, on the London & South-Western only about one-fourth of the revenue is from freight, while on the North-Eastern it is nearly equally divided between goods, minerals and passengers.

The length of haul has already been referred to. Considered by itself this should not be a reason why larger vehicles with larger loads and greater power, together with a shortening of the length of trains, should not be proportionately as profitable on the short haul as on the long haul. But the case cannot be entirely considered by itself. Less than car load lots to one destination are more costly to handle than full car load lots to one destination. So that large cars may prove to be economical only partially in goods traffic, with an increasing economy in mineral traffic, as fast as the receivers can be either coaxed or compelled to provide storage for larger quantities.

The customs and prejudices of the people who travel have to be recognized as a fact to be dealt with, and this to a considerable extent prevents the economic handling of other than third class passengers.

It would seem from this brief review of some of the more salient differences in conditions that a daily, accurate knowledge by the division officer, involving statistical reports, such as have been described in the two articles in this issue, is quite as applicable and quite as necessary for economic working in the one country as it is in the other. The basis of economy in freight transportation is in full wagon loading, and the use of wagons of as large capacity as is adaptable to the business. As the wagon has larger capacity, the train with the same tonnage becomes shorter, and is moved with less power.

Yard work, the receiving, breaking up and marshalling of trains is notoriously a widely differing cost, not only in the yards of one railroad as compared with another, but also in different yards on the same road. A competent and economical yardmaster is indeed a great man. Among the forms described as being in use on this one British road, the most novel and perhaps the most profitable one is that which shows the number of wagons handled, the number of hours occupied by engines and horses, and the average number of minutes per wagon occupied in shunting by engines, horses and different kinds of employees. We know of no statistical return, either in England or in America, comparable with this one for securing economy in that part of the work where so much money is wasted.

To one who has had the opportunity to examine and study the daily, weekly and monthly statistical returns described in these two articles, it appears to be true that under widely varying conditions the two methods are not far apart in effectiveness in giving information for preventing waste and securing economy and reliability. Nevertheless, we should be inclined to criticise the British statistical forms as being too bulky, that is, there are many forms where, for the insertion of from four to six figures, nearly a square inch is allowed. A condensed return has somewhat the effect of a graphical diagram. It is handy and its meanings can be grasped at once. A comparison of the British and American blank forms shows a distinct difference in this respect. On one set of blank

forms (the round cornered cards referred to in the American description) condensation, small spaces and printing on both sides have great value, for, as one division superintendent in America expressed it, "it enables him to carry everything in his pocket that he does not have in his head."

December Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of December, printed in another column, contains accounts of 35 collisions and 17 derailments. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

	Place.	December	Killed.	Injured.
1.	Vergennes, Vt.	1st	3	30
2.	Frankfort, Ind.	5th	0	47
3.	Annabessacook, Me.	6th	4	3
4.	Danville, Va.	8th	1	4
5.	Batesville, Ark.	11th	0	15
6.	Canton, Ohio.	16th	0	2
7.	Palmyra, N. Y.	17th	0	1
8.	Stonington, Ill.	20th	0	25
9.	Harney, Nev.	22d	0	20
10.	Enderlin, N. Dak.	23d	11	33
11.	Detroit, Minn.	28th	5	0
12.	Terra Cotta, D. C.	30th	43	67

The collision at Vergennes, Vt., on the first is notable as being like the Eddington (Pa.) and Sudbury (Ont.) cases in November—air-brake cock closed. Do such cases multiply by "suggestion"? Or have we had them all along and concealed their true nature? The collision at Danville, Va., on the 8th was made notable by the fact that it occurred near the place where President Samuel Spencer was killed, and served as a reminder to some people that faulty working of the block system is not so infrequent as might appear. The collision at Enderlin, N. Dak., appears to be notable mainly by reason of the number of victims, the cause—so far as can be judged by the particulars given—being commonplace. The Terra Cotta collision has already been reported in previous issues, but it is being investigated by the Interstate Commerce Commission, and will, no doubt, be the subject of a report by that body. Some of the testimony taken at the hearing by the commission was published in the *Railroad Gazette* of January 11.

The number of electric car accidents reported in the newspapers of the United States in the month of December was 12, the number of persons killed was eight, and injured 103.

The butting collision at Woodville, Ind., in November, reported in our summary for that month, is declared by the officers of the road to have been due to the negligence of the engineman of westbound passenger train No. 47, first section. This engineman either did not sound his whistle to indicate to the train on the side track that there was a second section, or he sounded it and got no response. In either case he was culpable, for if no response was heard he should have stopped and given notice to the train on the side track by word of mouth.

Substitution of the Electric Motor for the Steam Locomotive.*

The purpose of the paper is fourfold: 1, to record certain facts relative to heavy electric traction which have been established by experience; 2, to present calculations of relative costs of steam and electric traction in railroad service, based upon these facts; 3, to point out the importance of standardizing electric railroad traction equipment as rapidly as may be consistent with progress, and 4, to raise the question whether a frequency of 25 cycles per second or 15 cycles per second should be adopted for the operation of alternating current railway motors.

The first part of the paper is a fairly complete summary of the arguments in favor of electric traction, little of which is new. The third and fourth sections deal with subjects of little more than academic interest to operating railroad officers at the present time and will not be touched on in this brief summary of the paper. The most valuable and interesting discussion is that dealing with the estimate of the comparative costs of operation with steam and electricity.

The authors adopted the grand average results obtained in operation by steam locomotives upon the existing railroads of the United States, as set forth in the report of Statistics of Railroads for 1904 compiled by the Interstate Commerce Commission, and proof-sheets of the report of the Commission for the year 1905. The classification of operating expenses adopted by the Commission and generally used by the railroad companies in their annual reports is followed and the itemized operating expenses in the case of operation by electricity are compared with corresponding expenses under existing conditions of steam motive power equipment. The estimates are based upon the assumption that single-phase alternating current equipment is used; that the trolley potential is 11,000 volts; that each power-house supplies railroad line to a distance of 150 miles in each direction, the feeder potential employed being 60,000 volts; that the overhead construction is first-class in every respect, and steel bridges and field poles set in concrete being exclusively used for the support of both trolley conductors and feeders.

Maintenance of Way and Structures.

Under the general heading, "Maintenance of Way and Structures" item, "repairs of roadway," if changed at all should show some reduction under conditions of electric operation, but no material change is to be expected. We assume, therefore, that this item, amounting to 10.818 per cent. of total operating expenses, will remain unchanged.

The items, "renewals of rails," "renewals of ties" and "repairs and renewals of bridges and culverts," may be conveniently grouped. In the aggregate, these on the average steam operated railroad amount to 6.33 per cent. of the total cost of operation. If the electric locomotive be substituted for the steam locomotive, it is safe to predict that this group of items of expense will be reduced. They would probably be reduced about one-fourth; in other words, they should approximate 5 per cent. of the total operating expenses. The cost of track maintenance is increased by reason of the electric bonding of the rails. This bonding, including the cost of special bonds necessary where an automatic track signal system is used, will cost about $500 per mile under average conditions. Its cost of inspection and maintenance should not exceed $50 per mile of single track per annum. The annual cost of "renewals of rails," "renewals of ties" and "repairs and renewals of bridges and culverts" averages in the United States $400 per mile of track, which is 6.633 per cent. of average operating expenses under steam operation, and for equal trains, as we have estimated, 5 per cent. for electric operation. The effect of the cost of track-bonding, therefore, would increase the items under consideration by about one-eighth, which is equivalent to an increase of 0.8 per cent. in operating expenses.

Item "repairs and renewals of fences, road crossings, signs and cattle-guards" will not be changed by the adoption of electricity.

Item "repairs and renewals of buildings and fixtures" includes repairs and renewals of engine-houses and shops, also water-tanks and coal-handling apparatus. Under electric operation it is evident that this item would be materially reduced from 2.366 per cent. to about 1.3 per cent. of the total annual operating expenses.

Item "repairs and renewals of docks and wharves" obviously will not be affected.

Item "repairs and renewals of telegraph." It is probable that this item will be somewhat increased in general where electric operation is adopted. The effect upon the operating expenses, however, is so slight as to be practically negligible.

Item "stationery and printing" will not be changed.

Item "other expenses" will not be affected.

Under the general heading "Maintenance of Way Structures" the classified statement of operating expenses of a railroad electrically equipped includes the following items in addition to the foregoing:

a. "Repairs and renewals of track bonding."

This has been referred to and is included in the tabulated statement as a separate item, amounting to 0.8 per cent. of operating expenses.

b. "Repairs and renewals of overhead or third-rail construction."

From detailed calculations of the cost of high-class overhead construction, where two tracks are to be equipped, the cost of overhead construction is, approximately, $10,300 per mile. For single track work, using steel poles and brackets and catenary support, the cost closely approximates $4,800 a mile. Of the total line mileage of the United States in 1905, amounting to 216,974 miles, approximately 0.4 are in double track, including yards and sidings for single track lines, and 0.6 are single track. The grand average cost of overhead steel construction of the type considered, therefore, closely approximates $5,000 per mile of track. The amount which should be allowed for "repairs and renewals of overhead construction" should not exceed $150 per mile of track per annum. This is equivalent to $210 per mile of line per annum, the average ratio of track mileage to line mileage being 1.4 to 1. The increase in operating expenses due to this item is about 3.25 per cent., the average operating expenses per line mile in the United States for the year 1905 being $6,451.

Maintenance of Equipment.

Item "cost of superintendence" will not be changed.

Item "repairs and renewals of locomotives" amounts to 7.509 per cent. of the average operating expenses of our steam railroads. This item does not include the expense of cleaning boiler tubes and packing cylinders, nor ordinary regular inspection, this being charged to the item "engine and roundhouse men." It does include all expenditures for account of repairs and renewals and rebuilding of locomotives, tenders, snow-plows (when attached to locomotives), furniture and loose and movable tools and supplies used in connec-

*Extracts from a paper by L. B. Stillwell and H. St. C. Putnam read at the January meeting of the American Institute of Electrical Engineers.

tion therewith. It also includes the cost of locomotives, tenders and appurtenances thereunto belonging, built or purchased to make good the original number charged to construction or equipment.

As regards repairs and renewals of electric locomotives, actual experience to date is not sufficient to justify us in fixing a figure for this item which can be regarded as established. There is, however, evidence sufficient to justify an estimate which in the average case should be approximately correct.

The reports of the Interstate Commerce Commission do not show what proportion of the item "repairs and renewal of locomotives" is chargeable to renewals, but from inspection of detailed reports of our most important railway systems it seems fair to assume that in the case of the average railway from 4 to 5 per cent. of the total cost of repairs and renewals of locomotives represents the cost of renewals.

Taking into account all of the various considerations which must affect the conclusions in the general case, so far as we have been able to gather them, we are of the opinion that for equal drawbar pull, the repairs and renewals of electric equipment of locomotives, assuming good design and construction according to present standards of the art, should not exceed 1 cent per locomotive mile, and will probably approximate 0.9 cent per locomotive mile.

Taking the higher figure, it is evident that the substitution of electric equipment for all parts of a steam locomotive other than frame, wheels, axles, cab and other parts which are common both to electric and steam locomotive construction, a very great saving is effected. We have been unable to fix with satisfactory exactness a figure representing the average cost of repairs and renewals of these parts, but it would seem liberal to allow 1.5 cents per locomotive mile, this being equivalent to an allowance of something over $400 per annum per locomotive. Taking this figure and adding the estimated costs of repairs and renewals of electric equipment, we have 2.5 cents per locomotive mile as the estimated total cost of repairs and renewals of electric locomotives, performing the average work now done by steam locomotives.

In 1904 the aggregate revenue train mileage operated was about 1,050,000,000. To cover locomotive mileage in switching, operating work trains and pushers we assume 1,300,000 locomotive miles. In 1904 the aggregate repairs and renewals of locomotives was $105,633,752, the average cost per locomotive mile, therefore, being 8.1 cents. A reduction to 2.5 cents, therefore, is equivalent to a saving of 70 per cent. in the cost of this item, or 5.256 per cent. of operating expenses, reducing this item to 2.253 per cent. of total operating expenses under electric operation.

Item "repairs and renewals of passenger cars." In cases where electric locomotives are substituted for steam locomotives, there should be some reduction in this item. Painting should be considerably reduced by reason of the elimination of smoke. The life of the upholstery and interior decoration of the car will be increased. No reduction has been made, however, in this estimate.

Item "repairs and renewals of freight cars." This item will be favorably and very materially affected if it should ever prove practicable to operate heavy freight trains by locomotives located at intervals throughout the trains and controlled by the multiple unit system. Assuming that the methods of train operation remain the same, the adoption of electricity will still effect a reduction, for two reasons, viz.:

1. The practical elimination of damage by fire which now frequently is superimposed upon damage caused by collision or derailment.

2. Reducing the wear and tear of wheels and brake equipment in descending long grades, by reason of the opportunity afforded to brake the trains by causing the motors to operate as generators. In the way of an estimate nothing more definite than a guess can be advanced. In the opinion of the writers the general substitution of electricity for steam operation in freight service should reduce this item from 7.657 per cent. to something like 6 per cent. of operating expenses.

Item "repairs and renewals of work cars" will not be changed materially.

Item "repairs and renewals of marine equipment" obviously will not be changed.

Item "repairs and renewals of shop machinery and tools" will be reduced under electric operation since the repairs to locomotives will be radically decreased as shown and since the tool equipment required for the electrical machinery is materially less expensive and varied. It would seem reasonable to expect that this item would be reduced from 0.662 per cent. to about 0.5 per cent. of total operating expenses.

Item "stationery and printing" will not be changed.

Item "other expenses." We estimate that this will be reduced from 0.562 per cent. to about 0.4 per cent.

Conducting Transportation.

Item "superintendence" will not be changed.

Item "engine and roundhouse men" includes, in addition to the engine crew, roundhouse men, whose work, of course, is chiefly in connection with the cleaning and maintenance of the engines. This item averages for the railroads of the United States 9.451 per cent. of the operating expenses, of which 91 per cent., or about 8.6 per cent. of the operating expenses are for enginemen and for firemen. Of this 8.6 per cent. approximately 5.5 per cent. is for enginemen and 3.1 per cent. for firemen.

In considering the substitution of the electric locomotive for the steam locomotive it is obvious that the change eliminates the work which the fireman is employed to perform. Under average conditions the services of thoroughly competent motormen can be obtained at a figure which will represent a reduction of 1 per cent. in operating expenses, making this item 4.5 per cent. instead of 5.5 per cent.

The expense for roundhousemen, which under steam operation is about 8.5 per cent., will be greatly reduced both by reason of the reduction in the number of locomotives required for a given service and also by reason of the demonstrated less cost of maintenance per locomotive unit. It is entirely liberal to allow for this item one-fourth of its cost in steam operation, the saving here effected being equal to 0.64 per cent. of the average operating expenses of steam railroads in the United States.

The estimated cost of the item under consideration, therefore, is 4.71 per cent. of total operating expenses.

Item "fuel for locomotives." One of the marked economies resulting from the substitution of the electric motor for the steam locomotive in railway operation is in the reduction of the fuel account. The cost of fuel upon the average steam railway in the United States for the five years, 1901 to 1905, inclusive, constituted 11.292 per cent. of total operating expenses. The aggregate cost in 1905 was $156,429,245.

We estimate that for the operation of the entire freight and passenger service of the United States as existing in 1905, the aggregate energy required at bus-bars of power-houses would approximate 12,500,000,000 kilowatt-hours per annum.

At 0.6 cent per kilowatt-hour the total cost of energy for traction, for the operation of all auxiliaries, and for the supply of light and heat to passenger trains, would closely approximate $76,000,000 per annum. This figure represents a saving of about $80,000,000, as compared with the coal used by steam locomotives in the year 1905. The average cost of this item for five years, viz., 11.292 per cent., would therefore be reduced by electric traction to 5.533 per cent.

Item "water supply for locomotives" is eliminated if electricity be substituted for steam.

Item "oil, tallow and waste for locomotives" should be considerably reduced. We assume that it will be reduced to 0.25 per cent.

Item "other supplies for locomotives." We make no change in this item.

Item "train service" is not changed.

Item "train supplies and expenses." This item among many others includes the following, which will be changed by the substitution of electric motive power, viz.: "Heating, lighting, cleaning and lubricating cars, including the cost of supplying and pumping gas into cars. We have included in the estimate of electric power required energy sufficient to light all cars three hours out of every twenty-four. We have also included energy sufficient to heat all passenger trains by electricity an average of three months per annum. The cost of cleaning the cars should also be reduced by the elimination of smoke and cinders from the locomotives. All things considered, we believe it is fair to assume that under electric operation this item will approximate 1 per cent. of operating expenses.

Item "switchmen, flagmen and watchmen" will not be changed.

Item "telegraph expenses." There will be a slight increase in the cost of this item even under the best plans proposed, and we therefore increase it to 0.2 per cent.

Item "station service." No material change.

Item "station supplies." No change.

Items, "switching charges, balance," "car per diem and mileage, balance" and "hire of equipment, balance" will not be changed.

Item "loss and damage." There should be a material reduction in the charges for loss due to destruction of freight, etc. Another saving will result from the practical elimination by reason of damage of fire, which now not infrequently is caused by sparks from locomotives. These savings will be offset to some extent by damage due to telegraph, telephone or other wires coming in contact with the power circuits, unless reasonable care be exercised in preventing such accidental contact by the adoption of proper precautions when the electric equipment is installed. In our estimate we have reduced this item from 1.112 per cent. to 0.75 per cent.

Item "injuries to persons." We have thought it best in the absence of satisfactory data to leave this practically as it stands, our estimate being 1 per cent.

Item "clearing wrecks." This item will be reduced under electric operation, and it would seem that 0.2 per cent. is a fair estimate of its probable amount.

The following items will not be changed: "Operating marine equipment," "advertising," "outside agencies," "commissions," "stockyards and elevator," "rents of tracks, yard and terminals," "rents of buildings and other property," "stationery and printing" and "other expenses."

General Expenses.

As regards the several items included under the heading "General Expenses," the adoption of electricity will cause no material change.

Recapitulation of Expenses.

	Maintenance		Conducting		
	Way and structures.	Of equipment.	trans-portation.	General expenses.	Grand total.
Amount in 1905..	274,415,279	288,012,604	769,613,017	55,002,127	1,387,043,027
Per cent.: 1905 ..	19.784	20.765	55.486	3.965	100.0
1904.	19.519	19.967	56.670	3.844	100.0
1903.	21.185	19.133	55.895	3.785	100.0
1902.	22.255	19.127	54.671	3.947 *	100.0
1901.	22.272	18.629	54.979	4.120	100.0
Av'ge for 5 years..	21.003	19.524	55.540	3.933	100.0
Cost electricity*..	22.354	12.287	43.454	3.933	$2,028

*Estimate of cost of operation.

According to our estimate, if all the railways of the United States were to-day operated by electricity, using the single-phase alternating current system at the potential adopted for the equipment of the New Haven Railroad, the energy required for operation being developed by power plants such as are to-day in extensive use and transmitted at potentials well within limits established in practical service, and if the rolling-stock equipment consisted of locomotives and multiple-unit trains, fitted with motors and control apparatus no better than the best which now exist, the aggregate cost of operation, which in 1905 amounted in round numbers to $1,400,000,000, would be reduced by about $250,000,000.

To accomplish this result, power plants delivering about 12,500,000,000 kilowatt-hours per annum would be required. Assuming the radius of transmission from power-houses to be 150 miles, the load factor in railway service should be not less than 0.75, and taking this figure it appears that power plants capable of delivering a maximum output of about 2,800,000 kilowatts will be sufficient to operate the entire railway service of the United States as existing in the year 1905. The average output required is about 10 kilowatts per mile of line and seven kilowatts per mile of track.

In 1905 the average gross earnings of our railroads per mile of line were $9,598, and the average operating expenses $6,409. The foregoing calculations lead to the conclusion that high-class electric equipment now available would reduce this average cost to $5,265. The difference is $1,144 per mile of line, against which apparent saving must be charged the annual interest and depreciation of the power plant, the addition to permanent way equipment, comprising overhead construction and track bonding, the transmission circuits and the sub-stations with their equipment. Assuming 5 per cent. interest on cash cost of these items and allowing 5 per cent. for a sinking fund to cover depreciation of power-house with its equipment and 2½ per cent. for a sinking fund to cover depreciation of the overhead construction and distributing system, the aggregate of fixed charges works out at $837 per mile of line. The saving in operating expenses, therefore, is more than sufficient to take care of the increase of fixed charges. In other words, it appears that the entire railroad system of the United States could be operated to-day at less cost by the electric motor than by the steam locomotive. That the railroads in general if so equipped would realize a large increase in earning power will be admitted by all who have given the subject intelligent attention.

The discussion which followed the reading of the paper was confined chiefly to opinions as to the future of the electric locomotive and to the somewhat academic question of frequency and other details on which it is apparently necessary to agree as to standards.

Mr. Frank J. Sprague in opening the discussion took issue with the authors on the assumption that high potential a. c. operation would be the ultimate solution of the problem of electrification. He believed that direct current at 1,200 or 1,500 volts transmitted through a third rail would give better results in every way than high potential alternating current using the overhead system. He was more concerned with some of the immediate possibilities of limited installations than with generalizations regarding all the railroads in the United States. Some of the railroads are in the hands of receivers and some of the others ought to be. Electrifying them would not take them out of the hands of a receiver, and money could not be raised to electrify them in any event.

Mr. B. J. Arnold was of the opinion that some form of high potential overhead conductor is to be the final solution of the problem. He believed in the third rail, where it was applicable, but did not believe there were many places where, in the future, it could be used. He thought that eventually legislation would be passed which would prohibit the use of the third rail in exposed places, particularly in yards. In designing the installation for the Grand Trunk at the Sarnia tunnel he chose the a. c. system with overhead conductor, for the reason that in the large yards at each end of the tunnel, where much switching is done, it seemed to him essential that the conductor be kept from under the feet of the men. It is interesting to note that the plans for this installation were completed nearly four months before the New Haven road adopted the same system.

Mr. W. B. Potter (General Electric Company) had a word to say with regard to the much-maligned third rail. We have not yet had a chance to malign some of the overhead construction, and it might be just as well to wait a while before giving a verdict.

Mr. W. S. Murray (Electrical Engineer, New York, New Haven & Hartford) presented some interesting figures on the repairs and renewals of locomotives. The repair item for the electric locomotives of the Valtellina line, covering a period of something over two years, is 1.8 cents per mile. In order to get a comparative figure for steam locomotives he had taken the charges for repairs on 20 locomotives in passenger service and 20 locomotives in freight service. The cost per locomotive mile for passenger engines was 5.6 cents and for freight locomotives 6.68 cents. For the passenger locomotives the shop repairs amounted to 3.88 cents per mile, and the maintenance charges, including cost of oil and waste, flues cleaned, engines wiped and turned, boilers washed, etc., was 1.72 cents.

Mr. William McClellan (Westinghouse, Church, Kerr & Co.) strongly endorsed the high potential overhead trolley a. c. single-phase system, in view of the satisfactory results obtained in the electrification of the Rochester branch of the Erie Railroad. With regard to the cost of locomotive repairs he said that in making estimates of this item they had assumed that an electric locomotive would cost for maintenance five-sixths of the cost of a steam locomotive on the basis that the boiler repairs of a steam locomotive amount to one-sixth of the total repairs, and that the repairs to machinery and running gear for steam and electric locomotives would be the same. He pointed out that figures of maintenance given by European roads were misleading, for the reason that the cost of labor is much less in Europe, and also that more care is taken in the operation of the machines; nor did he believe in basing assumptions on the cost of repairs to an electric locomotive running on a test track, no matter what the service may have been, because in that case the machine was in the hands of a competent motorman at all times, but in practice it would probably be misused by more or less incompetent men.

A New Method of Car Recording at Local Stations.

BY F. LINCOLN HUTCHINS.

The ideal car record is one which requires no indexing, or recording, other than is afforded by an individual unit record made at the initial point where movement begins. Such a record is both simple and available, but until ready to adopt this labor and time saving method it may interest those having to do with car records

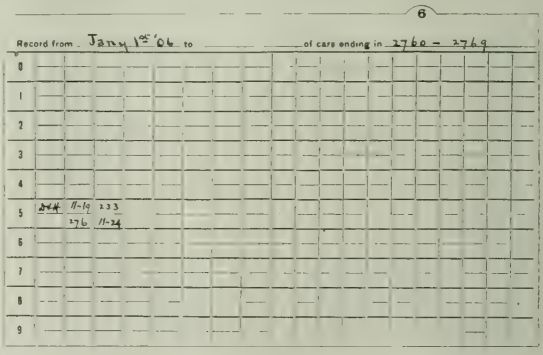


Fig. 1.

to know about a card record system, which has been in use with very satisfying results, at the Troy, N. Y., station of the Boston & Maine Railroad and at various other points for a shorter period.

One thousand, five by eight, index cards, properly ruled and printed upon both sides as shown in Fig. 1, are placed in four trays, which are set in flush with the top of a flat top desk or table; between each set of ten cards are placed guide cards numbered consecutively from 0 to 99; the cards themselves have small tabs projecting above the top edge of the card numbered from 0 to 9; while upon the card itself there are ten lines numbered from 0 to 9. It is, therefore, apparent that there is a certain definite line for recording all car numbers up to a limit of four numbers, viz., the guide cards providing for all hundreds from 0 to 9,900; the small tabs all tens from 0 to 9, and the lines upon the cards for all the digits.

As an illustration note the record of D. & H. C. car number 2,765 in Fig. 1, which shows upon the fifth line, upon card with tab six, and which belongs behind guide card 27.

Particular attention is called to the device of having the number line divided into two parts by a line through the middle. This serves a very useful and important checking purpose as well as making the record more legible.

The operation of the method can be described as follows: The recording clerk sitting at the desk has, say, an inward list before him, either in book or slip form, as is the practice of the yard force; suppose it to be the full record of cars brought in by train 276, engine 2,734; Holton conductor; arriving in yard at 10.25 p.m., November 19, 1906.

The first car upon this list may be D. & H. 2,765; the clerk therefore pulls toward him all the cards which are in front of the one having tab 6 behind card 27; taking that card out he writes

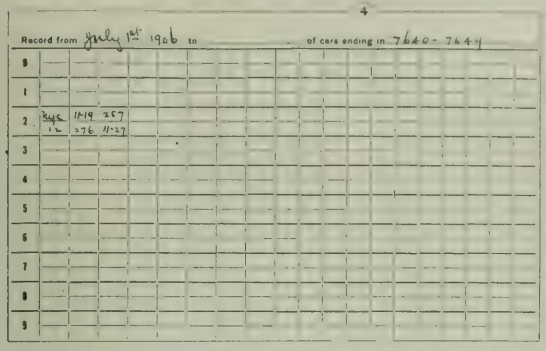


Fig. 2.

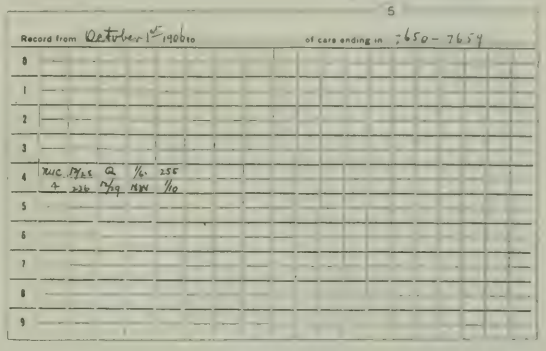


Fig. 3.

in the upper portion of the first blank space in line five the initials D. & H., and immediately against it and still above the dividing line, the date, immediately below it and under the dividing line the train number, then the record will appear thus:

D. & H. 11-19
276

The next car upon the list may be N. Y. C. 127,642; ignoring for the moment the first two figures (12), he pulls forward guide 76, takes card tabbed 4 and upon line two makes entry above the line of initial N. Y. C., immediately below it the first two figures (12), they being considered as part of the initial; places the date in the upper and the train in the lower as in the above example, when the record appears thus: (Fig. 2.)

N. Y. C. 11-19
12 276

When cars go forward the record is completed by adding the movement, but with the date and train number reversed, thus:

D. H. C. 11-19 233 N. Y. C. 11-19 257
276 11-24 12 276 11-27

At junction points where cars are exchanged with other roads a complete record may have four entries; for instance, the yard slips may show N. Y. C. 47,654 to have arrived on train 236, Dec. 28th, delivered to the C., B. & Q., received from the C. & N.-W. and then outward on train 255, when the record upon the card will appear as follows: (Fig. 3.)

N. Y. C. 12-28 Q 1-6 255
4 236 12-29 N.W. 1-10

It is supposed that this record is made by the L. S. & M. S. at Chicago; the illustration, Fig. 3, will show that in order to look up a record all that is necessary is to pull forward the cards in front of the one having the record when the whole continuous record appears at a glance.

When a card is filled with records across the lines it may be still retained in the file for reference, or better, it may be placed in a permanent file where the accumulation of years may be kept together without confusion or trouble in locating old records. The reversing of the date and train is a very important feature, as it checks the work of the number taker and the recording clerk; it also makes the record clearer and more easily read.

The recording clerk starting with his received record knows that all his dates come in the upper portion of the line, and as no two dates can come adjacent he is automatically stopped from mixing up the records; should two dates come together he would know at once that something was wrong; he may have a forwarded in place of a received record; the preceding forwarded record may have been skipped; the number or the initial may be wrong; any one of these errors might not have been so readily discovered and corrected without this checking device.

This method makes a continuous record and brings all records together in sequence no matter for how many years they are retained, either in the current or permanent file; there is no going from book to book, nor from page to page to find any record. More than this, it is much easier kept and referred to than any book or slip record.

Printing the cards upon both sides in reverse position makes it possible to use five hundred in place of one thousand cards, the odd numbers appearing upon the front and the even numbers upon the reverse side, but it is recommended that the lines upon the back be reserved for the records of those cars which outnumber the others upon the face of the card so that the card may be used for as long a time as possible and thus facilitating reference.

Such record is practical for the largest as well as the smallest station; in the latter case one set of cards will last a very long period, while in the former they will be exhausted and new ones required oftener.

The time necessary to make the records is from 30 to 90 per cent. less, according to the style of indexing now in use.

First Report of the Interstate Commerce Commission on the Coal Traffic.

The Interstate Commerce Commission has transmitted to Congress its first report on its investigation of discriminations and monopolies under the joint resolution of Congress of March 7, 1906. The report deals with bituminous coal carried east of the Ohio river, and in territory bounded on the south by the Norfolk & Western Railway, on the north by Canada, and on the east by the Atlantic seaboard. The roads involved are the Norfolk & Western, Chesapeake & Ohio, Baltimore & Ohio, Pennsylvania, Buffalo, Rochester & Pittsburg, Beech Creek division of the New York Central, Pittsburg, Shawmut & Northern, Buffalo & Susquehanna and West Virginia Central & Pittsburg (now part of the Western Maryland). The report shows that all of the above companies own, directly or by stock ownership in other companies, large interests in coal lands, and such ownership by each company is specifically described.

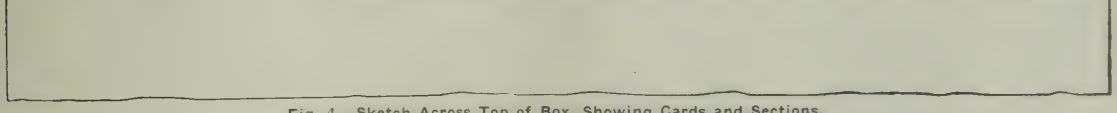


Fig. 4—Sketch Across Top of Box, Showing Cards and Sections.

The interest of railroad officials in corporations or companies operating coal mines or engaged in coal traffic was found to be as follows:

Norfolk & Western.—No officer is shown to have any such interest.

Chesapeake & Ohio.—One officer has an interest in five or six

thousand acres of coal lands in Kentucky, about 30 miles from the line of the Chesapeake & Ohio. There is no coal operation on the land.

Western Maryland.—One officer owns five shares of the capital stock of the Abrahams Creek Coal & Coke Co., par value $100, which he had purchased from the president of the coal company.

Pennsylvania Railroad.—Ownership of stock in coal companies by officers and employees has created a serious and dangerous condition. These officials and employees are of three classes:

(1) Those who, by investment, have purchased interests in coal properties or stock in coal companies, paying the full money value of the property or stock purchased.

(2) Those who, joining with others holding options on or titles to coal properties, acquired interest therein by promoting or allowing the use of their names as promoters, thereby acquiring stock at little or no cost to themselves.

(3) Those to whom stock in coal companies was given outright by promoters.

As to the first class, the policy of permitting officials and employees of railroad companies to hold investments in coal companies furnishing traffic to the railroad is, in the opinion of the Commission, a mistaken policy and is responsible for favoritism. In any event, it subjects such officers and employees to criticism and suspicion. The policy should be speedily changed and the practices thereunder forbidden.

As to the second class, this system was used to a large extent by persons outside of officers and employees of the road to advance their own interest and to enlarge the shipments from the coal properties they were operating, the purpose being to secure by means of the influence of railroad officials and employees undue and unjust advantage over other coal companies having no such affiliations. A number of officers and employees, from responsible officers of the road down to the local car distributers and chief clerks of the division superintendents, have adopted this method of securing stock—that is to say, in some cases by hardly any payment at all and in others by outright gifts of stock. This policy and practice should be abolished, as it brings discredit upon the management and is responsible for various and grave injuries to persons conducting a legitimate and independent business in coal mining without any association with the officials and employees of railroads. It is a significant fact that, so far as the evidence goes, those companies organized to include railroad officers and employees as stockholders have prospered much more than their competitors who have no such associations.

As to the third class, the officers and employees to whom stock in coal companies was given outright, without subterfuge or even pretense of purchase, this system was frequently resorted to, and the officers and managers of the coal companies usually selected the officers and employees of the railroad whose influence it was thought desirable to secure. This practice has grown to be a scandal on the Pennsylvania, and no one who appeared before the Commission attempted to justify it. The Commission cannot too strongly express its disapproval of these practices.

Notice is taken of an executive order issued by the president of this railroad company on July 5 last requiring all officers and employees to divest themselves of any interest, direct or indirect, they may have in stock of any coal companies or firms, or with any individual owning or operating mines located on the Pennsylvania system, or dealing in coals produced therefrom; and also to divest themselves of any interest, direct or indirect, that they may have in any companies or firms, or with any individuals, engaged in any other business, where the holding of such interest might in any way conflict with their duty to the company or the company's duty to the public.

Baltimore & Ohio.—Ten officials of this company own an aggregate of $717,800 par value in shares of stock of coal companies which have their plants on and are doing business along the lines of the Baltimore & Ohio. This stock was acquired in some cases by purchase and in others by allotment as a bonus with bonds purchased, and in a few instances by gift. The criticism applied to practices on the Pennsylvania applies to these practices on the part of the officials of the Baltimore & Ohio.

New York Central.—No ownership by any officer or employee of the stock or bonds of coal companies is disclosed, except that certain shares of the Beech Creek Coal & Coke Company, of the Clearfield Bituminous Coal Corporation, and underlying companies, in which the New York Central has stock interests, were issued in the names of certain officers of the railroad company to qualify them as directors of those coal companies, that they might represent the holdings of the railroad company.

Buffalo & Susquehanna.—There was no evidence disclosing ownership in coal companies by any officer or employee of this company.

Buffalo, Rochester & Pittsburg.—There was no evidence disclosing ownership by an officer or employee of this company in coal companies, other than the interest of President A. C. Yates in the Pittsburg Gas Coal Company, and that the Iselin family own a majority of the stock of the railroad company and also a controlling interest in the Cowanshannock Coal & Coke Company.

Pittsburg, Shawmut & Northern.—There was no evidence disclosing ownership in coal companies by any officer or employee of this road.

In regard to contracts in the form of trust or conspiracies in restraint of trade, the Commission finds in the Associated Railways of Virginia and the Carolinas an agreement among the several railroads parties thereto not to reduce coal rates without consultation, and the inference is that the consent of the railroad companies represented in the association is required.

In the Tidewater Bituminous Steam Coal Traffic Association the Commission finds that certain percentages were agreed upon as to the traffic to be carried by each road, which were never enforced as contemplated by the association by-laws. Nevertheless, the minutes of the association show clearly that there has been a joint agreement from the organization of this association to the present time between all of the carriers parties thereto, fixing the rates upon each road for the transportation of bituminous tidewater coal. This finding covers, in the opinion of the Commission, the real purpose of the continued life of the association after the other purposes of the association seem to have been abandoned.

In the Eastern New York and New England All-Rail Bituminous Coal Traffic Association, the purpose of the association was to see that the prices of coal and freight rates were maintained, and if any railroad company party to the agreement did not maintain such prices and rates, they were subject to such action as the executive committee might advise. The minutes of one meeting show that the principal question for discussion was that of restriction of shipments to the markets covered by the association. The matters in dispute which were not adjusted or decided by the executive committee or at a meeting of the association were referred to the presidents of the roads, who would continue negotiations until an agreement was reached. This association, by joint action, fixed rates for all roads parties to the association, and at the meeting of March 8, 1905, changed for the first time the form of resolution fixing the rates and set forth an "individual announcement" that existing rates would be continued. This, the Commission finds, was the same as the previous agreements as to rates.

In the Bureau of Bituminous Coal Statistics, Buffalo district, originally called the Buffalo Coal Association, the principal purpose seems to have been the maintenance of rates between the parties.

In the Railway Association of Eastern Ohio and Western Pennsylvania, located at Pittsburg, which is described as a "statistical bureau," the evidence as to results attained is very meager, but at the last last meeting, in February, 1906, there were at least forty persons present, representing the different roads composing the association. It is probable that further facts as to this association may be developed in subsequent investigations.

In the Ohio Coal Traffic Association, at Columbus, Ohio, an agreement appears as to rates by all of the roads, although in many instances rates are fixed thereby which should be competitive. The whole purpose of the association seems to be the maintenance of agreed rates on coal traffic. Apparently the original purpose was to apportion the territory and tonnage among the several railroads on agreed percentages, and to make up the deficit of any road not carrying its agreed percentage, either in money payment or, in some other way, and to penalize those roads which carried more than their agreed percentages, and further to fix and agree upon the rates at which coal was to be carried upon the several roads.

While it may appear that the original purposes of these associations were not carried out as set forth in the by-laws or agreements, still it was apparent to the Commission that the associations were used for the purpose of agreeing upon and maintaining freight rates, and that the distribution of tonnage to the several roads was only maintained in so far as the same was accomplished by fixing agreed freight rates.

Under the head of monopoly of any part of the trade or commerce in coal or traffic therein, evidence concerning the "community of interest" between the Pennsylvania, Baltimore & Ohio, Norfolk & Western, Chesapeake & Ohio, New York Central, and Philadelphia & Reading, is considered. The associations having failed to accomplish the desired purposes, the Pennsylvania determined to buy sufficient of the stocks of the Chesapeake & Ohio, Baltimore & Ohio, and Norfolk & Western, so that acting with others it might control the policy of these roads. The ownership thus acquired by the Pennsylvania and also by that system and the New York Central is stated. The Commission reaches the conclusion, aside from the question whether the Pennsylvania had a majority of the stock of the other railroad companies mentioned, except the New York Central, that as a matter of fact the Baltimore & Ohio, Chesapeake & Ohio, Norfolk & Western and Philadelphia & Reading were practically controlled by the Pennsylvania and the New York Central, and that the result was to practically abolish substantial competition between the carriers of coal in the territory under consideration. Since the taking of evidence in this investigation, the Commission is advised through the public press of the

sale by the Pennsylvania of its stocks of the Baltimore & Ohio, Chesapeake & Ohio, and Norfolk & Western, or a part thereof, but who is to become finally the owner of these stocks the Commission is not advised. The action on the part of the Pennsylvania appears to the Commission as a recognition of the public demand that there should not be stock ownership by one road engaged in interstate commerce in a substantial competitor also engaged in interstate commerce.

The ownership or interest in coal properties or coal traffic by carriers or their officers or employees has, in the opinion of the Commission, brought about discriminations, injustice and inequalities in the service to independent operators, and has prevented many persons who desired to engage in mining coal from doing so, and such relationship on the part of the carrier company or its officers and employees has produced suspicion, oftentimes well-founded, and complaints which bring upon the carrier company and its officers and employees—whether guilty of discrimination or not—the enmity and ill feeling of those who, if treated fairly, should sustain and aid the carrier in its useful development. In some instances the effect of such ownership has been to stimulate abnormally the favored companies. Competition has been to some extent hampered from the fact that persons were not permitted to develop their properties, the whole tendency of which would be to increase the price of coal to the general public. The combinations or contracts of the carriers, members of the associations mentioned, has had the effect of increasing freight rates and also the price of coal to the consumers.

The report of the Commission goes into car supply and car distribution in detail for each road, giving full statements concerning the practices of the several carriers, with comment and criticisms based on the facts disclosed as follows:

First.—It appears to the Commission that one of the most fruitful sources of complaint by shippers, as far as car distribution and the furnishing of facilities is concerned, has grown out of the want of publicity on the part of the carriers in their dealings with shippers. The situation has been such on the roads where there has been the greatest amount of discrimination and favoritism that shippers were unable to ascertain accurately what was the system of car distribution in effect, and information was not given, and in some instances was refused, as to whether the system supposed to be in effect was faithfully and fairly carried out. If the carriers had conducted their business with shippers openly and had furnished information as to car distribution, to which shippers were entitled, much of the favoritism would have been averted and wherever unjust suspicions were aroused, the fact that they were incorrect would have readily appeared. In two instances, to wit, the Pennsylvania and the Baltimore & Ohio, it was almost impossible for the shipper to ascertain accurately what was the system of car distribution, and whether it was faithfully carried out. Especially as to coal-car distribution, the best safeguard to the rights of shippers is publicity in connection with all the public duties of the carriers, and whenever there has been a car distribution the details of which were open to the inspection of shippers, while there may have been complaints by shippers of not receiving as many cars as they required, still there has been little or no complaint as to unfairness of the carrier as between shippers.

Second.—The method of rating mines on those roads where the capacity of the mines to produce coal is an element considered in the distribution of cars to the several divisions or districts and mines has not been carried out with the care or fairness which should characterize such responsible and important duties. In some cases men have been employed for this purpose with no previous experience which would justify intrusting such work to them, and in other instances this difficult task has been conducted in a way which fostered suspicion and dissatisfaction. If capacity of mines is to govern in the rating for car distribution, the persons or companies owning the mines should be fairly represented when such a rating is made. Many inequalities and unjust methods are used in arriving at the capacity of each mine. For illustration: On the Baltimore & Ohio and the Pennsylvania, and probably elsewhere, if one company owns more than one mine a car distribution is made to it based on the capacity of all of its mines, which equipment it may divide among the mines owned by it as it pleases, the result of which is that the company frequently closes down one or two mines, and all the cars due to it are sent to the mines which are being operated until the capacity of these latter mines is run up, and then, by the same process, the capacity of the mines which were closed down is increased. This is done for the purpose of working up a larger rated capacity for each mine than it could have if it had only the cars to which it was entitled, and it is unfair and unjust to the company or person owning but one mine and should not be permitted.

Third.—The stock ownership by the Pennsylvania and the New York Central in other carrier companies within the territory covered by this report tends to eliminate competition in rates which might otherwise exist between the railroads carrying coal to tidewater and to diminish competition of tidewater coal with all-rail coal. It is strenuously claimed on the part of the Pennsylvania that the acquisition of the stocks of the Baltimore & Ohio, the Chesapeake & Ohio and the Norfolk & Western by the Pennsylvania was the real cause for the cessation in rebates, which seems to have taken place immediately after the stocks in these companies were acquired. This claim in part seems to be justified.

At the same time the Pennsylvania claims that there is no evidence in the record to show that the Pennsylvania Railroad Company or any of its officers have either directly or indirectly attempted to affect in any way the rates on any of these roads, but that instead the evidence distinctly shows that no such effort on the part of the Pennsylvania or its officers has been made. It is difficult for the Commission to understand how the Pennsylvania Railroad Company's purchase of stock in these competing roads could have brought about a cessation of rebates on the roads of the other companies unless the Pennsylvania exercised its control over the rates of these companies by reason of its stock ownership; and while the use of its power by the Pennsylvania in that particular contributed to the maintenance of lawfully established rates, still the result shows the existence of the power.

Some discussion was had before the Commission, when the effect of the stock ownership above referred to was being considered, as to the differential in rates between the Pennsylvania and other coal fields, and the question was raised whether the Pennsylvania had the power to fix these differentials, and there was also evidence raising the question whether this stock ownership has unduly increased rates on bituminous coal to northern points, but these matters were not before the Commission under the resolution of Congress above referred and its investigation was not undertaken.

Fourth.—On the Pennsylvania and the Baltimore & Ohio a very large part of the shipments of coal is carried in what are known as "individual cars" owned by coal operators along the lines of these two roads. These cars are bought and paid for by the individual operator and then are put into their service exclusively by the railroad company, and for their use an allowance is made to the owner of the car of 6 mills per mile, which sum, however, is insufficient to pay the interest on the money invested, but the operator gets an incidental benefit in the amount of coal which he can thereby get to market and the regularity of car service. Nearly every railroad officer and coal operator who was examined on the subject of "individual cars" condemned their use. It has appeared in the evidence that the Pennsylvania during the fall of 1902 sold to the Berwind-White Coal Mining Co. 1,000 cars, or the contracts therefor, to be used by the latter company as its "individual cars," and during the same period the Pennsylvania sold to the Keystone Coal & Coke Co. 500 cars which were being built for the railroad, and at about the same time the Pennsylvania leased 700 cars from its equipment to J. W. Ellsworth & Co. About a year after a report was made to President Cassatt, by a committee of officers, recommending that the equipment of the company be increased, looking toward the final elimination of the "individual car." The reasons for the abolition of the "individual car," as given by the committee, are as follows:

> Reduction of switching in terminal and intermediate yards, reduction in empty-car mileage, elimination of tracing and special movements made at owners' request, the saving in yard and clerical forces, which, measured in money, is estimated at $225,000 per year for the lines east of Pittsburg, and at $50,000 per year were it possible to do away with the individual cars on the lines west of Pittsburg.
>
> From a traffic or commercial standpoint.
>
> The avoidance of constant irritation and jealousies from suspicion of preferences and the avoidance of charges of discrimination, it being assumed that the railroad company is prepared to furnish regular supply of cars.
>
> It cannot be denied with our limited freight-car equipment the use of individual cars materially assists in taking care of important shipments, insuring to these interests a regular supply of cars, and if the cars are then taken over by the railroad companies and the cars are divided strictly on basis of production, there may be times when the railroad company will be unable to handle important items of traffic at the proper times.

So it will be seen that within about one year following the sale and leasing of 2,200 cars by the Pennsylvania a committee of its officers recommended the abolition of "individual cars." In the opinion of the Commission the use of "individual cars" is a source of discrimination, inequality, and unfairness in the service rendered to the shippers by the carriers, and steps should be taken at the earliest possible moment to abolish their use in the coal service.

Fifth.—Another source of discrimination in the system of car distribution is the assignment of cars to certain operations for fuel coal or company coal without charging such cars against the prorata distributive shares in the equipment of the road; in other words, treating such assigned cars as arbitrary cars and not counting them against the percentage to which the operator receiving them is entitled. This method of distributing cars interferes with and to a certain extent nullifies any fair system of distribution which may be put into effect, creates inequalities and injustice as between shippers, and is frequently used by the railroad company to enable it to get its fuel supply at less than the market price for coal, and amounts to an arbitrary assignment of cars in considera-

tion of the difference between the price the company has to pay for fuel coal and the market price.

The recommendations of the Commission are as follows:

First.—That every common carrier be required to make public the system of car distribution in effect upon its railroad, showing how the equipment for coal service is divided between the different divisions of its road and how in times when the supply of equipment does not equal the demand it is divided among the several mining operations along such road, and that the carrier further be required to publish at stated periods and at each divisional headquarters the system of car distribution in effect and the actual distribution made to each mining operation under such system.

Second.—That where the capacity of the mines is the basis for the distribution of equipment, a fair, just and equitable rating of the mines be required, and that provision be made for the representation of owners of the mines at the rating thereof.

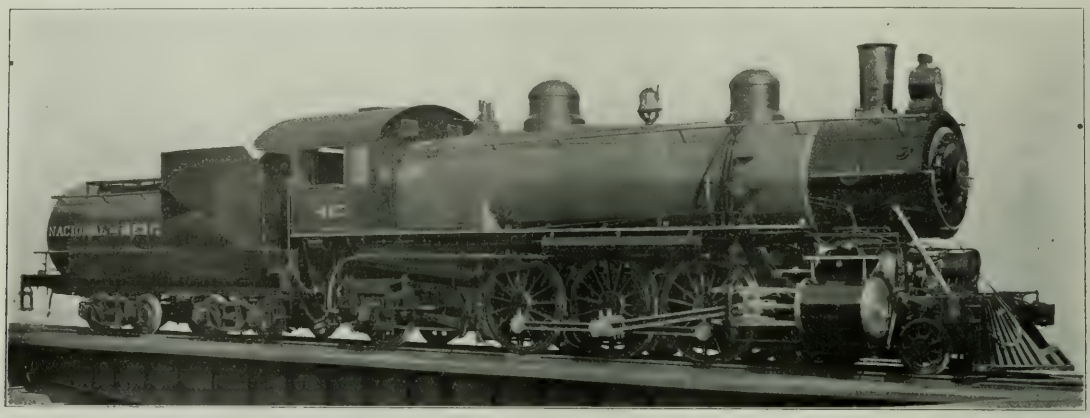
Third.—That after reasonable time carriers engaged in interstate commerce be prohibited from using "individual" or "private" cars for the handling of coal traffic; and, further, that when a carrier is unable to furnish all the cars required by all the shippers upon its line, all cars in service on the road, excepting individual or privately owned cars until their use is prohibited, be treated as the equipment of the company and subject to distribution according to the system or plan in effect at that time.

Fourth.—That carriers engaged in interstate commerce be forbidden after reasonable time to own or have any interest, directly or indirectly, in any operated coal properties, except such as are exclusively for their own fuel supply, and that ownership, either directly or indirectly, by officers or employees of common carriers of any coal properties or any of the stock of coal companies, along the line of road by which they are employed, be forbidden.

After further investigation the Commission will make another report.

Balanced Pacific Type Locomotive for the National of Mexico.

The Baldwin Locomotive Works has recently delivered a four-cylinder balanced compound locomotive of the Pacific (4-6-2) type to the National Railway of Mexico that possesses some interesting features. With engines of this type the forward driving wheels set so well to the front that either the connecting rod for the inside cylinders must be bifurcated in order to span this axle or the cylinders themselves must project beyond the line of the smoke-box in order that their work may be done on the forward axle. In this design the bifurcated connecting rod was chosen and the cylinders placed in the same horizontal line, by which all four are coupled to the second pair of driving wheels. In the case of the bifurcated rods, the front end is provided with lips which bear against the body of the stub so that the bolts are relieved of all shearing stress. The brass is split and is provided with a wedge adjustment. At the back end the stub is fitted with the usual strap and key.

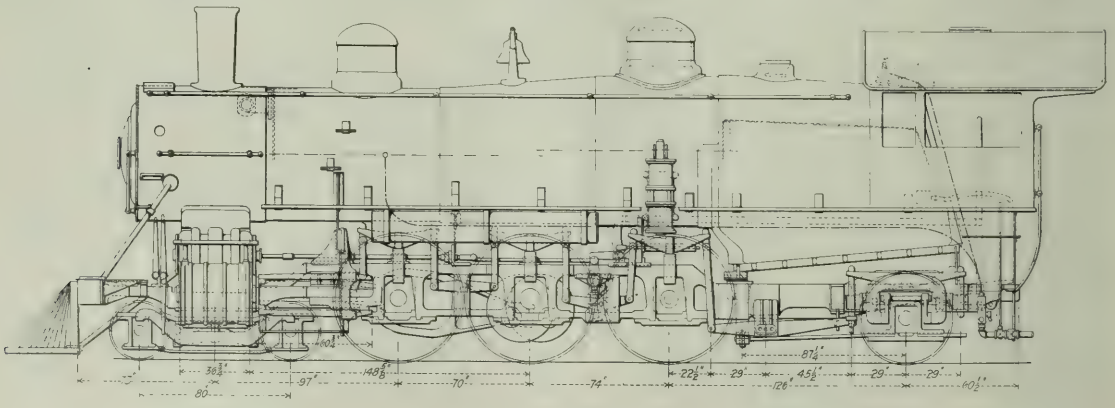


Pacific (4-6-2) Type Locomotive for the National Railway of Mexico.

One piston valve is made to serve one set of cylinders, and this is driven by a Stephenson link motion with the eccentric on the third or rear driving axle. This arrangement, made necessary by the use of the built-up crank axle, requires that the valve rod should be very long. It therefore reaches from a point about midway between the second and third pair of drivers, forward to the cylinder. In order that it may not buckle, but may work properly, it is supported at two points, and is provided with a knuckle joint in addition, as shown on the side elevation.

The crank axle is built up of seven pieces in accordance with the general design that has been adopted by these works. The crank cheeks are circular and the central member is of cast-steel.

A peculiarity of the frames is that they are given an offset outwardly at the driving boxes in order to obtain a greater length



General Elevation; Pacific (4-6-2) Type Locomotive for the National Railway of Mexico.

of box than would be possible with the frames held in to the distance of 44 in. between centers, that prevails at other points along their length. This offset amounts to ¾ in. on each side, making the distance between frame centers 45½ in. By this means a journal length of 10 in. is obtained between the crank cheek and the inside face of the wheel hub.

At the rear the Rushton trailing truck is used. In this the box is held rigidly between the pedestals and the cast-steel equalizer, or spring seat, is suspended directly on the spring links. The bearings for these spring links are bolted to a supplemental frame, which is secured to the main frame by means of cast-steel brackets.

The steam pressure shows the tendency to increase that has marked American practice for some time, and is well up to the top notch of what has been used in actual practice. Whether this exceedingly high pressure is really economical or not, is a matter that is as yet undecided, and which can only be settled by a thorough investigation coupled with actual working effects.

Another point of peculiarity, in that it is not a widespread practice, is the use of the cylindrical tank, that possesses the advantage of a high capacity coupled with the freedom from internal staying, to which must be added that of perfect accessibility of the running gear and all parts below the frames.

The following are some of the principal dimensions of this engine:

Cylinders, diameter	17 in. and 28 in.
Piston, stroke	28 "
Boiler, type	Wagon top
" diameter	70 in.
" thickness of sheets	⅝ in. and ¾ in.
" steam pressure	220 lbs.
Fuel	Soft coal
Firebox, length	114⅛ in.
" width	66¼ "
" depth, front	75¾ "
" depth, back	61⅜ "
" thickness of sheets, sides, back and crown	⅜ in.
" thickness of tube sheet	½ in.
" material	Steel
" water space, front	4½ in.
" water space, sides and back	4 "
Tubes, material	Steel
" number	301
" diameter	2¼ in.
" length	20 ft.
Heating surface, firebox	186 sq. ft.
" " tubes	3,527 "
" " total	3,713 "
Grate area	52.1 "
Wheels, driving, diameter	67 in.
" front truck, diameter	30 "
" rear truck, diameter	48 "
Journals, main driving	11 in. x 10 in.
" other driving	9 " x 12 "
" front truck	6 " x 10 "
" rear truck	8 " x 14 "
Wheel base, driving	12 ft. 0 in.
" " total	33 " 11 "
" " engine and tender	62 " 11 "
Weight, on driving wheels	147,040 lbs.
" " front truck wheels	45,300 "
" " rear truck wheels	35,000 "
" total engine	227,340 "
" engine and tender (about)	370,000 "
Tender, water capacity	7,500 gals.
Tender, coal capacity	12 tons.
Service	Passenger
Tractive effort	35,720 lbs.

$$\frac{\text{Weight on drivers}}{\text{Tractive effort}} = \text{factor of adhesion} = 4.11$$

$$\frac{\text{Total weight}}{\text{Tractive effort}} = 6.36$$

$$\frac{\text{Tractive effort x diameter drivers}}{\text{Heating surface}} = 644.55$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 71.21$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 0.05$$

$$\frac{\text{Weight on drivers}}{\text{Total heating surface}} = 39.16$$

$$\frac{\text{Total weight}}{\text{Total heating surface}} = 61.23$$

Vol. of 2 H. P. cylinders = 7.35 cu. ft.

$$\frac{\text{Total heating surface}}{\text{Vol. 2 H. P. cylinders}} = 505.17$$

$$\frac{\text{Grate area}}{\text{Vol. 2 H. P. cylinders}} = 7.09$$

Equivalent firebox heating surface = 789.04 sq. ft.

Total equated firebox heating surface (Vaughan's formula) = 975.04 sq. ft.

The Prussian Finance Minister in presenting his estimates to Parliament said that while the estimates for 1906 called for $40,000,000 for new rolling stock, the pressure of traffic had led to issuing a loan for $25,000,000 more for that purpose, and this proving insufficient he had exceeded his authority by spending $12,000,000 more. Even this had so far failed of meeting the requirements of traffic that his estimates for 1907 would call for an appropriation of $108,000,000 for further additions to rolling stock; from which it appears that the growth of traffic has exceeded all calculations there as well as here. Coal production in Prussia was 30 per cent. greater in 1906 than in 1905, coke production 33 per cent. greater, pig-iron production 14 per cent. greater, and steel production 20 per cent. greater. Of the latter, 73 per cent. was consumed in Prussia. The total increase in freight traffic was 10½ per cent. Advance in rates of pay to employees taking effect this year will absorb $12,500,000 aside from the pay of additional men.

Harriman and Hill Operating Methods Compared.

J. Kruttschnitt, Director of Maintenance and Operation of the Harriman Lines, makes the following reply to a recent editorial in the *Wall Street Journal*:

This article did not treat our lines fairly. After referring to the great work of Mr. Hill, who has challenged the admiration of all of us, it is said that Mr. Harriman has been building "a great financial institution" and that "Union Pacific continues to climb mountain ranges at a 116-ft. grade."

It is true the financial standing of the Union Pacific is a monument to Mr. Harriman's genius, but the rebuilt and reconstructed Union Pacific and Central Pacific lines are quite as much to his credit. The reconstruction of both the Union Pacific and Central Pacific was carried out on broader lines than on any other transcontinental road, and we do not think any line can to-day transport freight more quickly, economically and efficiently than the Union Pacific and Southern Pacific. It should be remembered that the Union Pacific climbs the Rocky Mountains on an 82-ft. and not a 116-ft. grade, and this on double track thoroughly block signaled and heavily ballasted. I am under the impression, gathered from Mr. Hill's time cards, that Great Northern does its heaviest mountain climbing on grades of 116 ft. to the mile and without block signals. In the matter of average train load, and even in the matter of the much misunderstood and misleading operating ratio, our lines do not suffer by comparison, as the following figures will show:

Comparative Operations, Year Ending June 30, 1906.

	Union Pacific System.	Northern Pacific.	Great Northern.
Average miles operated	5,404	5,401	5,006
Per cent., operation to earnings	52.07,† 48.77‡	50.79	50.42
Cost, M.-of-W., per mile of road	1,832,† 1,519‡	1,387	1,095
Tons of new rails laid	67,946	22,560	33,950
Tons of freight carried 1 mile	6,501,411,061	6,126,514,118	5,497,195,987
Passengers carried 1 mile	642,544,122	659,650,227	402,066,841
Passenger-train miles	9,510,740	8,057,721	7,316,332
Passengers per train	66	74	51
Freight-train miles, incldg mixed	12,755,053	13,097,617	9,308,753
Freight locomotive mileage	14,374,122	15,928,937	11,635,550
Excess of freight locomotive miles over freight-train miles	1,619,069	2,831,340	2,327,197
Ratio of above excess, per cent.	13	22	25
Cars per freight train	31.64	31.71	37.09
Tons of freight per loaded car	21.54	20.21	22.33
Tons freight per locomotive mile	452.30	384.61	471.56
Miles run per locomotive owned	35,637	31,468	*29,700
Earnings per train-mile	$3.00	$2.85	$3.08
Expenses per train-mile	$1.56,† $1.56‡	$1.47	$1.55

*Estimated.
†Including reserve fund charged to expenses for future maintenance.
‡Excluding reserve fund charged to expenses for future maintenance.

The following figures are compiled from working time tables:

Average speed of time freights, omitting dead time at terminals:

	Miles per hr.
Great Northern, St. Paul-Seattle:	
No. 401	12.8
No. 402	12.5
Average	12.7
Union Pacific, Council Bluffs-Ogden:	
No. 52	16.1
No. 53	14.1
No. 54	12.3
No. 55	13.2
Average	13.9

The density of traffic is not far different on both roads, yet the Union Pacific runs 5 time freights daily, while the Great Northern runs 2½ time freights daily. Union Pacific also runs many extra fruit specials in small train lots, at very fast speed.

It would thus appear that Mr. Harriman has been able to spare enough time from building a "great financial institution" to devote some attention to the rate of grade at which the Union Pacific climbs mountain ranges, for he seems to have moved his freight trains with only 13 per cent. excess of locomotive over freight train miles, while Mr. Hill shows an excess of 22 per cent. and 25 per cent. The Great Northern train load last year averaged somewhat more than ours, but the locomotive load—which is the better test of comparative loading—was only 19 tons, or 4 per cent. more. When the differences between the two systems are considered, the Great Northern carrying the larger part of its traffic on the comparatively level eastern portion of its system, nearly all of its traffic having no speed requirements, while a large part of Union Pacific

business is composed of California fruits, which is expedited business moved in small train loads, our lines do not suffer by comparison; and the superiority of the physical condition of the Union Pacific, both as to roadway and equipment, is so universally admitted as to need no comment from me. In making comparisons with the Great Northern, the fact must be kept in mind that that road hauls a great deal of lumber, ore and grain, whereas the Union Pacific tonnage is of a more diversified character. We move some coal, but no ore to speak of.

So far as average train load is concerned, we do not attempt to always load locomotives to their maximum rating, our tonnage ratings being based on speed requirements as well as the hauling capacity. Any other policy we consider detrimental to the best interests of our patrons, and, in fact, in the first five months of this fiscal year, in order to haul trains at faster speed, we deliberately reduced our average train load on the Union Pacific 31 tons.

Watching Freight Traffic by Daily Returns.

AMERICAN RAILROADS.

So much has been said and written, and usually somewhat vaguely, of the use of daily statistics by American railroad companies, with resultant comparisons of their use by British railroad companies, that it seems well to make a somewhat detailed examination of this subject. This examination, however, will be limited to the use of statistics for the purpose of securing economy in working, as a substitute, or rather as an aid, to observation and inspection. It will have nothing to do with the preparation and publication of half-yearly or yearly reports.

Economic statistics for railroad working have a value in inverse proportion to the time reported on, that is to say, six-hourly reports, daily reports and perhaps weekly reports have the highest value for the divisional officers, for the reason that the information comes to them quickly on their knowledge and memory of the attendant conditions, and remedies and corrections of waste and dangerous practices can be made at once by the divisional officers.

The American division superintendent may be considered the chief officer of a short piece of railroad, but not an isolated one. While he regulates the local business absolutely, nevertheless, since his road has its mouth open at both ends for through traffic, he must regulate it in conformity with the through schedule trains and other through trains. Although the line which he controls is short and he can easily move, and he frequently does move, from one end to the other and watch the working of the division yards and shops, nevertheless, on the best regulated railroads, he has placed on his desk each morning at 9 o'clock all the statistics of the operations on his division during the previous day from midnight to midnight, and also their comparison with the previous day and corresponding days last month and last year. These statistics are accurate as far as they go, and indicate to him immediately whether or not he is operating economically as well as efficiently. They have the practical advantage that they show the facts of the preceding 24 hours, the true story of actual and present operation, and if the figures suggest that a change in methods is necessary the remedy can be applied at once. Substantially all of this information for the daily report comes by telegraph or telephone, and between midnight and morning the night clerk has time to compile it on the blank forms used for the purpose, and have it ready for the superintendent by the time he comes to his office. During the day, at intervals of six hours, he receives telegraphic reports showing the condition of the terminals or marshalling yards under his control. These six-hourly telegraphic reports are not necessarily sent to his office, they are telegraphed to him wherever he is along the line.

The "Reports Showing Movement and General Condition" show the number of through trains, of loaded cars, empty cars and total cars received and despatched in each direction at each terminal; the same data for those passing a midway point; the total number of time freight trains in each direction with a percentage of those making schedule; the total number of passenger trains in each direction and those making schedule; the weather conditions at each terminal and at a midway point each six hours; the trains delayed in getting into each yard; the trains delayed at yards waiting for power; yard accidents; road accidents; delays due to motive power failures; delays due to car equipment failures; failures or delays due to switches, signals, rail renewals, or any failure of water or coal supply.

The daily "road run" report covers the actual movement of the trains while on the road, and is exclusive of the movement through the yards at the terminals. This gives the length of run of each train, the average time of each class of trains, and the average rate in miles per hour of each class. The data for the through slow freight trains give the maximum, minimum and average times in making trips, and where and why delays or detentions occurred. The maximum, minimum and average tonnage behind the tender, and the maximum, minimum and average number of cars hauled by the engines are given. The freight car movement is reported by the number of loaded and empty cars moved in each direction, together with the number of engines in service.

The "lay-over sheet" is another daily report showing cars awaiting train movement from the yards and from interchange connections for the preceding 24 hours. This sheet also includes the movement passing important points, weather conditions, and so forth. This is received by telegraph and compiled by the night clerk.

Another daily report, which is a compilation of the divisional reports, is made for the general superintendent and for the general manager. This is so designed as to give to the general officer, within the space of an ordinary foolscap page, a thorough knowledge of the freight train work of his railroad during the preceding day. It shows the number of trains and of loaded and empty cars passing the important points on the line, and in order to give condensed information, the cars are reported in separate columns with the totals carried out, and over the separate columns are the initials A. B. and C. "A" indicates full loading or what is called "summer rating," "B" indicates about 5 per cent. less loading, and "C" about 10 per cent. less than full loading. It will be observed that while this does not give to the general superintendent and the general manager the total tonnage, it nevertheless shows them the important facts, *i. e.*, the loaded and empty car movement and the relative loading of cars and engines. This is important inasmuch as it gives them every day sufficiently precise information about the quantity of the traffic and the efficiency of their officers in securing full car loading and full engine loading. This same daily report informs them of the number of cars awaiting train movement at the different stations at six o'clock in the morning. It shows them also the number of cars awaiting transfer to connecting lines; it shows them also the number of cars interchanged during the preceding 24 hours with connecting lines.

One of the most interesting, and probably the most valuable set of statistics kept by the division superintendent, is on what he calls his "cards." These are pieces of Bristol board, 3⅜ in. wide by 7¾ in. long, with round corners. On a division which includes a considerable number of branches, there are liable to be more than 20 of these cards. If the division consists of a section of main line, with few if any branches, the number of cards would be reduced as much as one-half. The cards are ruled and have printed dates opposite each horizontal line, so as to include the record of one month. The statistics are filled in by the clerk each morning, so that the division superintendent has in a form for convenient reference all the data which he thinks he needs from the beginning of the month up to date, and a great deal of this data includes like information for the corresponding day in the previous year, together with increases or decreases carried out. When the division superintendent is at his office, these cards, with a rubber band around them, are apt to lie on his desk for ready reference. From them he can answer most questions asked of him by his superior officers, and he is also enabled by the use of them to reply intelligently and quickly to complaints or suggestions coming from his subordinates, or from customers of the road. When he travels, these cards are in his pocket. For example, his record of passenger trains shows the number of trains run on time each day, together with the percentage of those which kept their schedule and compared with the corresponding day in the previous year; the number of passengers carried, divided into through passengers and local or way passengers; the total car movement; the loaded and empty car movement in each direction; the number of trains; the number of cars in each classified train; the average gross weight behind the tender; and the maximum, minimum and average time of movement; the interchange of cars at junction points; complete data from the yards of the number of cars and cuts made, and of those weighed.

The above is a somewhat incomplete and hasty description of the daily reporting system, and it happens that the example chosen is that of a division on an American railroad where the freight traffic is of overwhelmingly greater importance than the passenger traffic. It has been so chosen for the reason that the economies to be effected in railroad working are much more important, and have a greater money value in the handling of goods and minerals than in the handling of passengers. Passenger train service is necessarily developed by less scientific methods. It is a catering to public convenience and public taste. It can be increased or diminished by so much as the convenience and comfort of those who travel is anticipated.

BRITISH RAILROADS.

In considering the statistics found necessary to keep a close check on the good working and economical handling of British freight traffic, and in comparing them and their results with statistics kept in other countries, we must not overlook the differences in conditions existing. In England the movement of goods and mineral traffic may be said to be fairly steady, and, in consequence, regular or scheduled services have been arranged to all parts of the country, which work with pacticaly the same precision and regularity as passenger trains.

Goods despatched overnight are expected to be delivered at destination the following morning, and if this is not done, the traffic

goes to a competing road. Now, although this system goes on to a limited extent in other large countries, it follows, on account of the long distances to be covered, and the rate conditions, that it can only amount to a very small (it might be said an insignificant) part of the huge freight business they do, and consequently there is much more scope for moving freight economically than on British lines.

On the other hand, atmospheric conditions do not enter to anything like the same extent into the difficulties in working on British railroads as in some countries, nor do accidents, mishaps, etc., to rolling stock, or blockages to traffic occur with the same frequency; in fact, the whole railroad machinery works with comparative smoothness and regularity on the long-established British lines, instead of flowing in abnormal rushes in one direction at one period and perhaps in an entirely different one at another season of the year, as in some of the huge undeveloped countries presenting railroad problems to-day.

The district officer's problem is a much more complex, if not a more difficult one, on British railroads than abroad. Not only does he control the movement of the traffic by trains and engines, but as the company also undertakes the collection and delivery of practically the whole of the merchandise business, a good deal of attention must be given to the punctual working of the traffic through the warehouses, and in the care and management of the huge carting establishments. The same waste in administration and detail may occur in connection with these departments unless very closely watched.

Then, again, there is the question of hours of labor and other conditions of service, as well as the innumerable restrictions which make for the safety of passengers and staff. Probably in no other country do the same stringent conditions apply.

Parliament, too, seems never tired of calling for returns of the hours worked by specified grades of men, and a good deal of adverse criticism and other more effective means are leveled at the heads of railroad companies whose men's hours are not kept down rigorously to the hours stipulated. This results in a large amount of time being devoted to the question, which is certainly not one to help in the direction of the economical movement of traffic.

Now, what does the divisional superintendent watch, and what statistics does he require?

First, he must see that the goods trains, carrying the urgent freight, work approximately as punctually as do passenger trains. To enable him to do this he receives, on his arrival at the office in the early morning, returns or telegrams from all his important stations, showing the departures and arrivals of all his scheduled trains during the previous night and day. These returns have already been assembled on a blank form, which gives a complete picture of this part of the previous day's work done by the express and fast goods trains. It gives for each train the scheduled time and actual time of starting and of arrival; the minutes late; the causes of delay; the number of wagons (loaded and empty); the class of engine; and the weather conditions.

The delays en route are immediately taken up, and the serious blots put right the same day, and the returns are then passed out to be recorded statistically, with the average departures and late arrivals duly worked out. It will, however, be noticed that the individual treatment of the delays suffered by the train are first dealt with before statistical figures are compiled.

Second, he has to consider whether his large scheduled goods-train service of trains which must run are loading to something like the capacity of the engines, and that the service is rearranged whenever the traffic falls off or increases. He does this daily by means of the columns headed "No. of Wagons" and "Class of Engine" on the form above described, and also by the daily record of the loading of his trains and the percentage loaded to maximum or otherwise. For this purpose he has a blank form, filled in day by day throughout the month, showing the loading of each goods and mineral train worked out by percentages to a mineral load basis. This shows the total number of trips, number of trips fully loaded, number of trips three wagons or less short of loading maximum, number of trips four wagons or more short and the percentages of the last three items above. At the end of the month the totals of these daily returns are assembled in a statistical "Summary showing the percentage loading of goods and mineral trains" for each district and summed up in totals, giving the same information for the whole line. In this return comparisons are made with the preceding month and for the corresponding month of the previous year.

Third, he has to move his mineral and similar class traffic, which corresponds to the "heavy freight" in America, and in Great Britain consists of materials and coal, as economically as possible. Even here the traffic is so steady that most of the trains are scheduled, and are dealt with similarly to the merchandise trains, except that if not fully loaded they are not run unless under exceptional circumstances. The surplus is worked by special trains, but with these there is no service necessity to run them if not fully loaded, and as there is not the same fear of congestion on British railroads, the principle adopted is that the man who has authority to order to special power has to report to his district officer, and receives his censure or approval as to the necessity for running any special not fully loaded to the capacity of the engine. These daily and monthly returns and comparisons are used for watching the necessity for specials; and in addition the officer has a daily return of the work done by the special trains. This informs him, concerning each train, of the time ordered and actual time of starting; time the engine is held at the disposal of the traffic department; number of goods wagons; cattle, mineral, fish, empties and total wagons; and for passenger trains, the number of vehicles, loaded, empty and horse boxes; where the train is ordered to go; the class of engine; name of guard or brakeman; and an explanation of the necessity for running the special.

A return of miles per hour obtained from freight engines is compiled weekly and circulated to all district officers showing the miles run by the engines at each shed in their district, and the hours the engines were out, together with comparative figures for the previous year. From these the average miles per hour are easily seen, and with the shunting and stationary return, mentioned in a later paragraph, any falling-off can at once be located.

The full loading of wagons is watched by a system of daily statistical returns, which seem to be adequate for passing judgment and for the immediate correction of abuses. The weights loaded in each wagon are recorded at the stations daily on a form showing in detail the wagon number, destination, description of traffic, and weight of either goods or minerals in each company's wagon, or foreign or private-owned wagon. From this data the average weight per wagon is arrived at. The whole are brought under the notice of the agent in charge first thing in the morning, and any points requiring attention are dealt with. The return is then passed on to the district officer (daily from large stations and weekly from small stations). Further, each station renders a report showing their justification for any wagons sent out with less than full load. These daily returns make it easy clerical work to assemble this information on another form for any desired period, showing the average loading of all traffic in company's and in foreign wagons. They furnish also the information from each station, which is collated on another form of return showing either weekly or monthly the shipments, in tons, of goods, minerals, coal and coke, transfers and gross tonnage. This return includes also the salaries and wages, with cartage separate, and the cost per ton on goods and transfers only. On the same return is an analysis of goods, tonnage received and forwarded, of salaries and wages chargeable to received traffic and forwarded traffic, yards, offices, miscellaneous and total. It includes also a daily average of consignments and rolling stock left over during the period.

A daily report of wagons left over or under load at the close of each day's work is made by all the principal stations to the district officer, showing the wagons on hand not unloaded at the close of the day's work. It may, however, be said here that generally, as to British railroads, the left over items, liable to be so large in American practice, are rare in British practice. The steadier and more uniform conditions here enable the companies usually to do the day's work within the day.

The shunting and stationary times of engines at stations are difficult items to watch, and probably the best form of statistics is the rough and ready method of dividing the number of wagons dealt with into the time occupied at each station. This is recorded on a form rendered to the district officer daily, and in addition to applying to engine switching, it is also used to check horse and capstan switching, and the "shunter's capstan men," and other supervising staff, which is worked out to the average minutes occupied per wagon. This form shows the aggregate time, excluding meal times, occupied in switch engines, train engines and total engines; the time that train engines are standing; and the time of "shunting" horses, inspectors and foremen, of "shunters," of "capstan men" and hookers-on, of shunt horse drivers and mates, and also the total number of wagons dealt with. The summary on the same sheet gives the average number of minutes per wagon for most of the above items, and the like figures for the corresponding day in the previous year. A monthly return from each station is assembled on another form showing the number of wagons handled, the number of hours occupied in shunting by engines, horses and different classes of employees. This is totalled so as to get unit figures for each district and for the whole line. Station and cartage working is watched by a unit measurement, and this unit is the cost per ton. A daily station report shows the hours worked; regular and overtime and total daily wages; the tonnage received and forwarded and the total; the wages cost per ton on the goods; the number of men engaged separately on received and forwarded traffic as regular, extra men, casuals, and hours overtime; the arrears of work at the close of the day; the supply of rolling stock of the different classes, and so forth.

The cartage working is watched by a daily report which records the vans sent out with each kind of load at six different periods during the day. It also records the arrears of work of the previous day and the same day. It gives a summary of the cartage work

done, both by company's teams and hired teams, and the number of loads and tons delivered and collected. It also includes a daily inventory of men and horses and their conditions. The record of the time that traffic is out for delivery is regarded as highly important.

Shortage of Cars in Germany.

The United States Consul at Kehl, Germany, reports that there has for many months been a serious shortage of cars in Germany. All the railroads there are owned and operated by the Government. Consul Britain says in a report to the State Department:

The greatest cause of the scarcity (of cars) is the extraordinary activity in the iron and steel industry. For the first half of 1906 nearly 700,000 more cars of coal, coke and patent fuel were delivered by the syndicate than during the corresponding period of last year, and the daily dispatch of cars has frequently exceeded 21,000 in number.

The Prussian State Railway authorities have been severely criticised in consequence of the shortage of railway cars. Thus, during June, although 221,991 more cars were available than in June, 1905, the shortage amounted to nearly 1,000 cars a day. But, on the other hand, it is questioned whether, even with this shortage made good, it would have been possible to satisfy the demand.

The marked scarcity of cars at this time of the year is all the more disquieting, since the farmers will shortly be drawing heavily upon all available railway rolling stock to move agricultural produce. The result of this deficit in the number of cars supplied has been that in several collieries the mines have been compelled temporarily to stop work, a measure which in these days of high wages is a costly matter.

Atmospheric Railroad Traction.

BY W. B. PALEY.

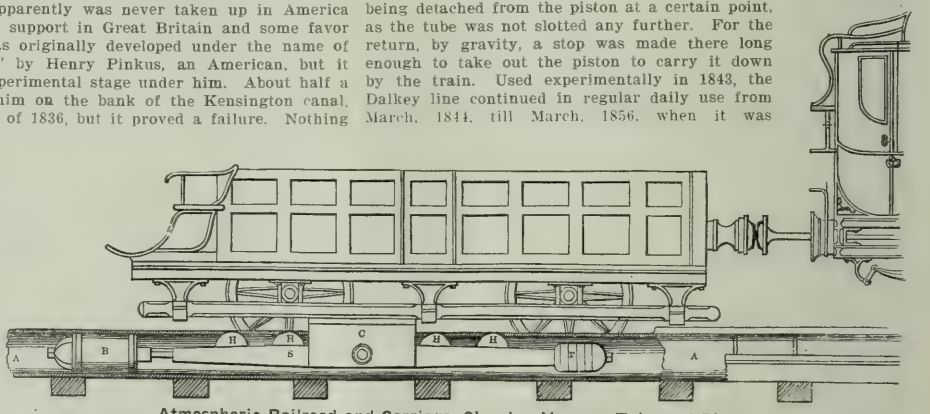
One of the most interesting chapters in British railroad history is that connected with the long-forgotten "atmospheric" system of traction. The scheme apparently was never taken up in America but it obtained powerful support in Great Britain and some favor on the continent. It was originally developed under the name of the "pneumatic railway" by Henry Pinkus, an American, but it never got beyond the experimental stage under him. About half a mile of it was laid by him on the bank of the Kensington canal, near London, at the end of 1836, but it proved a failure. Nothing daunted, Messrs. Clegg and Samuda introduced the improvements under which the "atmospheric" system, as they called it, undoubtedly proved that it amounted to something. Trains were to be worked by a piston "B" covered with leather, shown in one of the drawings published herewith, which was moved along in a tube or pipe "A" by exhausting the air in front of it. As carried out in practice, this tube, generally of 15-in. inside diameter, consisted of a series of iron castings, fitted into each other and having projecting brackets or feet through which they were attached to the sleepers midway between the rails. On top of the pipe was a narrow continuous slot for the passage of a plate of iron "C" called the "coulter," which connected the piston with the leading or motor vehicle of the train. To get a vacuum, however, with an open pipe would be impossible, therefore along the slot lay, in a recess or groove cast on the top of the pipes, a belt "G" of well-greased leather. This was fastened down at one side and free at the other. It fitted close and made it possible to get a considerable degree of exhaustion by means of air-pumps worked by steam engines about every three miles. The piston in the tube had a rod "S" projecting behind it, fitted with four small vertical wheels, "H H H H."

Two of these wheels lifted up slightly the greased valve or belt in front of the arm connecting with the coach and two raised it behind, so that the weight of the atmosphere rushing in might drive the piston against the small resistance on the other side. Directly the second pair of wheels had passed under the valve a special vehicle followed carrying a long flat case "N" containing burning charcoal. This case ran in the trench or groove and sealed the valve up air-tight by melting a greasy composition "F" placed along the edge opposite to the hinge or attachment of the valve. There was a wheel "R" at each end of the heater, either of which could be used, according to the direction in which the train was travel ing, for lightly pressing down the valve preparatory to sealing. The heater, of course, could be raised up when the train was standing, or it would have burnt the valve. Iron bands were rivetted to the long valve or belt on both sides to strengthen it and prevent it from getting sucked into the tube.

Such was the method under which the "atmospheric" system attained a certain degree of success and excited hopes and expectations much beyond what its performances ever justified. The absence of smoke and ashes, the saving in strength of rails and substructures and the quietness of action were thought to be immense advantages. Few, however, foresaw what railroad traffic would become, and these advantages proved to be purchased much too dearly.

The first practical trials took place on Wormwood Scrubbs on June 11, 1840, where half a mile of single line, with a 9-in. pipe, was put down on the course of the present West London Railway. That line was then unfinished and at a standstill for want of money. Messrs. Clegg and Samuda, well-known engineers, laid and worked this experimental line at their own cost. It was a temporary affair, laid roughly, and rose at the rate of about 1 ft. in 115. An engine pumped up a sufficient vacuum (23½ in.) to run a light coach or two at the rate of 30 miles an hour up-hill. The side of the pipes was coated with tallow to reduce the friction of the piston. A valve in the piston could be opened by the motorman, so that the vacuum, being temporarily destroyed, would not hinder the stopping of the train. Brakes, of course, were also used. On June 29, 1840, the trials were witnessed by the Prince Consort, who took much interest in inventions. In 1843 the apparatus was removed as the road was about to be in operation with steam locomotives.

The system was tried soon after in Ireland by the same patentees on an extension 1¾ miles long of the Dublin & Kingstown Railway to Dalkey. Here the tube was 15 in. in diameter and the pumping engine of 180 instead of 16 h.p. The line rose part of the way as steeply as 1 in 57 and was much curved instead of being straight. Loads of as much as 60 or 70 tons could be taken up at about 18 miles an hour when the plant was new, and it could always whisk up a little train of 15 or 20 tons at 40 or 50 miles an hour. The last 560 yds. were run up by impetus, the carriage being detached from the piston at a certain point, as the tube was not slotted any further. For the return, by gravity, a stop was made there long enough to take out the piston to carry it down by the train. Used experimentally in 1843, the Dalkey line continued in regular daily use from March, 1844, till March, 1856, when it was closed to be converted to steam traction and extended to Bray. Both Brunel and Robert Stephenson, besides a commissioner from the French Government, had trials made on this line, though they came to by no means the same conclusions about its suitability for general traffic.



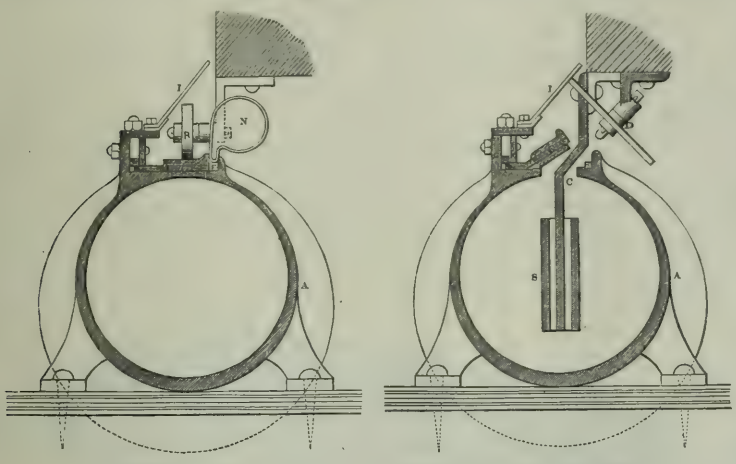
Atmospheric Railroad and Carriage, Showing Vacuum Tube and Piston.

The next bit of "atmospheric" was on the London & Croydon Railway, which laid a single line of it, as an addition, between New Cross and the terminus now called West Croydon. It was principally worked in 1845-7 between Forest Hill and Croydon and was fairly successful, mechanically, at first. Light trains were said to have been taken at tremendous speeds, vacuum being produced by pumping engines totalling 300 h.p. at two different places. A long incline had to be surmounted to get over the Brighton Railway. This soon proved too much for the apparatus when it got a little worn, the power used gradually to die away, and the affair got to be known as "the fainting lady." In 1846, when the Brighton and Croydon companies united under the title of the London, Brighton & South Coast the predominant partner put "the fainting lady" out of her misery. Uniformity of system was, of course, necessary.

The new system was somewhat hastily applied on the South Devon Railway, a 7-ft. or "broad" gage line intended to connect Exeter and Plymouth. It was built only from Exeter to Newton Abbot, 20 miles of level line, where atmospheric traction was in use for about a year from September, 1847. The line, like the others, had 15-in. pipes, but 22-in. tubes were to be used for the heavy gradients which extend westward from Newton Abbot. Al-

though begun, that part never finished on the atmospheric system, which was given up on the alarming discovery that the working expenses of the road were more than the receipts. This was chiefly due to a small traffic. The pumping engines had to be in steam ready to work at any moment; consequently they had little to do, while two or three locomotives could have handled all the traffic and been profitably employed.

In France, where the atmospheric system excited the greatest interest in scientific circles, it was in use from 1847 till 1860 between Le Pecq and Saint Germain, forming an extension, about 1¼ miles long, of a branch of the Chemin de Fer de l'Ouest from Paris to Saint Germain. The line rose 1 in 28½ to the terminus. The piston was taken out at the top and carried down by the train, the plant being built on Clegg & Samuda's system. It was given up finally because the growth of the traffic required the trains to be run through to Saint Germain, the apparatus being only powerful enough to work a very light train, into which passengers changed at Le Pecq. In fact, trains often had to be worked through by a locomotive.



Sections Through Vacuum Tube With Valve Open and Closed.

There was always difficulty in keeping the long valve sufficiently air-tight, nor would it stand the rapid lifting up and closing down. To get a sealing composition adapted to a changeable climate proved, also, troublesome. Many mixtures were tried but in hot weather they were likely to melt and get sucked into the pipe, while during frost it was not always softened enough by the rapid passage of the heater, an instrument which was dispensed with in very warm weather. In spite of a series of hinged iron lids "I" placed over the valve and raised by a special wheel "D" fitted diagonally on the first vehicle, rain and snow sometimes got into the pipe. On the South Devon line, which runs close to the sea for miles, the salt spray proved extremely injurious, rusting the iron and hardening and rotting the leather. No doubt improvements would have been made, and for a short, quick to and fro service of extremely light trains the system was fairly well suited, but for general railroad work its lack of adaptability was painfully conspicuous, while the power obtainable was much too small.

Foreign Railroad Notes.

In Japan the railroad from Osaka to Vakayama, 40 miles, is to be worked by electricity instead of steam as heretofore.

The Russian government has agreed with the Chinese Eastern Railroad Company that the latter shall work the Ussuri Railroad, built as the eastern section of the Siberian Railroad, until 1931.

The grain rates on the Russian railroad were to be increased January 1 by about 9 per cent., except shipments to Black Sea and Baltic ports and to the junctions with foreign railroads on the western border (substantially shipments for export), for which the rates are raised very little for short distances and about 8 per cent. for distances greater than 360 miles.

The German Dining Car Company at the end of its fiscal year, Sept. 30 last, had 56 dining cars and contracts with railroads for running such cars on 60 trains. It paid for the privilege of attaching its cars to trains an amount equal to 7¼ per cent. on its capital. Its net earnings were at the rate of $2,632 per car, which is three times as much as the dividend of 10 per cent. paid on its capital of $476,000. The capital indicates that its cars have cost less than $8,500 each.

The International Sleeping Car Company, which has its chief office in Brussels, is to increase its capital from 50,000,000 to 62,500,000 francs. The company has increased the number of its cars from 726 to 1,026 within the last five years.

Train Accidents in the United States in December.[1]

*†rc, 1st, Rutland Railroad, Vergennes, Vt., a gravel train ran into the rear of a preceding mixed train, wrecking the two passenger cars at the rear of the leading train, which took fire and were partly burned up. Three passengers were killed and 30 injured. The gravel train had become uncontrollable by reason of the failure of the air-brakes, due, it is said, to the closing of an angle cock by being struck by a piece of ballast.

unf, 1st, 10 p.m., Baltimore & Ohio, Guffy, Pa., a passenger train was derailed while running at full speed, and the engine and baggage car fell down a bank. The engineman was killed and the fireman and baggage man injured. It is said that the derailment was due to a misplaced switch.

xc, 2d, Chicago Great Western, Maple Grove, Iowa, collision between a freight train and a work train, wrecking both engines and several cars; one trespasser was killed.

xc, 3d, 4 a.m., Southern Railway, Suggsville, Ala., a freight train ran into the rear of a work train, wrecking the caboose; the conductor, engineman and flagman of the work train, who were asleep in the caboose, were injured, two of them probably fatally. The work train was standing on a side track where it had been all night, and the collision is said to have been due to the misplacement of a switch.

unx, 3d, Aberdeen & Asheboro, Troy, N. C., a special train carrying a circus was derailed and one car was overturned; one of the circus men was killed and two others injured.

bc, 4th, Chesapeake & Ohio, Mount Sterling, Ky., butting collision of freight trains; one fireman killed, three trainmen injured. The collision is said to have been due to a mistake in copying orders.

dr, 5th, Chicago, Indianapolis & Louisville, Frankfort, Ind., a passenger train was derailed by a broken rail and four passenger cars were ditched; 47 passengers were injured, but only two seriously.

dn, 5th, 4 a.m., Central of Georgia, Raymond, Ga., a freight train was derailed at a misplaced switch and the engine and six cars were ditched; the engineman was killed and the fireman injured.

rc, 6th, Chicago, Burlington & Quincy, Maquon, Ill., rear collision of freight trains; one engineman killed, one fireman injured.

bc, 6th, Maine Central, Annabessacook, Me., butting collision of freight trains, wrecking both engines and eight cars; four trainmen were killed and three injured. The collision was due to misreading of time-table by the conductor of an extra train.

xc, 6th, New York, New Haven & Hartford, Meriden, Conn., collision between a freight train and a switching engine; one trainman killed.

xc, 6th, Boston & Maine, East Rochester, N. H., collision of freight trains; engineman and one brakeman killed.

unx, 6th, Michigan Central, Otter Lake, Mich., a passenger train was derailed and three passenger cars were ditched; 20 persons were injured, three of them seriously.

[1]Accidents in which injuries are few or slight and the money loss is apparently small, will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments: defects of roadway.
eq	Derailments: defects of equipment.
dn	Derailments: negligence in operating.
unf	Derailments: unforeseen obstruction.
unx	Derailments: unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

*rc, 8th, Southern Railway, Danville, Va., northbound freight train, standing in the yard, was run into at the rear by a following passenger train (No. 34), and the caboose and several freight cars were wrecked. The wreck took fire and was partly burned up. The engineman of the passenger train was scalded to death and a brakeman of the freight injured. Three other persons were injured. The passenger had received a clear block signal before the freight train had cleared the block, and the flagman had failed to go out and protect the freight train after being told by the conductor to do so.

xc, 9th, Pittsburg, Kan., a passenger train of the Missouri Pacific ran into a freight of the St. Louis & San Francisco, at the crossing of the two roads, while moving at high speed, and wrecked several freight cars. The passenger fireman was killed and the engineman and one passenger were injured.

rc, 10th, 2 a.m., Illinois Central, Paducah, Ky., a northbound passenger train approaching the station at uncontrollable speed, due, it is said, to failure of air-brakes, collided with an empty engine which was to take this train over the next division. Three passengers and two trainmen were injured.

rc, 11th, Cincinnati, Hamilton & Dayton, Lima, Ohio, a passenger train ran over a misplaced switch and into the rear of a freight train standing on a side track, making a bad wreck. The fireman was killed and three other trainmen were injured.

unx, 11th, St. Louis, Iron Mountain & Southern, Batesville, Ark., a passenger train was derailed on a sharp curve and one passenger car and a refrigerator car fell down a bank. It is said that the passenger car rolled over three times, the bank being 50 ft. high. Of the 15 passengers in the car all were injured, two probably fatally.

unx, 12th, Atchison, Topeka & Santa Fe, Seward, Okla., a passenger train was derailed and the first four cars were ditched. The train was running slowly and only one passenger is reported injured.

unx, 12th, 8 p.m., St. Louis, Iron Mountain & Southern, Neelysville, Mo., passenger train No. 1 was derailed, and two coaches, one sleeper and a private car, were ditched. Ten passengers and two trainmen were injured.

rc, 13th, New York, Chicago & St. Louis, Mentor, Ohio, a freight train ran into the rear of a preceding passenger train; two trainmen were killed and 12 passengers were injured. There was a dense fog at the time.

rc, 13th, Illinois Central, New Orleans, La., a pay car train ran into the rear of a preceding freight train, wrecking the engine and several cars. The engineman was killed and the fireman fatally injured. There was a dense fog at the time.

bc, 15th, Texas & Pacific, Donaldsonville, La., butting collision of freight trains; four trainmen killed and two injured.

xc, 16th, 10 p.m., Pennsylvania, Canton, Ohio, an eastbound express train ran into a freight of the Wheeling & Lake Erie at the crossing of the two roads, and both engines and one mail car and one smoking car were badly damaged. The engineman and fireman of the freight were fatally injured.

dn, 16th, 9 p.m., Texas & Pacific, Waterford, La., a passenger train was derailed at a misplaced switch and overturned; fireman killed; engineman and two trainmen injured.

rc, 17th, St. Louis, Iron Mountain & Southern, Bald Knob, Ark., a slow freight train was run into by a following fast freight, and the engine, caboose and one car damaged. The conductor and one trainman were killed, and two trainmen were injured.

*xc, 17th, New York Central & Hudson River, Palmyra, N. Y., a freight train on track No. 3, standing at a water tank, was run into at the rear by a following freight, derailing the caboose and one freight car, which fell on track No. 2. Passenger train No. 57, on this track, approaching just at that moment, was derailed and its two engines were overturned. One engineman was fatally injured. The caboose of the wrecked freight train took fire and four passenger cars, two baggage cars and some of the freight cars were quickly burned up.

xc, 17th, Atlantic Coast Line, High Springs, Fla., a freight train collided with some freight cars; three trainmen killed and one injured.

dr, 17th, Southern Railway, Viley's, Ky., a mixed train was derailed by spreading of rails, and one passenger car was overturned and fell down a bank. Five passengers and one trainman were injured.

rc, 18th, Cleveland, Cincinnati, Chicago & St. Louis, Crossville, Ill., rear collision of freight trains; one trainman killed and one injured.

bc, 18th, 3 a.m., Houston & Texas Central, Thornton, Tex., passenger train No. 5 ran over a misplaced switch and into the head of a freight train standing on side track, wrecking both engines and several cars. Five trainmen and two passengers were injured.

bc, 18th, Vandalia road, Bushrod, Ind., butting collision of engines; one brakeman killed; three other trainmen injured.

bc, 18th, Atlantic Coast Line, Jacksonville, Fla., butting collision between northbound passenger train No. 82 and a southbound freight; one man killed; three injured.

unf, 19th, Yazoo & Mississippi Valley, Southwood, La., a passenger train was derailed by running over a cow, and the engine was overturned. The engineman and fireman were killed.

unx, 19th, Chicago, Rock Island & Pacific, Cullison, Kan., passenger train No. 30 was derailed and several cars were overturned; 12 persons were injured.

xc, 20th, Wabash road, Stonington, Ill., an empty engine ran into a work train, damaging several cars. Twenty-five employees were injured, eight seriously and one fatally.

unx, 20th, 11 p.m., Rutland road, Shelburne, Vt., an express train was derailed and several passengers slightly injured.

bc, 21st, Great Northern, Hillyard, Wash., butting collision between an empty engine and a freight train. Three employees killed. The engineman of the empty engine had no conductor, and started from the station in violation of rules, and without a clearance card.

eq, 21st, 10 p.m., Boston & Albany, Allston, Mass., an express train consisting of two engines and eight cars was derailed, while running at high speed, by the breaking of a parallel rod of the second engine; but, according to the reports, one brakeman was the only person seriously injured. The leading engine was the only part of the train not derailed.

bc, 22d, Southern Pacific, Harney, Nev., a freight train standing at the station was run into by a passenger train from the opposite direction, and 20 passengers were injured. The freight conductor was in the station, to ask for more time, and the engineman is said to have failed to clear the main track because his watch had stopped.

*†xc, 23d, 2 a.m., Minneapolis, St. Paul & Sault Ste. Marie, Enderlin, N. Dak., an eastbound passenger train, about two hours late, collided with a switching engine at the entrance to the yard, and both of the engines and several passenger cars were wrecked, and some of the cars fell down a bank. Two dead cars were overturned and the wreck took fire from coals in the stoves in the cars. The train was well filled, and nine passengers (all in the smoking car) were killed and 33 were injured, two of them fatally. The smoking car was crushed by the baggage car, which was pushed backward and upward and then fell through the roof of the passenger car. The switching train was on the main track in violation of rules.

bc, 24th, Buffalo, Rochester & Pittsburg, Eagle, N. Y., butting collision between passenger train No. 2 and an empty engine, wrecking both engines and the first two cars of the passenger train. Two trainmen killed and two injured.

*rc, 25th, Philadelphia, Baltimore & Washington, Wilmington, Del., a passenger train ran into the rear of a preceding freight train, and the passenger fireman, who jumped off, was injured. The caboose and three cars of the freight train were wrecked and took fire, and, with a quantity of lumber in a lumber yard near the road, were burned up. It is said that a block signal man had given a false clear signal.

xc, 25th, Rio Grande Western, Mounds, Utah, passenger train No. 3 collided with a freight engine standing on a side track; three trainmen killed.

dn, 25th, Southern Railway, Moncrief, Fla., passenger train No. 3 was derailed at a derailing switch and the engine was overturned. The fireman was killed and the engineman scalded.

bc, 26th, Cleveland, Cincinnati, Chicago & St. Louis, Brookville, Ind., butting collision of freight trains. A man riding on one of the engines was killed and two other men were injured, one of them fatally.

dr, 27th, Gulf, Colorado & Santa Fe, Somerville, Tex., a passenger train was derailed at a defective switch, and the engine and first two cars were overturned. The engineman and fireman were fatally injured.

†xc, 28th, Northern Pacific, Detroit, Minn., an empty engine ran into the rear of a stock train, which had been stopped on account of a hot journal. Five men sleeping in the caboose were killed.

xc, 29th, Seaboard Air Line, Peachland, N. C., passenger train No. 32 collided with a string of freight cars, making a bad wreck. The engineman was burned to death.

†rc, 30th, 7 p.m., Baltimore & Ohio, Terra Cotta, D. C., eastbound local passenger train No. 66, just starting from the station, was run into at the rear by a train consisting of an engine and eight passenger cars, and all of the three cars of No. 66 were wrecked. Forty-three persons were killed and 67 injured. The victims included some who were standing in the station platform. The empty train appears to have been running at uncontrolled speed under a permissive block signal. The engineman of this train had been on duty long hours without rest. There was a dense fog at the time. This accident was reported in the *Railroad Gazette* of January 4, 11 and 18.

bc, 30th, 11 p.m., Vandalia, Indianapolis, Ind., butting collision of locomotives running slowly in the yard. One fireman was killed.

eq, 30th, Southern Railway, Chatham, Va., a freight train was derailed at a curve by the breaking of the flange of a wheel, and eight cars were wrecked. Two men were killed and two injured.

Four-Cylinder Compound Locomotive for the Italian State Railroads.

There was exhibited at the recent Milan Exposition, a locomotive built for the Italian State Railroads that possesses so many variations from standard practice that it may fairly be classed as an experiment. The machine was built by the Società Italiana Ernesto Breda, Milan, and is one of the most powerful locomotives built, up to this time, for the state system. It is intended for service in express passenger work between Milan and Venice. It is a four-cylinder compound, with six wheels coupled, and, as will be seen from the reproduction of the photograph, is designed to run normally with the cab to the front. The four-wheeled bogie truck is set beneath the rear end of the boiler, and has a wheel base of 7 ft. 8½ in. A peculiarity of this truck is that the center plate is not situated midway between the wheels, but the space is so divided that the distance from the outer wheel to the center plate is 49.2 in. and 43.3 in. to the wheel beneath the throat. As the driving wheels are 75.59 in. in diameter the rigid wheel base is carried out nearly to the end of the smokebox, making it necessary to set the cylinders well out to the rear beyond the smokebox, and to carry them on an extension to the frames. The arrangement of these cylinders is even more novel than their location and general appearance. Instead of the usual arrangement of placing the high-pressure cylinders outside the frames and the low-pressure between them, or *vice versa*, the two high-pressure cylinders are placed on one side and the two low-pressure on the other side of the engine, one of each being outside and the other between the frames. These two sets of cylinders are each cast in one piece together with their common steam chest, forming an exceedingly complicated casting. They are bolted together along the center line, the low-pressure cylinders being upon the left-hand side. The arrangement of cranks on the two sides of the engine follows the usual practice in that they are set 180 deg. from each other and 90 deg. from those on the opposite side. This makes it possible to use a single distribution gear for each set, or two for the engine, in accordance with the usual practice. At the same time it will be noted that, with this arrangement, the actual starting will usually be done with either the high or low-pressure cylinders, while the others may be exerting no turning moment at all. For example, if both high-pressure cranks are on the centers, the starting must be done by the live steam admitted to the low-pressure cylinders, the whole work being done upon one side of the engine. The moment the engine has passed the center, however, the other set comes into action. This is merely an extension of the conditions that exist with the two-cylinder compound to the working of the four-cylinder, and is unusual.



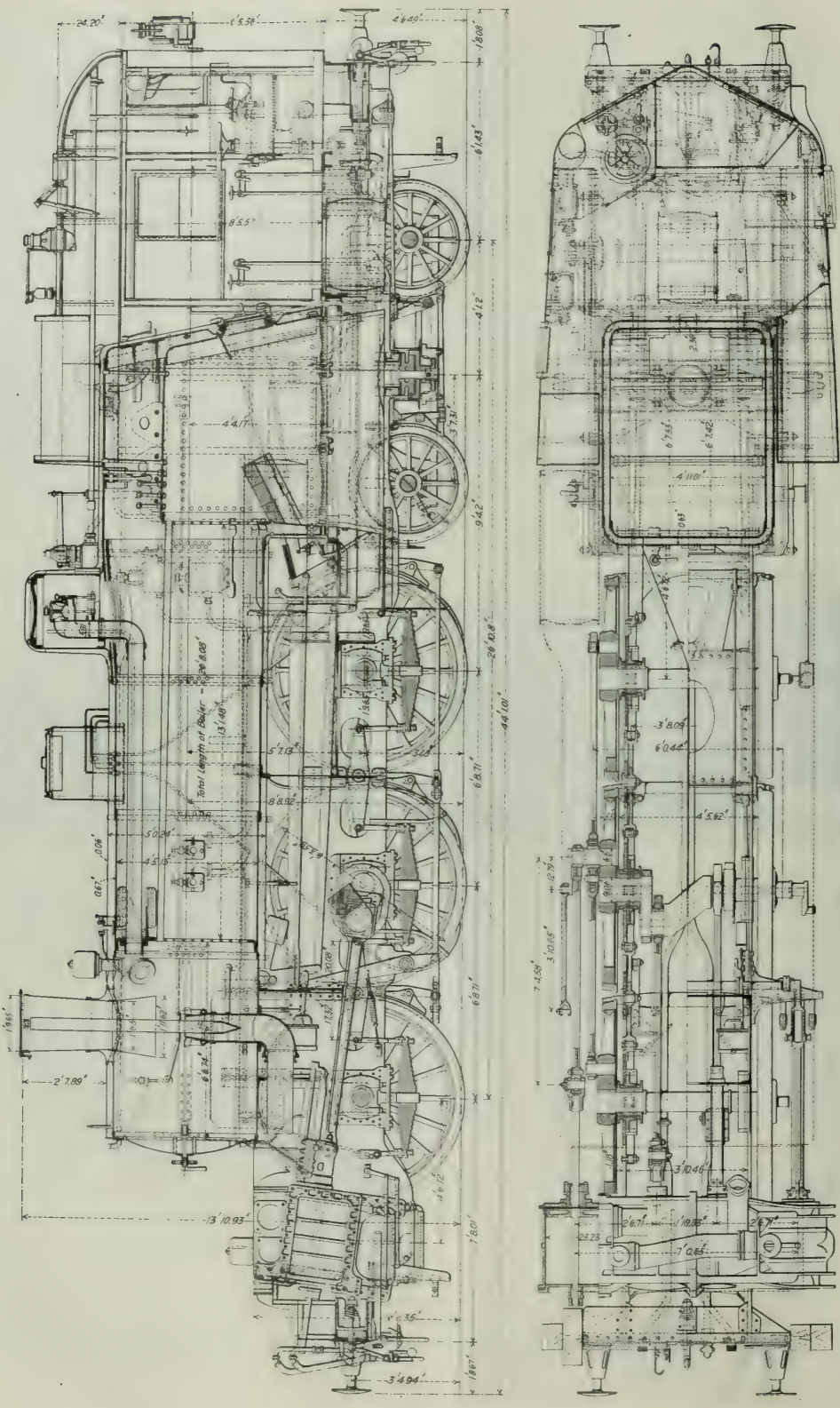
Four Cylinder Compound for Italian State Railroads. Normal Position of Engine and Tender.

In order to clear the forward driving axle with the cross-heads and guides of the inside cylinders, the latter are raised and inclined downward toward the wheels. It is thus brought about that one high and one low-pressure cylinder are horizontal while the other two are inclined.

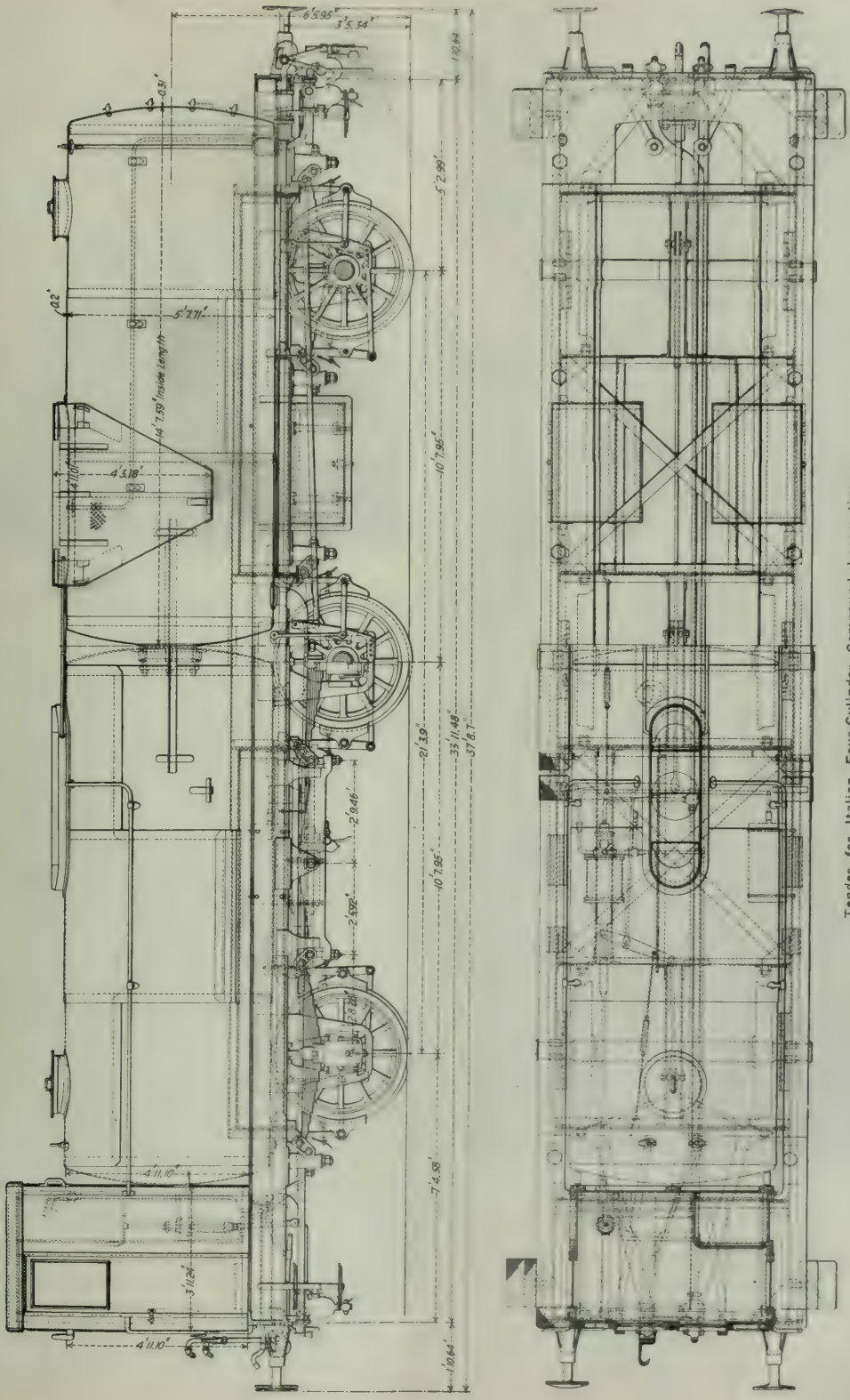
The four connecting rods drive the same axle, which is the middle one. This crank axle, whose general appearance is shown by the engraving, is of nickel steel made by Krupp, and contains between 5 and 6 per cent. of nickel. It is forged solid with the crankpins bored hollow with a 2¾ in. hole that extends back to the bend for the diagonal connection. This part is rectangular, with a thickness of 7⅞ in. and a depth of 10¼ in. The disc, uniting the crankpin portion to the journal, is strengthened by having a heavy steel band shrunk upon the outside. The valve gear is of the Walschaert type and is driven from the outside crankpins and crossheads. The reversing mechanism will seem rather complicated to an American and can best be understood by following out the lines of connection on the engraving. This shows that the reversing lever is replaced by the vertical screw and shaft with a horizontal wheel, operating a block sliding in the jaws of a bell crank, from the vertical arm of which a connection leads forward to an intermediate lever suspended beneath the boiler, by which the motion is somewhat reduced, and is thence carried by another connection on to the arm of the lifting shaft. The radius bar and its hanger are counterbalanced by a weight. The valve is of the piston type and works in a steam chest that is above and parallel to the outside cylinder. The valve itself can be made simpler than that commonly used with four-cylinder compounds in that it does not have to provide for the distribution of the high-pressure exhaust to the low-pressure cylinder and the final exhaust from the latter; for it has only to admit steam to the set of cylinders to which it is attached and exhaust the same when it has done its work. The ports leading to the two cylinders may have the same opening into the steam chest but cross in the casting, which makes it a complicated one to make, as already stated, but simplifies the valve construction and operation proportionately.

Steam is taken into the dry-pipe at the dome through a Zara throttle valve which has already been described in the *Railroad Gazette* of December 21, 1906. This is a balanced throttle in which the use of a double seated valve is avoided and the balance obtained by a piston at the lower end. In this case it possesses a further modification by which steam is admitted to the receiver between the two sets of cylinders, whence it flows to the low-pressure steam chest and serves to start the engine. As the valve starts to open, a small valve at the side, controlled by a separate arm on the throttle rod, is opened and admits steam to the receiver. After the engine is under way, and the throttle is opened more, this passage port to the receiver is closed by the further movement of its valve and the engine is put into compound action. The general appearance is shown by the photograph of the apparatus as set up for demonstration. The dry pipe runs to the front tubesheet and then, at the T head, turns to the left, and drops down through the smokebox to connect beneath it with the flange of the high-pressure steam chest at the point shown on the plan.

The steam after having done its work is exhausted into a pipe 9⅞ in. in diameter, that occupies the same position and reminds one very much of the pipe leading from the low-pressure cylinder back to the smokebox in the Mallet compound built for the Great Northern Railway, and illustrated in the *Railroad Gazette* of Oct. 12, 1906. In each case, an expansion joint has to be inserted. The single exhaust pipe of this engine finally terminates in a variable nozzle of the annular type that can be operated from the cab by the rod that is shown extending along the side of the boiler in the reproduction of the photograph; while the details of the mechanism can be followed out in the drawing. It consists simply of an arrangement of bell cranks and connections by which the two halves of the nozzle are turned back and forth on hinges by which the opening about the central pipe is made larger or smaller. This central pipe is suspended from above and ends in a cone at the bottom by which a core is cut out of the center of the exhaust jet. The central cone is no novelty, but the use of a pipe reaching to the top of the stack by which the steam is prevented from filling the hollow that has been formed will be new to most readers. The effect of this will undoubtedly be to give the exhaust jet a wider angle of divergence than it would otherwise have, while the presence of the pipe at the center will probably check the velocity of the blast, though this last effect will be hardly appreciable.



Plan and Elevation of Italian Four-Cylinder Compound.



Tender for Italian Four-Cylinder Compound Locomotive.

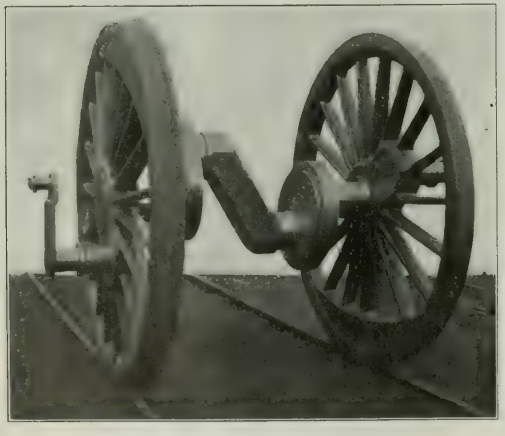
The stack offers no particular novelty other than the damper over the top, which is common European practice.

The spring suspension varies somewhat from American practice in the details of its arrangement. In the first place the three pairs of drivers are equalized, but the equalizing bars are so proportioned that only about 30 per cent. of the total weight on the drivers is carried by the main pair, while about 35 per cent. is carried by the front and back pair, each. This just reverses the usual custom in the United States; where, if any difference is made, the greater weight is put on the main pair of drivers. Nor is this all. The driving springs are underhung and have a camber away from the load. That is, the main plate is bent back and down so that it has passed the horizontal position. This is something that is almost never done, and every attempt is usually made to avoid this condition of spring action. Finally, the spring hangers are acting under compression, and these are comparatively small bars or bolts of about $1^3/_{16}$ in. diameter, with the whole thrust taken against the face of the nuts by which the length is adjusted.

The engine is fitted with the Westinghouse brake, with shoes on all wheels, worked by two cylinders, one on each side, and set well forward beneath the smokebox. A hand-brake of the screw type is also added, so that the driver brakes can be set in that way if it is desired; a condition that has not yet been provided for in similar service in this country.

The boiler is fitted with a copper firebox with side sheets held by stays of manganese bronze whose composition is 94 per cent. copper, 1 per cent. tin and 5 per cent. manganese. This produces a metal of about 43,000 lbs. tensile strength with an elongation of 30 per cent. The firebox roof-sheet and boiler shell are of iron, having a tensile strength of 53,000 lbs. and an elongation of 27 per cent. The tubes are of brass. A short brick arch carried on side brackets is used. At the door plates are inserted to protect the sheets from the shovel. For an engine of this length the tubes seem short; though, in reality, they are not particularly so, as they have a length of 13 ft. 1½ in. The water leg is very narrow, being but 2⅝ in. thick at the rear.

In the cab we find still more changes from the usual order. Like the American suburban engines that are intended for working in both directions without turning, this engine is provided with coal bunkers in the cab. These are placed on the right-hand side, one beside the firebox and the other at the end, as shown in the plan. The capacity of these bunkers is five tons. With such an arrangement it will be natural to expect that there will be a heavy load upon the right-hand side bearings of the truck when the engine is loaded, and that, if a variation is made in the strength of the springs to carry the loads imposed on the two sides, the engine will be thrown over to the left when it is empty. This is exactly what did happen in the case of some locomotives built for an American road

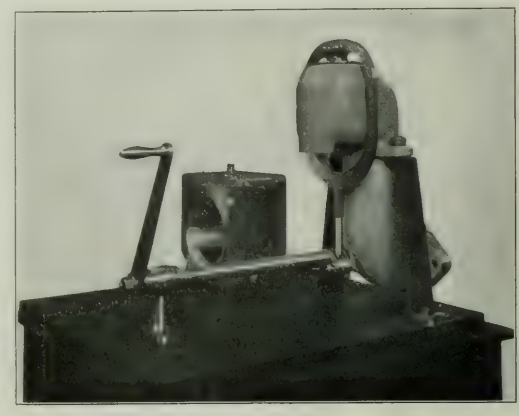


Crank Axle, Italian Locomotives.

a number of years ago when the coal bunker was placed on one side of the cab.

In the matter of cab and engine fittings the locomotive abounds in novelties, some of which would appear to American eyes to be decided inconveniences. Take the location of the operating parts in the front left-hand corner of the cab as an example. The throttle lever is suspended from the roof and swings across the cab. Back of this is the screw reversing wheel, and over behind it is the engineer's valve. It may be a mistake, but it seems difficult to imagine an arrangement that could be much unhandier and one in which speed of manipulation in case of an emergency would be much more hampered, to say nothing of the exceedingly cramped space that is apparently given to the engineman in which to do his work.

The tender is quite as novel in design as the locomotive itself, and it is difficult to account for some of the details on the ground of practical utility. In the first place it has a cylindrical tank, in which there is no novelty, but why the tender should have been provided with two tanks, placed end to end and connected by pipes at the bottom is difficult to understand. These tanks are each 5 ft. 7.7 in. in diameter and 14 ft. 7.6 in. long, and have a total combined capacity of 4,445 gals. At the top of each there is an oblong water hole, below which is a well of perforated metal so that the water



Zara Throttle Valve, Italian Locomotives.

entering the main body of these tanks is strained of its coarser impurities.

In addition to the two tanks the tender is also fitted with a brake van in which is the brake wheel by which the brakes may be applied. Shoes are set upon each side of each wheel by means of a hand-operated screw that must take some time in its manipulation. The shoes are interfulcrumbed, so that all are brought to a bearing at the same time. One of the features of the tender is the readiness with which it can be detached from one end of the engine and attached to the other, it being the intention to provide for running the locomotive with either end to the front, but with the tender always at the rear. The running gear also varies somewhat from the ordinary type found abroad in that the two pairs of wheels next the brake van are equalized, but with the equalization so proportioned that the greater weight is carried by the wheels at the end. Other than this, the spring suspension is typical of European practice, having the usual semi-elliptic springs over the journal boxes. Here attention may be called to the difference in the practice as shown on the engine and on the tender. On the latter the spring hangers are in tension and the set of the springs is against the load, while on the engine the reverse is the case, as already noted. The underframe is metal, with I-beam side sills, and the bracing follows the general lines of ordinary design.

In this engine we have another instance of radical departures from accepted practice, as so often occurs on European railroads, where the mechanical superintendent has a free hand to build what he chooses, and where it sometimes seems that he was bent on doing something different from his neighbor. That such an engine will work all right, there can be no doubt, but when looked at with an eye to accessibility of parts and convenience of handling it seems as though it left much to be desired. It is rarely that an engine appears that shows so much of originality of design and variation from current practice as this one. In fact, there is scarcely a point between the rail and the top of the stack that does not present some point of difference as compared with American practice, in addition to the points that have been touched upon. Such, for example, as the design of the truck, the shape of the cab, the rectangular sandbox, the safety valve on the dry pipe, the frames, the comparatively small diameter of the boiler shell, the high pressure, and, in fact, every detail entering into its construction, all of which makes it exceedingly interesting as a study of what is going on away from home.

The principal dimensions of the engine are as follows:

Cylinders, diameter, H. P.	14.17 in.
Cylinders, diameter, L. P.	23.22 "
Piston, stroke	23.63 "
Wheels, diameter, driving	75.59 "
Wheels, diameter, truck and tender	43.11 "
Wheel base of engine	26 ft. 11 "
Wheel base of engine and tender	65 " 7.6"
Boiler, length	26 " 8 "
" diameter of shell	4 " 5 "
" thickness of shell	0.66 "

Firebox, thickness of tube sheet	1.18 "
Heating surface	2,317 sq. ft
Grate area	32.29 "
Tubes, kind	Serve
" number	129
" diameter	2⅜ in.
" length	13 ft. 1½ "
Steam pressure	220 lbs.
Height of center of boiler above rail	8 ft. 8⅝ "
" " top of stack above rail	13 " 11 "
Frame, total length of engine	40 " 7 "
Engine, total length over buffers	44 " 1 "
Engine and tender, total length over buffers	81 " 9.7 "
Weight in working order	155,680 lbs
" on driving wheels	95,400 "
" of engine and tender	237,450 "
Coal capacity	9 tons
Water capacity	4,445 gals.
Working speed	56 miles per hour
Tractive power	19,640 lbs.
Ratio of high to low pressure cylinders	1 to 2.68

$$\frac{\text{Weight on drivers}}{\text{Tractive power}} = 4.85$$

$$\frac{\text{Total weight}}{\text{Tractive power}} = 7.93$$

$$\frac{\text{Tractive power x diameter drivers}}{\text{Heating surface}} = 669.63$$

$$\text{Firebox heating surface} = 115.66 \text{ sq. ft.}$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 68.66$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 0.052$$

$$\frac{\text{Weight on drivers}}{\text{Total heating surface}} = 43.03$$

$$\frac{\text{Total weight}}{\text{Total heating surface}} = 70.22$$

$$\text{Vol. 2 H. P. cylinders} = 4.30 \text{ cu. ft.}$$

$$\frac{\text{Total heating surface}}{\text{Vol. 2 H. P. cylinders}} = 515.58$$

$$\frac{\text{Grate area}}{\text{Vol. 2 H. P. cylinders}} = 7.5$$

The Protected Third-Rail on the Milan-Varese Railroad.

A recent bulletin of the Italian State Railways, summarized in *L'Ingegneria Italiana* of Nov. 16, offers interesting details of construction and expense of operation of this secondary line running from Milan to Porto Ceresio. The third rail used is of the regular State Railroad type, 39 ft. 4 in. long, weighing about 90 lbs. to the yard. A special steel a little softer than the average is used for these rails; its resistance is about 11 times that of copper. The rails are hard enough for use under wheels, however. The third rail is placed between the two tracks, being carried to the outside at switches and crossings. Its axis is 25⅝ in. from that of the nearer track-rail, and rises 7⅝ in. above it. At the joints, the third rail is provided with a fish-plate having two poles, and with the idea of further ensuring the continuity of the circuit there is set a copper connection with lugs. The supporting insulators are composed of a cast-iron tripod and a cap separated by an isolating cylinder of artificial granite. The cap is in direct contact with the third rail, and does not obstruct its longitudinal expansion, but prevents any lateral displacement by the interposition of a couple of cleats forming part of the cap itself. These insulators are attached to the ends of extra long ties, nearly five yards apart. Their insulating efficiency is so great that even after being soaked in water for over 100 hours they can resist a continuous current of 1,100 volts for six hours without any noticeable sparking or heating. To provide for lengthening due to changes of temperature, a space is left at intervals of 10 rails (131 yds.), and special flexible connections are used to maintain the circuit. At switches, grade crossings, etc., the circuit is closed by an underground copper cable, like those connecting the sub-stations with the conductor. At each break the third rail is bent downward, so that the connecting shoe will take it even at high speed without sensible shock. Every 1⅝ miles there are set along the line, in cast-iron boxes, knife section insulators, connected with the third rail by insulated cables. These are normally closed, dividing the conductor into so many sections; when opened, they make it possible to locate speedily any break or short circuit along the line. At the stations, and in general wherever employees or the public have to cross the tracks, the third rail is protected against contact by wooden planks which cover it above and at the side, and are supported by wooden stakes driven in the ground two meters apart. In connection with the station platforms, the protection is furnished by a corrugated iron strip set in the granite of the platform. The track rails are 10-13 yards long, weighing about 72 lbs. to the yard, with wooden ties, 17 to a 13-yd. rail. These rails are used for the return current, and are provided at the joints with copper connections. In addition, the two rails of one track, as well as the inner rails of double track, are joined every 100 meters by copper connections. The resistance of one kilometer (.62 miles) in operation is about 0.037 ohm; the loss due to insulation varies under normal conditions from 0.15 to 0.2 ampere per kilometer of third rail, according to the humidity. The total third rail mileage from Milan to Porto Ceresio is about 72 miles. The installation of the third rail cost about $493,600; the expense of operation has been as follows:

Year ended June 30:	Personnel.	Exp. material.	Total.
1903	$2,167.78	$2,858.52	$5,026.30
1904	2,154.46	2,773.22	4,927.68
1905	2,159.48	5,320.05	7,479.52

*From July 1 to June 30.

The Teredo in South Africa.

The ravages of the teredo have so serious an effect on wharf and pile maintenance cost, all along the South African coast, that the situation is comparable with that of our Gulf states and of southern California, varying with localities, as is the case in this country. It seemed desirable that a comparative study should be made of the methods used to meet the difficulty, and Mr. W. W. Hoy, General Manager of the Central South African Railways, has kindly collected for us the data printed below. Reports are given from the General Manager of the Cape Government Railways, the Director of the Portuguese system, and the Chief Engineers of the Central South African system and of the Durban Harbor Department, and an abstract of a paper by Mr. F. W. Waldron, Resident Engineer of the Mossel Bay Harbor Works, read before the Cape Society of Civil Engineers, is appended. It is fair to say that a complete resumé of the best foreign practice in dealing with the teredo is thus given:

LOURENCO MARQUES RAILROAD.

Lourenco Marques, Oct. 18, 1906.

In reply to your letter of even date and the copy of the Central South African Railway's General Manager's letter enclosed therein, regarding the depredations of the teredo to the timber used in the construction of the pier at this port, I beg to state that the timber used is, as you know, of the Australian jarrah, a sort of wood which resists pretty well the attack of that mollusc. The timber, which is already some four years old, is somewhat attacked by the teredo, especially between the lines of spring tides and leap tides. The holes, however, are not very deep at present. For the protection of timber from the teredo we have coated it with tincture "Sotor." This tincture is not, however, sufficiently lasting to convey a complete idea of its efficacy.

F. RAMOS COELHO,
Engineer-Director, Camino de Ferro de Lourenco Marques.

CAPE GOVERNMENT RAILWAYS.

Cape Town, Oct. 15, 1906.

With reference to your letter of the 17th ultimo, regarding the protection of wooden piles from the ravages of the teredo, I subjoin, for your information, copy of a report by the resident engineer in charge of construction, Buffalo river bridge, who has had some experience with timber piles:

"The device of a lock joint concrete pipe made in half sections, referred to by Mr. Price, has been tried in various countries with more or less success, and where no bracing or walling below water is required, it would be preferable to use these pipes in place of copper sheathing, provided that suitable material for their manufacture is to be obtained economically. A lock joint whole section pipe made of Monier concrete for slipping over piles is manufactured by Messrs. J. Wright & Sons, of Southcoast Junction, Natal, but I am not aware of the cost of the same."

T. S. M'EWEN,
General Manager.

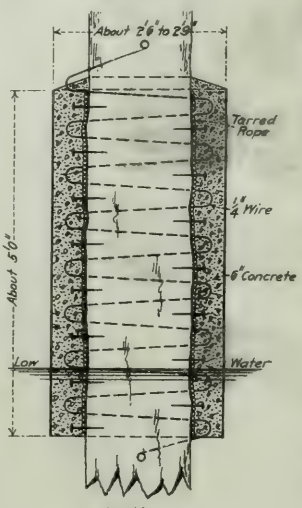
HARBOR DEPARTMENT, DURBAN.

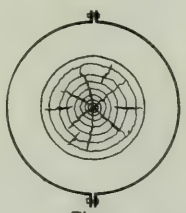
Durban, Oct. 31, 1906.

Both the teredo and the limnoria are very destructive to timber in our bay, and for nearly 20 years past round jarrah has been used for piles for timber wharfage as being least liable to injury from these sources. Recently we have made use of turpentine (syncarpia laurifolia), which has worm resisting properties equal if not superior to jarrah. Our experience is, however, that no timber will withstand either of these destructive agents indefinitely, and therefore for a number of years past wooden structures have as far as possible been superseded by permanent concrete wharfage, of which we have now 6,835 ft. practically complete with depths from 23 to 34 ft. alongside. The readiness with which the teredo and the limnoria attack timber will be understood when I mention that in the case of blue gum piles of 18 in. diameter employed alternatively with jarrah wood piles for the timber wharfage at the bluff, a number of the former were practically eaten through in three or four years, and others have had to be, and are being,

renewed from time to time. These blue gum piles were grown in the colony and were not nearly so good for submarine work as imported jarrah or turpentine, though, of course, the latter are much more expensive. We have tried many experiments for making piles worm-proof, such as sheeting them with Muntz metal or copper but without any permanent success. Hewn or sawn timber is more readily attacked than round timber, and now we use nothing but round piles for this class of work, as it is considered that the astringent properties of the wood next to the bark, and the bark itself, act as a deterrent, and for bracings we use double-headed iron rails on account of hewn timber being a ready prey for the work.

As is well known to marine engineers the destructive effects of the teredo and limnoria on timber are chiefly experienced between low water and high water marks of ordinary spring tides. Some years ago I made an experiment of encasing a wooden pile in concrete for a few feet on either side of mean tide level to ascertain how far the ravages of these creatures might be checked by this means. The process was as follows: Around the pile to be protected tarred rope was wrapped to serve as a cushion against expansion. Over this and fastened from a point about a foot above high water mark, a spiral binding of fencing wire was loosely wound so as to leave 2 in. or 3 in. clearance between the spirals and the pile, the object of this being to reinforce the concrete casing. Over this the two semi-circular halves of a cylindrical shell or mould were placed and bolted together, the bottom being stopped up by means of canvas wound tightly over the lower end of the mould and round the pile. A mixture of ordinary concrete was then poured in and allowed to set for some days, after which the mould was detached and set aside. The accompanying section shows the work when finished. The result attained so far has answered my expectations and I see no reason why piles protected in this manner should not last for a number of years longer than in ordinary cases where the timber is continuously exposed to attack. My experiment was, however, confined to this instance alone, and as the pile selected was in a sheltered position under one of the timber jetties, I am unable to say whether the front piles of a structure protected on this principle would stand the direct shocks communicated by vessels moored alongside without breaking up the concrete casing. Some means of preventing this might if necessary be devised, but the inner piles would, of course, be in no danger.





Pile Protection by Concrete Sheathing, Durban, South Africa.

I should be glad to know the particulars and results of any experiments made at other ports for the prevention of injury to timber structures from causes similar to those dealt with in the foregoing remarks.

—ACTING CHIEF ENGINEER.

CENTRAL SOUTH AFRICAN RAILWAYS.

September, 1906.

With reference to your letter of the 17th instant, I have only had occasion once to put in piles for a temporary bridge in sea water, on the east coast of India, and to protect the piles from the teredo navalis they were sheathed in copper. The same experience was met with in this method of construction, in that the copper was soon stripped when sinking the piles, and such portion of the plates as remained above sea level were soon stolen by the local boatmen. I had eventually to fill in the spot with dry stone rubble in order to carry the railroad across it.

Personally if I had anything to do with constructing a quay I should never dream of using any timber in it below sea water level, as I consider our knowledge of reinforced concrete is sufficiently advanced to enable satisfactory piles to be made of this substance which would resist any attacks, and if the locality did not suit these concrete piles, I should be inclined to sink a series of small walls to a satisfactory depth to form the face of the quay wall.

—CHIEF ENGINEER.

CAPE SOCIETY OF CIVIL ENGINEERS.

Extract from paper entitled "The Destruction of Timber on the South African Coast by Marine Wood-borers," by Frank W. Waldron, A.M.I.C.E., member, Resident Engineer, Mossel Bay Harbor Works.

The distribution of the limnoria according to various authors is as follows:

Along the American coast from Florida to Nova Scotia, Long Island Sound, the coast of Massachusetts, the Bay of Fundy, the North Pacific coast, Puget Sound, the Straits of Fuca, upon the coast of Great Britain, and in other parts of Europe, they also exist around the South African coast more or less from East London to Robben Island, though the limnoria has not up to the present been seen at Mossel Bay.

As far as is known, no wood is proof against the marine wood-borers except sneezewood, but as this wood is scarce, and almost unprocurable in suitable sizes, its existence has to be disregarded in designing marine works of any magnitude.

A few piles of sneezewood were used at Port Alfred (Kowie river) in the construction of some groynes. These piles were removed after being down for over 40 years, and found quite intact and free from any kind of decay.

The following is a list of the various woods used on this coast, and observed by the author:

(1) Jarrah.
(2) Teak.
(3) Karri.
(4) Knysna iron wood.
(5) Knysna yellow wood.
(6) American elm.
(7) Pitch pine, and several kinds of deal.

Of all these woods, jarrah in an unprotected state gives the best results; an instance has, however, just come under observation, where the end of a 12 x 6 jarrah bracing was almost destroyed in 12 months.

At East London, jarrah piles 12 in. and 15 in. square were attacked by the teredo and limnoria.

The late Mr. G. F. Tippett, resident engineer to the East London harbor board, stated in a communication to the public works department: "That some of the jarrah in our wharves has stood fairly well, but some has been attacked by the teredo, also by the limnoria. That which was hard and would not float stood well, but that which was light and buoyant did not stand so well. Karri is sometimes substituted for jarrah."

Mr. Tippett gave the life of jarrah as piles at 15 years.

The wharves referred to have been down between nine and ten years, the piles of which are all cut die square.

The acting resident engineer, Durban harbor board, also says: "Round jarrah piles if cut at proper seasons and grown in the iron-stone districts could be depended upon to last for a long period. Some of the piles driven in an old wharf at the time of the Zulu war (22 years ago) are still in fair state of preservation; round piles have been used extensively in wharf construction here and we have always found it stand well, notwithstanding that the teredo and limnoria are very active in these waters. That used in form of square bracings was eaten clean away for about two and three feet between low and high water mark.

"Several kinds of timber from Australia have been tested from time to time, but none of these come up to sound jarrah, with the exception of syncarpia laurifolia, turpentine wood—which, after being under test for two years' immersion, shows no signs whatever of being attacked."

It will be seen by the preceding evidence that notwithstanding the durability of jarrah over other woods, under some conditions it succumbs to the wood-borer much earlier than is generally supposed, so that unless the timber has been grown in the proper soil and felled in the right season, there is little chance of it standing the effects of the worm for any considerable period.

Teak.—Twelve inches square used for piles at Port Alfred were soon destroyed; some of these in a jetty were completely eaten through between high and low water, with the combined work of the teredo and limnoria in 12 years.

Yellow Wood.—Unprotected has been used extensively for temporary piles; some of these have been nearly destroyed in three months; instances have, however, been known where they have lasted for more than a year.

Some creosoted fender piles in a jetty at Mossel Bay have been down for 12 years, are in fairly good state of preservation under

the water, but almost destroyed above water where subjected to much wear.

Knysna Iron Wood.—Unprotected does not appear to last much longer than yellow wood; some fender piles have been quite destroyed in three years.

Karri.—This timber though tough, heavy and close in grain, does not withstand the teredo well. In some piles used for staging, nearly two-thirds of the cross section has been bored in 12 months, the outside showing little evidence of the presence of the worm. At Robben Island some karri fenders 12 in. x 6 in. were destroyed to a depth of 1½ in. by the limnoria in five years, but only a few teredo workings were found in the same timber.

Pitch Pine, Oregon Pine and Memel.—Has been used for piles and framing, but none of these in an unprotected state will last long.

American Elm.—Although too expensive in this country for jetty or wharves, even if suitable, is used sometimes for framings of tugs, lighters, etc. Some time ago whilst a steam tug at Mossel Bay was undergoing repairs it was discovered that the keel was eaten by the teredo. A portion of the copper sheathing on it being chafed, exposed the wood, at which spot the worm attacked it, almost destroying the keel in a few months.

At Mossel Bay the teredo is practically active in all kinds of timber, more so, it is believed, than at any other place on the coast. The limnoria has, however, not been seen there.

Protective Measures.—Of the various means of protecting timber used in sea works against the wood-borers, none have so far been found altogether efficacious or reasonable in cost.

The methods of protection resorted to in this country are few, and they are as follows: Copper sheathing, creosoting, and the "teredo" or "worm nails" (such as used in Holland).

In weighing the merits of the above means of protection, it does not appear that the advantages are commensurate with the cost.

The copper sheathing of piles if properly done will cost from 4s. 6d. to 5s. per foot run of 12 in. x 12 in. timber, creosoting 2s., and teredo nails about 3s., in addition to the cost of the timber.

As already shown the copper sheathing, unless kept intact, which is most difficult, does not ensure the safety of the wood under it. Creosoting has also its disadvantages, inasmuch as the timber which takes creosote best is in nature light and soft grained, and will not bear heavy strains in structural features, whereas a heavy close grained wood does not absorb enough creosote to protect the timber for any length of time.

Teredo nails were used in a small number of piles at East London many years ago. The surface of the wood exposed to the attack of the teredo is covered with flat headed iron nails driven close; these nails on rusting formed an impervious coating. The system was, however, not continued for obvious reasons.

Various other methods of protection have been attempted in different countries, such as paints of verdigris, paraffin, asphalts, salts of mercury and of iron; cylinders of earthenware pipes slipped over the pile joined together, and the space between the pile and the cylinder filled with sand or cement have been used with a fair amount of success.

None of the methods of protection either external or internal have been altogether successful; the question therefore arises whether it is not better in the long run to use steel structures where the marine borers are active.

In ordinary jetties or wharves a steel girder 12 in. x 7 in. weighing 65 to 75 lbs. to the foot with a special cast-iron shoe, may be used for piles. It can be driven through any material into which timber is driven by an ordinary pile driver and a suitable dolly. Where solid rock is found the pile without the shoe can be dowelled into the same.

As regards the first cost of steel it should be very little more than timber, and in some localities less.

A 12-in. x 7-in. girder at 70 lbs. per foot being used in place of a 12-in. x 12-in. timber will cost from 5s. 6d. to 6s. 6d. per foot run. The walings and bracings may also be made from girders of various sections.

Regarding the protection of steel structures against rust, this may be effected by painting, or tarring the part above low water, but that below low water cannot be so treated; it is, however, found that the natural sea growth where not disturbed forms a coating in a very short time, which affords some protection from rust.

Discussion.

Mr. George Valder, representing the New South Wales Government, said that in Australia, New Zealand and South Africa, he had given attention to the question of timbers suitable for harbor work, and as far as his knowledge went no timber resisted the action of the teredo worm with the single exception of the turpentine tree (syncarpia laurifolia). In the paper just read Mr. Waldron referred to an experiment with a turpentine pile at Durban harbor; this was, he believed, the only trial of turpentine in South Africa, but he was pleased to be able to state that in this instance it had again proved a signal success. The engineer about two years ago had this pile raised; it had then been in the water a little over five and a half years, and although all the piles near it were badly damaged by the teredo and limnoria, this turpentine pile was as sound as the day it was put in. The engineer was so pleased with this result that he at once ordered 100 piles of from 50 to 55 ft. long. These had been used in connection with the Durban harbor works and a further large consignment had since been obtained.

Mr. Wynne-Roberts said that his experience fully bore out the remarks of Mr. Valder in the use of turpentine as the most successful timber to resist the teredo. He found the iron used in the bay for jetties was very liable to corrosion, and as an alternative to this or steel, he would like to see reinforced concrete employed, as at Southampton and at many places on the Continent and in the United States. With the use of reinforced concrete there was no danger from corrosion; the experiments at Liverpool showed that rusting from immersion in sea-water was negligible. He thought that the two points in favor in the use of reinforced concrete in the place of timber were (1) no painting required and (2) not attacked by the teredo or rust.

Mr. G. Lacy Good.—In 1882, when engineer-in-charge of harbor works investigations in the West Indies, for the late Sir John Coode, I found old jetties constructed of native white cedar, quite unscathed, and was informed that the teredo had never been known to attack this particular wood. But whole trees were used in these instances, stripped only of their bark; and I am of opinion that many other timbers might be found to resist worm action, were they not sawn up and the hearts thereby exposed.

As a further proof of this, during my experience in 1875-6 on the harbor works at the Isle of Man, where untrimmed piles of pitch pine over 50 ft. long, were used in the temporary stagings, there were never any signs of worm action.

Previous to the year 1882 it was believed amongst marine engineers at Westminster that green heart, though sawn up, was impervious to worm action. Mr. Good's researches, however, in the West Indies disproved this idea; for, as an instance, he found the Royal Engineers' Jetty at Barbadoes, which was constructed of that famous South American timber, had had to be sheathed with copper, owing to the inroads of the teredo. He remembers the agitation, caused by his report, in Sir John Coode's office, for at that time designs were being got out by Sir John for Table Bay harbor, in which the provision of green heart as fender piles to the Loch Jetty had been included.

Mr. Good's own experience of over 30 years agrees with Mr. Waldron's as to this worm action being greater in the warmer than in the colder seas, their action being more concentrated where the range of the tide is small, as in the case of Oceanic Islands, where the tidal wave does not exceed 2 ft. at full and change of the moon: the limit of destruction extending from a few feet below low water up to near high water mark.

The admixture of fresh water, as in the case of river estuaries, is usually discouraging to the teredo; but at Knysna harbor, South Africa, though there must be a considerable flow of fresh water over the surface of the salt, on the ebb tide, he found the results of worm action greater than he had observed elsewhere.

With regard to the question of the use of steel versus wood in the construction of marine works, no doubt, as Mr. Waldron says, in the long run steel structures would prove more economical than timber, but where funds were limited and timber plentiful, and the range of tide at the same time small, Mr. Good is of opinion that timber cased with Muntz metal at the water line should be used. The cost of the sheathing would not exceed £32 per bay or £2 15s. per foot run, in the case of a three-piled jetty, where the range of spring tides did not exceed 5 or 6 ft.

Scupper-nailing, as teredo or worm nailing is called in England, was a practice largely in use on the East Coast, and proved very effective in protecting the timber piers from destruction, as the large flat heads (about 1 in. in diameter) of the nails soon rusted together and formed a veritable coat of mail. He had seen this work done on a large scale at Great Yarmouth, and as this sort of work is relegated to the old men, who would otherwise have no employment, and are glad to earn a few shillings, the cost is not great. As, however, the heads of the nails are apt to spring off when the piles are being driven, it is not a practice Mr. Good can recommend. Creosoting, he has little faith in.

It is not generally known that some of the softer rocks are also subject to the boring propensities of certain denizens of the sea, but Mr. Good believes these do not come under the teredo classification but under that of the bivalve, these rock boring creatures being encased in long finger shaped shells. He came across an instance of rock thus acted upon when making an investigation at Kirkcaldy Harbor, N. B., where the argillaceous shale had been honeycombed by some marine creature, the perforations being as though cut by a drill, the foundations of the lock gates to the dock being thereby endangered.

Mr. R. Devenish-Meares.—The timber approach jetties at the entrance to the Kidderpore docks, Calcutta, were built of 14-in. sq. Greenheart piles in 1890. The writer had occasion to examine them

in the cold weather of 1900, and found many of them eaten away so completely as to reduce the area of the pile to, in cases, not more than 8 in. sq.; their ravages were worst between about 4 ft. above to 4 ft. below low water; below the lower level the timbers were practicaly intact. Perhaps the difference in the zone of depredation of the teredo between Table Bay and Calcutta may be accounted for by the difference in the nature of the bottom; that at Kidderpore was a fine silt, that at Table Bay, he believes, sand. The water at Table Bay he believes clear, that at Calcutta is of the consistency of pea soup for the greater part of the year. Not only the Greenheart piles, but also gate sill timbers and caisson timbers of teakwood were so badly eaten away within a period of nine years that gates and caissons had to be docked and new timbers put in.

It was found when the timbers were taken off that the teredo had actually attempted to eat into the steel plates, many holes being observed in these up to $^1/_{64}$ in. deep and perhaps $^1/_8$ in. in diameter.

As protection from further damage the new timbers were sheeted with Muntz metal.

Jetties built upwards of 40 years ago above Calcutta, at the various Ghâts, had their piles, in cases, sheeted with zinc. Any so sheeted were still perfectly good in 1900, so it was considered that to sheet all new piles and timbers below water was the best preservative that could be used.

Interurban Freight and Express.*

BY EDWARD C. SPRING,
General Superintendent, Dayton, Covington & Piqua Traction Company.

Recent legislation in many of the eastern states favorable to the handling of freight and express by electric lines has caused the managements of such roads as are affected to look into the feasibility of establishing a freight or express business on their lines. Hitherto trolley freight has received comparatively little attention in the East, and in other regions rather less than the attention given to it in the middle states. Massachusetts interurban companies have recently been given permission by the Railroad Commission to engage in the freight business. Similar action has been taken in favor of the interurban systems of New Jersey. Massachusetts legislation has established a liberal policy to permit street railways to carry freight in order to afford additional facilities for the transportation of merchandise and farm products, thus giving a decided boom to localities where steam railroad facilities are limited. Naturally eastern operators are looking to the interurban lines of the Middle West for a solution of this same problem, where freight and express services have been in operation for some time; but, as a matter of fact, the roads of the Middle West have not fully shown or satisfied themselves as to the best course to be followed in taking care of this new branch of service.

Opinion is divided among managers of electric roads as to whether it is more advantageous to handle merchandise at express or freight rates. Each manager has his own personal opinion and ideas, and in summing them up we cannot but see that each man's opinion is based upon peculiar circumstances affecting his own property. The steam roads of the country have the advantage over electric lines in this respect, as the conditions under which they operate are more generally similar.

Freight traffic on electric lines has not developed enough to differentiate between freight and express traffic. The word freight as applied to steam roads cannot, in its literal sense, be applied to electric lines at present. Freight business means handling freight in carload lots by trains. The number of roads in the country today equipped for such service with enough of track to make it profitable is quite small. Our power stations are not equipped for this extra heavy service, nor is our rolling stock sufficient, or the physical condition of our track in shape to stand the wear and tear of such service. In view of these facts, which are all well known to you, roads must confine themselves to light freight and express service, and it is useless for us to think of competing with steam roads in handling freight in carload lots at this time. Handling light freight and express has, however, been so successful that the question of handling carload lots is being seriously considered, and has been successfully accomplished by a few roads, but carload freightage over connecting lines is a problem yet to be worked out. A universal interchangeable freight traffic and the making of joint rates are two matters which the officials of the steam roads have, up to the present time, been reticent in entering into with the electric lines, although a few of the smaller steam roads have entered into traffic arrangements with some of the electric lines.

The number of advantages offered by electric lines in handling certain commodities is becoming more apparent every day, each road having its own particular line of goods from which it gets the greatest part of its revenue. The interurban lines running through a farming community should have ample equipment to handle all business offered it daily without difficulty. Motor cars should be so equipped that trailers could be handled without delay, because the handling of merchandise with trailers as much as possible holds down operating expenses. Each company should have several box-car trailers to take care of carload business in addition to the handling of local freight. In all cases we must offer the same inducements to the shippers as are prevalent on the steam roads. The interurban freight stations at Cincinnati, Ohio, and Indianapolis, Ind., afford two of the best object lessons in the handling of freight at large terminals.

I believe that there is great need of reform in the manner of handling this business in most of the companies through the Middle West. The jealousies which exist between the companies must be done away with, and the hearty co-operation of all roads to the one end of serving the best interests of the electric lines must be pre-eminent. The necessity of rebuilding the road to take care of this heavy traffic must be seriously considered. Above all things I would not for a moment encourage any road to go into the freight or express business to the detriment of its passenger service. The freight branch of the service has a wonderful future, but I do not believe that the day will ever come when freight earnings are greater than earnings from passenger traffic, until all the independent roads have consolidated, and are operating upon private right of way and with double track.

The road that serves the large manufacturing and commercial centers, where the consignee demands his goods at a given time, and whose business warrants his paying well for their prompt delivery, can do an express business, charging express rates, and make it profitable, but to engage in a freight business on freight rates under these conditions would be suicidal. On the other hand, on any road that operates through a farming district, and caters to the demand of the farmer, to whom time is a small consideration, an express service would be entirely out of the question, and only freight traffic with the lowest possible rates should be considered. The farmer has not yet fully realized the advantages of interurban facilities, and charges higher than the present steam road rates are severely questioned. The merchants in farming towns, knowing that the farmers will not pay anything extra for quick service, are equally unwilling to pay more than what the steam roads charge, and so in this case also the only way that the electric railway can hope to get a local freight business is to make the same rates as those of the steam roads. Tobacco, corn, wheat and oats can be handled at a profit under many conditions.

We have a chance in this comparatively new field of service to maintain a standard of rates and not repeat our experience in the passenger business and later be obliged to change our rates. I do not believe that an express service on a short line can be maintained as profitably by the railway company itself as it can be by a regular line express company operating over connecting lines; experience of steam roads has been to this effect:

After the division of rates among the various companies the percentage that would revert to the company that originated the business would be so small, that in many cases business would be done at a loss. Delivery and collection by wagons are large items of expense. There are few places on interurban roads where companies can afford to maintain regular delivery wagons. The only way to maintain an express service under conditions that do not warrant the maintenance of wagon service is arrange with local teamsters along the line to handle merchandise from the car to destination. Many roads have tried to conduct an express service but have had to give it up and transfer the business to some electric express company specializing in this class of work.

Already interurban freight is hauled several hundred miles. Realizing that this growth has taken place within a few years, we can see the possibility of the future building of electric lines which will rival steam power systems in hauling long distance freight. And as the industrial and commercial needs press the interurban people to keep pace with the demand for greater freight transportation, this need will be met in the same energetic and progressive manner that has characterized the past development of passenger transportation.

*From a paper read before the 1906 convention of the American Street and Interurban Railway Association, at Columbus, Ohio.

The Northern Railroad of France has asked the Minister of Public Works for authority to introduce a new coal tariff applicable only to shipments in 40-ton (88,000 lbs.) cars, the cars to be furnished by the shippers. By this tariff the shipment of one 40-ton carload would cost 6 per cent. less than if forwarded in the ordinary 10-ton cars; if two 40-ton cars are shipped at once, the reduction will be 7 per cent., and so on, a reduction of 1 per cent. for every additional car up to 16 cars, for which the reduction is to be 21 per cent. The owner of the car will be allowed 5 centimes per kilometer = 1½ cents per mile run loaded. It is contended that if the shippers owned the cars they would ship more evenly throughout the year, instead of sending the chief winter's supply during a few weeks in the fall, when the railroads are most crowded with other traffic.

GENERAL NEWS SECTION

NOTES.

The Texas Railroad Commission has ordered a 20 per cent. reduction of Pullman fares within the state, effective February 1.

A "no seat, no fare" ordinance affecting the local street railways has been promulgated by the Street and Water Board of Jersey City, N. J.

The House Committee on Interstate Commerce reported favorably, January 25, the Sherman bill to prohibit the shipment of explosives in interstate commerce under deceptive markings or invoice.

The New York Central, on its electrified zone in the New York terminal territory, now has a force of "operating inspectors" whose duty it is to supervise the working and care of the electric locomotives and motor cars.

The Seaboard Air Line has notified the North Carolina corporation commission that it will establish the block system on its line between Hamlet and Monroe as recommended by the commission, the distance being 52 miles.

Officials of the Interstate Commerce Commission express the opinion that through effective co-operation by the railroads with the Government, the conditions of distress among the people of that section, arising from a shortage in the supply of railroad cars, have been remedied.

Hours of employment for telegraph operators on the Queen & Crescent have been fixed to extend from 7 o'clock to 7 o'clock, with 25 cents per hour for all overtime. An advance in wages, which it is stated amounted to slightly more than 10 per cent., was also granted. The new rules were made effective January 1.

On January 28 the New York Central began the electric operation of 15 Harlem division trains each way between Grand Central Station and Wakefield. The trains, which are White Plains locals, are made up entirely of motor cars, and are hauled by steam locomotives between Wakefield and White Plains.

Bids were opened in Omaha, January 28, for the transportation of 600 men, 500 horses and a large amount of equipment from Forts Robinson and Russell to San Francisco. Only the Union Pacific and Chicago & North-Western submitted bids, and both bids were for regular and full rates. Railroad officials say the Government will secure no more cheap rates.

It is reported from San Francisco that all lands of the Southern Pacific Company included in the Government grant to the Central Pacific Railroad in California, Nevada and Utah, with the exception of the timber property, will be placed on sale not later than July 1 of this year. The railroad company's holdings in these states amount, approximately, to 6,000,000 acres.

The railroads of Michigan have been assessed at $210,266,000, as against $202,651,000 one year ago. While the total valuation of the railroads is increased by over $7,000,000 the total taxes of the roads are reduced by about $65,000. This is due to the reduction of the rate of taxation, which was this year computed at $16.47 on each $1,000 valuation. One year ago the tax rate was $17.40 on each $1,000.

It is understood that freight handlers and yardmen employed by the New York Central, who, in common with the men employed by all of the lines entering New York and environs have been agitating for an increase in wages, for shorter hours, and for extra pay for Sunday work, will receive 19 cents per hour, an increase of one-half cent, and will have a 10-hour day, with overtime at the rate of time and a half for Sunday work.

According to press despatches from Philadelphia, car builders may lower the prices asked for steel cars since the Pennsylvania has intimated that it will itself build 500 steel coaches for which it is in the market, because the bids it received were so high. It is not known what the bids were, but motive power officials of the railroad say that the price should be between $15,000 and $16,000, or nearly twice that of a wooden car of the same class.

Two locomotives and the cars attached to them were seized in the Santa Fe yards at Lamar, Colo., January 17, by a force of deputy sheriffs, who bound and locked them with heavy steel chains and padlocks. This action was the result of advice from Judge Northcutt to the Prowers County officials to levy on railroad property if $25,000 back taxes, alleged to be due the county from the Santa Fe company, was not paid. Some of the cars tied up by the seizure of two trains contained live stock and others perishable freight. The contested sum was paid under protest.

It is reported that a trackage arrangement has been made between the Gould lines and the St. Louis & San Francisco by which the 'Frisco will run trains over the El Dorado & Bastrop, the New Orleans & Northwestern and the Texas & Pacific, from El Dorado, Ark., just north of the Louisiana line, into New Orleans. Mr. Gould is quoted as saying that the entire low-grade line from East St. Louis to New Orleans will be relaid with heavy rail to provide for greater traffic.

The men employed in all the departments of the Philadelphia & Reading Company's car shops, except passenger car and upholstering, have been put on 13 hours, starting January 18. The order affects 700 men, who have been on 10 hours for some time. The company has a large number of cars needing repairs, and the longer hours were found necessary in order to get them into the service. The order will likewise affect the St. Clair, Palo Alto, Schuylkill Haven and Pottsville shops.

After a conference, January 26, between president of Western lines and the Transportation Committee of the Chicago Commercial Association it was announced that the committe was convinced that a "reciprocal demurrage" law would be impracticable and would not solve the problem of the shortage of freight cars. At the next meeting of its executive committee the association will take action to prevent the passage by Congress and the state legislature of reciprocal demurrage bills which have been introduced.

The special franchise taxes of the Manhattan Railway Company for the years 1900 to 1905, inclusive, have been paid to Comptroller Metz. The Interborough Rapid Transit Company, now the owner of the Manhattan elevated railroad system, forwarded to the Comptroller four checks, amounting to $3,170,141.70. When the United States Supreme Court in May, 1905, finally upheld the franchise tax law as constitutional, the companies brought certiorari proceedings to compel the State Board of Taxes to review the assessments, and referees were appointed to take testimony on the charges of overvaluation. The certiorari proceedings were terminated a short time ago by orders that reduced the assessments to amounts calculated upon the percentages for those years respectively that it was found that the Tax Commissioners of the city of New York had generally accepted as the percentages of assessed valuation to real value for real estate in the boroughs of Manhattan and the Bronx.

Wage increases amounting to $400,000 a year were authorized by the Interborough Rapid Transit Co. January 23. The percentage of the increase varies, the highest being about 16 per cent. The following schedule shows the present and the new rate of wages:

Grade.	—Rate per day.— Present.	New.	Hours.
Trainmen: First year	$1.70	$1.80	10
" Second year	1.70	1.90	10
" After second year	1.80	2.00	10
" After third year	1.95	2.00	10
Conductors: First year	2.10	2.10	10
" Second year	2.25	2.25	10
" Third year	2.40	2.40	10
" After third year	2.40	2.50	10
Gatemen: First year	1.50	1.70	12
" Second year	1.55	1.80	12
Agents: First year	1.75	1.90	12
" Second year	2.00	2.10	12
" After second year	2.25	2.25*	12
Platformmen: First year	1.75	2.00	12
" Second year	1.75	2.10	12
Hand switchmen: First year	2.25	2.25	10
" Second year	2.40	2.40	10
" After second year	2.40	2.50	10

*A few.

In other departments, such as car equipment, mechanical and maintenance, the wages of the employees will be increased in about the same ratio as given the conductors and trainmen.

Reorganization at Panama.

With the resignation of Theodore P. Shonts as Chairman of the Isthmian Canal Commission it is announced that John F. Stevens, Chief Engineer, will be appointed Chairman of the Commission, thus replacing the work of building the canal directly and entirely under Mr. Stevens' charge and centralizing the administrative forces on the Isthmus. Secretary Taft is to go to Panama after Congress adjourns to supervise the reorganization.

Carnegie Institution Grant to Dean Goss.

The Carnegie Institution of Washington, D. C., has made a grant of $3,000 a year for a period of four years to Dean W. F. M. Goss, of Purdue University, Lafayette, Ind., for the purpose of determining the value of superheated steam in locomotive service; first, in connection with single expansion engines; and second, in connection with compound engines. This is the second grant which the institution has made to Dean Goss. While given to him person-

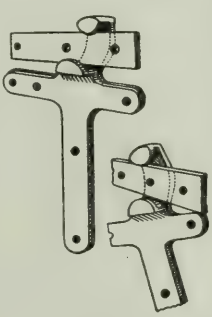
ally, its effect will be to stimulate and to make more effective the work of the Purdue locomotive laboratory. Funds thus received will be employed in supplementing the resources of the laboratory as derived from all other sources. The results of Dr. Goss's previous research under the auspices of the Carnegie Institution, which was for the purpose of determining the value of different steam pressures in locomotive service is now in press.

What Is a Box Car?

A box car belongs to the fowl family. During the spring and summer months it can be found in nearly every part of the country, its favorite haunts being railroad tracks, and it is easy to capture. In the autumn, however, like certain other fowls it goes into hibernation or flies to other climes. Scattered instances are known where specimens are captured during the autumn months. A lasso or a well-greased switch crew is sometimes used in snaring the box car, but main strength is the best weapon. In any case the hunter must be very wary, as any noise like the fluttering of a waybill will make the quarry disappear. Some railroads own large flocks of domesticated box cars, but they are carefully guarded during the close season. The wild box car when caught and fairly well loaded becomes perfectly stationary.—*Exchange.*

A New Car Door Hanger.

A new design of car door hanger is illustrated herewith. It is called an oblique hanger because of the form of the upper part. When this part is held in a vertical position, as one view shows, the flanges clear the rail, but when the hanger is dropped to normal position, with the lower part vertical, the flanges engage the rail, retaining the hanger in place. The upper and lower contact surfaces are rounded to minimize the bearing friction. The hanger may be applied to either flush or projecting doors. When applied to flush doors, the hanger nearest the advancing edge of the door when it is opened is given a pivot hinge to permit inward and outward movement of the door.



The Baker-Stewart Oblique Car Door Hanger.

The full flush-door equipment includes a vertical crank-rod on the same side as the hinged hanger. This rod has the usual hand lever revolving through a semi-circle for releasing and fastening the door. At its upper end is a crank and pin, and as the door is closed the pin enters a slot in a horizontal flat plate fastened rigidly to the body of the car. A similar crank and pin at the bottom engages a slot in a shoe grooved to engage the lower rail. The rails are bent inward at the proper point to carry the hanger and shoe of the opposite edge of the door to the closed position. It is claimed that this equipment makes a flush door spark-proof as well as burglar-proof.

For the projecting door the two bottom fixtures contain each a vertically-moving bolt which has an inwardly-extending offset portion near its lower end, notched for engaging the rail. When the door is closed the lower end of the bolt may be pushed down behind the rail. To open the door, the bolts are raised, the door pulled outward and the bolts lowered until the slots engage the rail. When opened to the desired point the bolts are disengaged from the rail, the door pushed inward and the bolts again dropped, holding the door against motion in any direction.

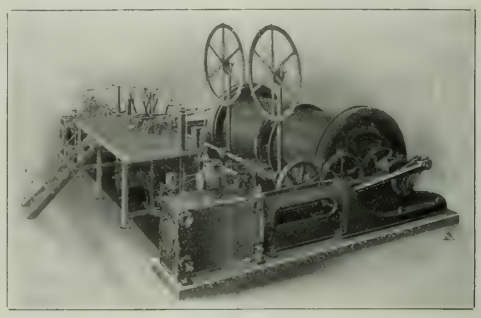
The hanger may be used not only with the equipment described, but with any other type of shoe commonly used on car doors, or with doors having no lower track and which close in a recessed bracket. The hanger is also made in small sizes for small ventilating car doors and also for barn doors. The Baker-Stewart Door Equipment Co., Indianapolis, Ind., is the maker.

Railroad Department Established by Hapgoods.

Hapgoods, the firm of employment experts, 305 Broadway, New York, has added to its organization a department devoted entirely to transportation, in charge of practical expert railroad men. This department is placing men experienced in railroad work in better positions in that line or finding them openings with mercantile houses, where their abilities are brought into play. This should be especially appreciated by firms doing a great deal of shipping, as the day of the rebate securing traffic manager is over and these high-salaried lobbyists are being replaced by thoroughly experienced railroad traffic men. Practically any kind of transportation man can be handled by this department, from the young clerk to the auditor or chief engineer. There are many instances where a man gets into a rut, and, do what he will, seems anchored to his present condition. Although he has abilities for a far better thing, he lacks opportunity. It is believed that this department will afford needed relief, and it is hoped that railroad men will avail themselves of its service.

A Large Mine Hoisting Engine.

The Hancock Consolidated Copper Co., John L. Harris, Superintendent, whose mines are located at Hancock, Mich., has ordered from the Sullivan Machinery Co., Chicago, a hoisting engine to be used for sinking the principal shaft, and for permanent service after the shaft is completed to its final depth of 4,000 ft. This hoist will be of the first motion, heavy duty, Corliss type, with engine cylinders 24 in. in diameter by 48-in. stroke, and two loose drums,



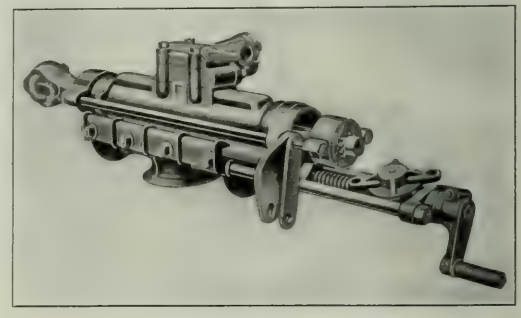
Sullivan Mine Hoist.

8 ft. in diameter by 9 ft. long, driven by hand friction clutches, and designed for hoisting in balance. The drums will be grooved for 1¼ in. steel rope, and the maximum hoisting speed under full load will be 3,500 f.p.m. The clutches and band brakes will be steam operated, with automatic compressed air substitution in case the steam pressure falls below a given point, due to accident or other reasons.

The hoist will be equipped with the Sullivan patent automatic throttle-closing device and interlocking automatic stop. By these contrivances the steam is automatically shut off at a fixed distance from the top of the shaft, allowing the engineer to bring the cage to a stop at the desired point by use of the brake. In case the engineer, for any reason, fails to set the brakes, they will be set automatically at the proper point to prevent an overwind. Hoists of this same design have recently been furnished to the Republic Iron & Steel Co., Republic, Mich., the Ironton and Colby Mines, Bessemer and the Dunn Mine, Crystal Falls, Mich. The accompanying illustration is of the Ironton mine hoist.

The "Chicago Giant" Rock Drill.

The latest improved design of the "Chicago Giant" machine rock drill is shown in the accompanying illustration. It has a number of new features. The shell, of which is of the adjustable type, provides for a double side bearing for the cylinder. The shell caps will take up wear in two directions, horizontal and vertical, with one adjustment. A removable cylinder stop is also provided in the lower end of the shell, its function being to prevent the cyl-



"Chicago Giant" Rock Drill.

inder from slipping out of the shell in case the feed screw should be run out of the feed nut. To remove the cylinder from the shell the stop is removed first; then by turning the feed screw the cylinder is run down in the shell until the feed screw is out of the feed nut, allowing the cylinder to be slipped out of the shell without dismantling the machine.

The cylinder is cast from a special mixture, having a tensile strength of 35,000 to 38,000 lbs. and presenting a fine polished surface when finished. The upper end of the cylinder is extended to form a chamber for the rotating mechanism, which is of the releas-

ing type. Three parts are used, equally distributing the rotating effort, and the pawls are made reversible; that is, should one of the engaging edges wear out, the pawl can be reversed so as to present the other unworn edge to engage with the ratchet. This doubles the life of each pawl. The ratchet is one piece with the rotating or rifle bar, which is extended on its upper end to fit into a chamber or recess in the upper head. This holds the rotating bar in a central position and relieves the rotating mechanism of side stresses.

The valve motion is positive and is of the tappet or rocker type, modified to give a short stroke feature, the length of the stroke being at all times completely under the control of the operator. The supporting pin of the rocker works in renewable steel bushings, is completely enclosed, and is kept in place by removable caps, locked in place by the valve seat when the machine is assembled.

An important feature is automatic lubrication. An oil chambe is provided in the valve seat communicating with the interior of the valve chest. Here the oil mixes with the operating fluid and is carried by it into the interior of the machine. One filling of the oil reservoir will last half a "shift." In case the rotating mechanism should not receive sufficient lubrication from the interior it may be oiled through the upper head when necessary.

High-grade materials, carefully fitted, are used, and parts are interchangeable. The drill works best and most economically with compressed air, but may be operated by steam, its positive valve motion and liberal port areas enabling it to work with steam that would be too wet for many rock drills. The Chicago Pneumatic Tool Co., Chicago, is the maker.

Railroads in Chile.

The government of Chile has arranged with a Belgian syndicate to build part of what is known as the "Longitudinal" railroad from Valparaiso north along the coast to Copiapo, 435 miles.

At the present time, with the exception of a few small lines, all the railroads in Chile are owned and operated by the government, but these are not self-supporting; on the contrary, they are an immense expense every year, the annual deficit amounting to several millions of dollars. This new line is to be a departure from this system.

The Belgian syndicate has had engineers examining the route, making plans and specifications, and preparing bids. The proposition of the syndicate has been accepted by the government and is now before Congress for its approval. For 50 years from the time work is started, the syndicate will own and operate the road, and at the end of that time the government shall have the right to buy it at an appraised valuation. The syndicate must pay to build and operate the line, but the Chilean government will guarantee an annual interest of 5 per cent. on the investment. Should the net earnings exceed 5 per cent. the excess up to 7 per cent. is to be equally divided between the syndicate and the government.

It is understood that work is to be commenced as soon as the project receives the approval of the Congress.—*Consular Report.*

Interborough Relief Fund.

The following relief fund plan has been announced by the Interborough Rapid Transit Co.:

Employees who join the fund will be divided into three classes —those who receive a monthly pay of less than $35, those who receive more than $35 and less than $75, and those receiving more than $75. Monthly payments will be at the rate of 75 cents for the first class, $1.50 for the second class and $3 for the third class.

If a motorman or conductor is disabled he will receive $2 per day for the first fifty-two weeks and $1 per day after that. In case of sickness, after the first six days and not longer than fifty-two weeks, those in the first class will receive 50 cents per day, the second class $1, and the third class $2.

By the death benefit plan, on the payment of a small amount the employees are insured for the benefit of relatives and other beneficiaries at the rate of $250 in case of death to those in the first class, $500 in the second class and $1,000 in the third class.

Persons in the service of the Interborough Company at the time of the inauguration of the relief department, January 15, will, until July 1, be afforded the privilege of becoming members of the fund without regard to age and without physical examination.

Projected Railroads in Texas.

The projected lines and those now under construction in Texas, according to the State Railway Commission, are as follows: Weatherford, Mineral Wells & Northwestern, from Mineral Wells to Texas-New Mexico state line, 275 miles; Kansas City, Mexico & Orient, from Sweetwater to San Angelo, and from San Angelo to Spofford or Del Rio, and from Knox City to the Red river, 150 miles graded, total projected 600 miles; Beaumont, Sour Lake & Western, from Trinity river to Houston, 45 miles; Beaumont & Great Northern, from Onalaska to Livingston, 15 miles; Brownwood & Cisco, from Brownwood to Cisco, 55 miles; Chicago, Rock Island & Gulf, from Carrollton to Irving, 12 miles; Gulf, Colorado & Santa Fe, from Brownwood to Texico, 350 miles; St. Louis, San Francisco & Texas, from Brady to San Antonio, 150 miles; Port O'Connor, Rio Grande & Northern, from Port O'Connor to San Antonio, with several branch lines, partly graded, 350 miles; Trinity & Brazos Valley, from Corsicana to Waxahachie, graded, 30 miles; Trinity Valley Northern, from Dayton to Cleveland, 30 miles; Wichita Falls & Northern, from Wichita Falls to the Red river, 20 miles.

Settlement of Firemen's Strike in Texas.

The general committee of adjustment of the Brotherhood of Locomotive Engineers (Atlantic system, Southern Pacific) has requested Vice-President and General Manager T. Fay to reinstate all engineers who left the services of the company on December 23 in their places on the seniority list, so far as the company desires to re-employ them, and the request has been readily granted. It is thought that this action forever settles the question of the right of the Brotherhood of Locomotive Engineers to adjust all differences between the railroad and all engineers, both road and yard, and that it forever settles the question upon which the strike of December 23 was ordered, the principal contention being that the Brotherhood of Locomotive Firemen should have control over yard engineers.

Clothing the Prairie With Silk.

Ten express cars loaded with Oriental silks on a special train on the Great Northern were derailed at Clontarf, Minn., January 19, during a blizzard. The cars were badly wrecked, and trainmen and citizens hunted silk all night.

To Reduce Freight Claims.

Freight and passenger agents on a division of the Chicago & North-Western have organized under the local name of the North-Western Agents' Association. The plan will be tried later on other divisions. Assistant inspectors will be appointed, to travel on freight trains wherever advisable, making suggestions to conductors and brakemen in relation to the handling of freight, thus reducing the claims against the railroads on account of damages.

Freight on Empty Coal Cars.

The management of the Harriman lines is reported to be paying $32,500 freight on cars in order to get them from the East into the coal fields of Illinois, where they can be loaded with coal for the West. The question arose of how to get the cars to the mines without having some road steal them for temporary use en route. The management finally decided to ship them as freight, and is paying $25 for the delivery of each car.

Boycott Against Trolley Roads Raised.

It is reported that as a result of a conference with D. G. Edwards, vice-president of the Consolidated Electric Railways of Indiana and Ohio, having about 1,200 miles of track, the passenger officials of the steam roads in that territory have decided to abrogate their agreement not to interchange traffic with electric lines. The electric lines had agreed to notify the Interstate Commerce Commission of the boycott declared against them by the steam roads and ask that body to enforce the section of the act to regulate commerce which requires all carriers to interchange traffic.

Projected Railroad in Peru.

A law has been passed for building a railroad from Lima, Peru, northwest to Huacho, about 80 miles, with branches to the ports of Chancay and Supe. The contractors are guaranteed 6 per cent. a year on the cost of construction and control of the road for 30 years.

Railroad Building in Manchuria.

It is reported from Japan that the Southern Manchuria Railway Company is to build an extensive system of railroads in southern Manchuria, with principal seaboard terminus at Dalny. These lines will cost about $10,000,000, half of which the Japanese Government has subscribed, the other half to be furnished by Japanese and Chinese bankers. Narrow gage lines are to be made standard gage, and coal mines developed.

Opening of Tehuantepec National Railway for Through Freight.

The Tehuantepec National Railway, as part of a through freight route between Atlantic and Pacific ports, was formally opened by President Porfirio Diaz, of Mexico, January 23, at Salina Cruz, the Pacific terminus of the road, by pressing a button which set in motion a crane that raised a shipment from the hold of the steamship "Arizona" of the American-Hawaiian Steamship Company and put it on board a freight car billed to Coatzacoalcos, the Atlantic terminus. The three doors of the railroad station at Salina Cruz were opened by President Diaz, Minister of Finance Limantour and Minister of Public Works Fernandez with golden keys. Sir Weetman Pearson, resident partner of S. Pearson & Son, Ltd., reviewed the work of construction and its two terminal harbors, and predicted that although the road is now capable of handling 1,000,000 tons of freight a year, its success as a traffic carrier would be so great that within seven years or less double-tracking would be neces-

sary. After the ceremonies a trip across the Isthmus was made in a special train to Coatzacoalcos, now renamed Puerto Mexico, where President Diaz unlocked a car containing the first shipment which he locked at Salina Cruz. Descriptions of the improvements made on the Isthmus of Tehuantepec were described in the *Railroad Gazette* of July 15, 1904, and November 9, 1906.

Railroad Extension in Hayti.

A concession has been granted by the Haytian Government to the United Hayti Corporation, with a capital of $15,000,000, to take over the National Railroad of Hayti, to operate a number of mining concessions and a direct steamship service to the United States and to Europe. The National Railroad of Hayti is the only railroad on the island and at present is only 30 miles long. It is planned to extend it from the present terminus south of the seaport of Gonaives to Hinche, a distance of 80 miles. This extension is expected to be finished by July next. A new road is also planned from Cape Haytien on the northern coast across the island through Hinche and Port au Prince. The extension of the National Railroad and the new line will traverse a rich copper, iron and coal district in the interior. Contracts have already been let for building piers and docks at Cape Haytien, Gonaives and Port au Prince. The Haytian Government guarantees six per cent. interest on an expenditure of $24,000 per mile for the railroads for a period of 50 years. All the rails, locomotives, cars and other equipment will be purchased in the United States. Among the promoters of the project are: William G. Price and John B. Mayer, of Philadelphia; O. B. Bechel, of Pottsville, Pa., and F. L. Price, of Tamaqua, Pa.

Compliance with the Rate Law.

The operating and passenger departments of the Baltimore & Ohio have sent out a circular letter to all ticket agents and passenger conductors, impressing upon them the importance of strictly complying with the Rate Law and forbidding any deviation from the passenger rates fixed by the tariff. They are told that there must not be a single exception to the prescribed rates, and that the railroad company, its officers, agents or other employees wilfully violating the law or wilfully permitting the same to be done, are subject to a fine of from $1,000 to $20,000 for each offence and are liable to imprisonment for two years. The letter explains that the same penalties are levied against passengers for any wilful act whereby they secure transportation at less than tariff rates.

Subway Connection between Brooklyn Bridges.

The Board of Estimate and Apportionment of New York City on January 25 voted in favor of a four-track subway loop to connect the Manhattan terminals of the Brooklyn and Williamsburgh bridges to be built by the city at an estimated cost of $5,245,000, which includes $500,000 for four stations. It will take about three years to build this connection. This ends the long controversy as to whether the two bridges should be connected at all, and, if so, whether by a subway or an elevated structure.

Profits of Japanese Steamships.

A consular report says that the net profits of the Nippon Yusen Kaisha (Japanese Steamship Co.) for the six months ended Sept. 1, 1906, were $622,000, to which was added a surplus of $491,700 from the preceding period. Of this sum $31,000 was placed to the reserve, $35,600 paid in bonuses to officials, $550,000 used for a 10 per cent. per annum dividend and $110,000 for a special 2 per cent. dividend (thus maintaining the usual 12 per cent. dividend), leaving a surplus of $387,100.

The company has placed orders with Japanese shipbuilding yards for the construction of six steamers, each of 8,600 tons, and they are expected to be completed in the course of 1908. For the payment of the cost of these steamers no loan will be raised, but the cost is to be drawn on a surplus so far accumulated and also on the reserve to be set aside for the depreciation of the value of steamers.

Panama Canal Contract.

The lowest bid submitted for building the Panama Canal was that of Oliver & Bangs, who agreed to do the work for 6.75 per cent. of the cost of construction. As satisfactory assurances of the financial standing of Mr. Bangs were not obtained, it was ruled that he could have no share in the contract. William J. Oliver, of Knoxville, Tenn., the other member of the firm, may, however, receive the contract, if by February 6 he can secure at least two independent contractors whose skill and experience combined with his own shall cover the whole field of work to be performed under the contract, and organize a corporation for the express purpose of carrying out the contract, this corporation to have a capital of $5,000,000, of which not less than $1,000,000 paid in cash and $1,500,000 in solvent subscriptions shall be available for carrying out the contract, and of which another $2,000,000 may be devoted to the purpose of procuring a bond as required by the contract, or as substituting instead, subject to the conditions of the bond, satisfactory cash or current securities. The next lower bidders were the MacArthur-Gillespie Company, who have been given the privilege of either withdrawing their bid or of allowing it to remain awaiting the result of Mr. Oliver's efforts to make good his bid. The other petitions have been rejected because informal and, in the case of the highest bid, excessive as well. It was announced on January 30 that Frederick C. Stevens, Superintendent of Public Works of New York State, is associated with Mr. Oliver in this contract.

Rail Production in the United States.

The *Wall Street Journal* reports that the rail mills of the United States have orders for a larger tonnage than ever before. Including business carried over from last year, the contracts aggregate nearly 3,000,000 tons, which is almost the total production of 1905.

The following table gives the production of all classes of steel rails from 1900 to 1906 inclusive, with 1907 estimated:

	Tons rails.	Price.	Gross sales.
1907	*4,000,000	$28.00	*$112,000,000
1906	3,650,000	28.00	102,200,000
1905	3,372,257	28.00	94,423,200
1904	2,284,711	28.00	63,971,900
1903	2,992,477	28.00	83,789,300
1902	2,947,933	27.33	82,542,100
1901	2,874,639	27.33	78,463,800
1900	2,385,682	22.29	76,933,700
Total	24,507,699		$694,324,000

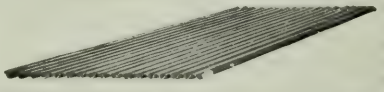
*Estimated.

A Modest Railroad Project.

There is being offered for sale a $50,000,000 stock issue of the Transcontinental Electric Railroad Company, a corporation which proposes to build a number of railroad lines. The principal main line is to run from some point in the vicinity of New York City to a point in Illinois on the Mississippi river, with a branch parallel to the Mississippi from the Gulf of Mexico to Lake Michigan. The $50,000,000 stock issue is one of a series of similar issues to be issued as required. The road will no doubt soon be in successful operation.

Asbestos Building Lumber.

A fireproof building material, composed entirely of asbestos fiber and hydraulic cement, is now commercially available, and can fairly be classed as one of the new and valuable materials of construction. This much can be said of it without testing: Because of its constituents it is fireproof, not affected by moisture or frost,



tough, hard, has only slight expansion and contraction due to heat or cold, does not crack or exfoliate when exposed to fire, needs no painting, has high insulating qualities for electric resistance, and, so far as observed during the past four years, its valuable peculiarities seem to increase with age. Its value for roofing shingles, sheathing on buildings liable to be set on fire by electric short circuiting, and for electric car construction, is quite obvious. It is made for and sold by the Franklin Mfg. Co., Franklin, Pa.

Transportation of Newspaper Employees on Special Trains.

The Interstate Commerce Commission, through Commissioner Harlan, has given an opinion in the matter of free transportation of newspaper employees on special newspaper trains. The opinion was given in answer to a petition of certain newspapers in New York City. It appears that the New York, New Haven & Hartford runs two special Sunday morning newspaper trains from New York, one to Springfield, the other to Boston. In compensation for this special service the railroad company receives 50 cents for each 100 lbs of newspapers carried; the total weight has usually been from 70 to 80 tons. It has been the custom to include in the service given by the railroad free transportation for certain newspaper employees, whose duty it was to assort the papers and make them up into packages for delivery as the train arrived at the various stations along the road, and free transportation of such employees from Springfield and Boston back to New York on any regular passenger train. The Commission holds that these so-called caretakers of newspaper companies may not lawfully be granted the free transportation that is permissible under the rate law to caretakers of certain other kinds of traffic specifically enumerated, and also that a commodity rate cannot be applied to the transportation of passengers or a passenger rate to the transportation of commodities; this latter point covering the question as to whether under a rate for carrying newspapers, transportation of employees of newspaper companies can be directly included. The Commission rules, therefore, that newspaper employees cannot lawfully be carried on special newspaper trains at any other than the regular passenger rates.

Damages for Revoke of Pass.

A damage suit attacking the validity of the Interstate Commerce law was filed in the United States Court at Louisville, January 24, by Erasmus L. Mottley and Annie E. Mottley, his wife. The defendant is the Louisville & Nashville Railroad. Plaintiffs allege that while passengers on a Louisville & Nashville train on September 7, 1871, they were seriously injured in an accident at Randolph, Ky.,

and that as a compromise of a threatened damage suit they were to receive annual passes for the rest of their lives. They allege that a written contract exists to that effect. They now ask $10,000 damages if the rescinding of their passes is upheld.

High Record Steel Business.

A statement was given out after the quarterly meeting of the directors of the United States Steel Corporation, this week, showing $41,744,964 net earnings for the December quarter, $151,619,111 net earnings for the year, and 8,489,718 tons of unfilled orders on hand. The surplus after charges and preferred and common stock dividends for the quarter ended Dec. 31, 1906, is $18,824,545, as compared with $14,697,318 in the previous quarter, and a surplus after charges and preferred stock dividend, only, in the corresponding quarter of 1905, of $16,416,563. From the surplus for the quarter there was appropriated $15,500,000 on account of expenditures made and to be made on authorized appropriations for additional property, construction and discharge of capital obligations. This leaves a balance of surplus for the quarter of $3,324,545.

The net earnings of the United States Steel Corporation for the last three years compare monthly and quarterly as follows:

	1906.	1905.	1904.
January	$11,856,375	$6,810,847	$2,868,213
February	10,958,275	6,629,463	4,540,673
March	13,819,840	9,585,586	6,036,346
First quarter	$36,634,490	$23,025,896	$13,445,232
April	$12,581,902	$9,037,925	$6,863,833
May	14,041,601	10,602,187	6,256,518
June	13,501,530	10,665,004	6,370,374
Second quarter	$40,125,033	$30,305,116	$19,490,725
July	$12,242,098	$9,035,168	$6,344,771
August	13,158,860	10,986,901	6,202,957
September	12,713,666	11,218,513	6,226,204
Third quarter	$38,114,624	$31,240,582	$18,773,932
October	$14,984,926	$12,400,306	$7,250,204
November	13,482,464	11,827,215	7,117,418
December	13,277,574	11,051,167	7,099,011
Fourth quarter	$41,744,964	$35,278,688	$21,466,633
For year	$156,619,111	$119,850,282	$73,176,522

The unfilled orders on the books of the company have been as follows on the dates mentioned, the figures being given in tons:

	Tons.		Tons.
December, 1906	8,489,718	June, 1904	3,192,277
September, 1906	7,936,884	March, 1904	4,136,961
June, 1906	6,809,589	December, 1903	3,215,123
March, 1906	7,018,712	September, 1903	3,278,742
December, 1905	7,605,086	June, 1903	4,666,578
September, 1905	3,865,377	March, 1903	5,410,719
June, 1905	4,829,655	December, 1902	5,347,523
March, 1905	5,597,560	September, 1902	4,843,007
December, 1904	4,696,203	June, 1902	4,791,993
September, 1904	3,027,436		

Senate Resolution on Block Signals.

The following resolution passed the United States Senate on January 29:

Whereas, On June 30, 1906, Congress passed a joint resolution directing the Interstate Commerce Commission to investigate and report on block signal systems and appliances for the automatic control of railroad trains, directing an investigation and report on the use of and necessity for block signal systems and appliances for the automatic control of railroad trains in the United States, and whereas such investigation and report was directed in the interest of protecting human life and preventing accidents on railroad trains;

Therefore Be It Resolved, That the Interstate Commerce Commission be and it is hereby directed,

First—To inform the Senate to what extent said investigation has been made;

Second—To transmit to the Senate such information as the Commission may have acquired on this subject;

Third—To inform the Senate whether or not it is wise to require railroad companies to equip their lines with the automatic block signal system;

Fourth—What length of time would be required to put in operation such system and its probable cost.

Fifth—The number of deaths caused by accidents on railroads during the years 1900, 1901, 1902, 1903, 1904, 1905 and 1906, and to what extent, if any, the death rate can be diminished by the adoption of the automatic block signal system.

Progress of Invention in Mississippi.

Two prolific inventors in a small town in Mississippi (we hesitate to mention names, but one is a clergyman) have obtained a patent on a means for preventing collisions when enginemen run by stop signals. They have, to quote the patent specification, "invented certain new and useful improvements in means for oiling tracks and applying the air-brakes for stopping railroad trains, and we do hereby declare the following to be a full, clear and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same. For neutralizing the traction power of the locomotive engine of a railroad train and for stopping the train we provide means operated by a track device which is operated by the movement of the train for effecting a flow of oil upon the top of the rails in front of the drivers and by the same means which effects the oil flow to cause the brakes to be partially applied to destroy the momentum of the train, and while the slipping of the drivers will be effective to stop the train the conjoint effect of the oil flow and applying the air-brakes will conduce to greater effectiveness and safety without the intervention of the engineer who from any cause may be incapacitated to act on the showing of the danger-signal. The design of our invention is to make the engineer more careful, and in the event of his failure to note the signal then the movement of the train will bring into action means for causing the oiling of the rails in advance of the drivers in conjoint co-operation with means for automatically operating the air-brake lever to apply the brakes."

Shipbuilding in 1906.

In 1906 there were 207 vessels launched at American shipyards against 361 in Germany, 511 in Scotland and 882 in England. The tonnage built in American yards, however, is greater than that in German yards. The yards on the Great Lakes, many of which are controlled by the American Ship Building Company, were specially busy. A detailed account of the new construction on the Great Lakes appeared in the *Railroad Gazette* of October 26, 1906.

The following table shows the tonnage built at the principal yards and the total production of the United States during the last two years:

	1906		1905.
	Vessels.	Tons.	Tons.
American Shipbuilding Co. (6 yards)	34	198,535	136,795
Great Lakes Works	9	48,671	43,470
W. Cramp & Sons	7	37,119	31,942
Newport News Co.	5	36,700	19,006
New York Shipbuilding Co.	12	35,500	34,390
Fore River Shipbuilding Co.	7	15,075	18,220
Toledo Shipbuilding Co.	4	12,808	5,360
Harlan & Hollingsworth	15	10,859	11,548
Delaware River Works	4	10,124	129
Maryland Steel Co.	10	8,857	22,028
United Engineering Works	12	7,744	1,910
T. S. Marvel	3	7,647	662
Cobb, Butler & Co.	3	3,709	625
Burlee Dry Dock Co.	4	1,472	2,006
J. H. Dialogue & Son	9	1,418	.....
Merrill-Stevens Co.	4	1,076	.....
Neafie & Levy Co.	5	699	552
Gas Engine & Power Co.	11	365	392
Skinner Shipbuilding Co.	2	331	600
Other firms	47	25,962	40,051
Total	207	464,671	368,494

TRADE CATALOGUES.

Concrete Piling.—The Raymond Concrete Pile Co., Chicago, has prepared a new edition of its catalogue concerning its system of concrete pile construction and foundations. This system, as our readers are aware, involves the use of a sheet steel form or shell driven into the ground by means of a collapsible steel cone, which is then withdrawn and the shell filled with concrete. The method is fully described and illustrated in the catalogue and the economy and advantages of the system set forth. A list of well-known architects and engineers who have used the piling is given, and a large number of views of buildings and other structures resting on this piling, or of the piling driven ready to receive the superstructure. There are also fac-simile testimonial letters from architects and engineers, and at the back is a reprint of an article by W. R. Harper, inspector in charge of the Academic group of buildings at the United States Naval Academy, concerning the use of Raymond concrete piling for the foundations for those buildings.

High Duty Metal Saws.—A recent catalogue of the High Duty Saw & Tool Co., Eddystone, Pa., illustrates and describes various types of cold sawing, cutting off and rotary slotting machines employing the "Tindel" high duty saw blades with inserted high-speed steel cutting teeth. The distinguishing feature of these machines is the "Paragon" driving mechanism, which employs only straight and bevel gears without worm gearing of any kind. This form of drive applies the power direct to the saw blade without the use of an arbor, and the point of application is below the cutting plane, so that the saw is pulled and not pushed through the work.

Diamond Core Drills.—Catalogue No. 55 of the Sullivan Machinery Co., Chicago, is on the subject of diamond core drills. The "foreword" explains the two principal objects of the book, which are: To give a proper idea of the theoretical and practical advantages of prospecting mineral lands with the diamond core drill; and to gather under one cover all the information necessary to the selection of a suitable drilling outfit, its purchase, use and maintenance. The book is standard size (6 x 9) and contains 157 pages. It covers quite completely the points mentioned and is well and fully illustrated.

Manufacturing and Business.

The Lidgerwood Manufacturing Co., New York, has removed its Chicago office, W. H. Baldwin, Sales Manager, from the Old Colony Building to 1917 Fisher Building.

Edmund H. Walker, who has for the past two years been Assistant to the President of the Standard Coupler Company, 160 Broadway, New York, has been appointed General Sales Manager.

The Colorado Gray Iron Foundry Co., 418 Majestic Building, Denver, Colo., has moved its offices to 1736 Broadway. The Estell Car Seal & Equipment Co. will also have its offices at the same place.

Crane Co., Chicago, now have their new steel foundry in full running order. In this department steel valves and fittings will be a specialty, and the facilities are such that prompt filling of orders is assured.

The Lock Joint Pipe Co., 346 Broadway, New York, has received an order from the Louisville & Nashville to protect with its sectional concrete pipe the piling in a portion of the Commendencia street wharf at Pensacola, Fla. The piles are all creosoted, and have been standing for eight years.

The Link-Belt Company, Philadelphia, Chicago and Indianapolis, has opened a branch office at 321 Ellicott Square Building, Buffalo, N. Y., in charge of H. C. Minier, to handle sales of its drive chains in Buffalo and neighboring territory in New York, Pennsylvania and Ohio. The company has also opened an office at 440 New York Block, Seattle, Wash., in charge of E. G. Brabrook, to handle conveying machinery in that territory.

Iron and Steel.

The Harriman lines are in the market for an additional 8,000 tons of rails.

The Long Island has ordered 2,000 tons of structural material to the Pennsylvania Bridge Company of Pittsburg; the Chicago & North-Western has ordered 1,100 tons of bridge material.

A number of railroads are in the market for small tonnages of bridge material amounting to about 8,000 tons, including the Erie, the New York, New Haven & Hartford and the New York Central & Hudson River. The St. Paul recently let contracts for over 8,000 tons, divided among four different shops, and is still negotiating for more.

OBITUARY NOTICES.

Hon. Andrew G. Blair, formerly Minister of Railways and Canals of Canada, died suddenly at Fredericton, N. B., from heart failure on January 25. He was born in Fredericton in 1844. He became a lawyer and later went into politics, soon becoming leader of the Liberal party in New Brunswick. In 1896, when the Liberals attained power in the Dominion, he was made Minister of Railways and Canals in the administration of Sir Wilfrid Laurier. This position he held for seven years, which were characterized by great activity in railroad building. He resigned in 1903 owing to a difference with his colleagues as to the policy to be pursued in regard to the construction of the Grand Trunk Pacific. Shortly afterwards he was appointed Chairman of the newly-constituted Board of Railway Commissioners, from which post he resigned in the fall of 1904.

Jonah H. White, Eastern Passenger Agent of the Atlantic Coast Line, died at his home, 120 East Eighty-fifth street, New York, on December 30, in his 76th year of life and his 36th year in the company's service. He was a fine type of the southern gentleman, with a memory for faces and names and an attentive courtesy which exalted and dignified his minor official position, with a result that few men had more personal friends and acquaintances than "Jonah." He liked to see his passengers safely aboard their trains, and they liked to see him. He was a great business getter; done by attention and courtesy. Mr. Craig, Passenger Traffic Manager, has issued a special circular, with Jonah's portrait and with this summary: "His work was characterized by the highest standard of loyalty, faithfulness and courtesy, such that commanded the respect and esteem alike of the officials of this company and of the traveling public."

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

The Engineers' Club of Philadelphia.

At a business meeting of this club to be held February 2 there will be a paper on "Single-Phase Railways," illustrated by lantern slides, presented by F. E. Wynne. At the twenty-eighth annual meeting of the club January 19, 88 members and visitors were present. The election of officers resulted as follows: President, Henry H. Quimby; Vice-President (for two years), W. P. Dallett; Secretary, Walter Loring Webb; Treasurer, George T. Gwilliam; Directors, J. W. Ledoux, John T. Loomis and Emile G. Perrot.

Iron and Steel Institute.

The annual general meeting will be held at the Institution of Civil Engineers, Great George street, London, S. W., on May 9 and 10, 1907, and the annual dinner will take place—under the presidency of Sir Hugh Bell, Bart.—in the grand hall of the Hotel Cecil, on Friday, May 10. The council will shortly award Carnegie Research Scholarships. Candidates must apply before February 28. The awards will be announced at the general meeting. Bennett H. Brough, Secretary, 28 Victoria street, London, S. W.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Little Rock & Hot Springs Western.—C. A. Pratt has been elected Vice-President.

Pennsylvania Company.—See Pittsburg, Cincinnati, Chicago & St. Louis.

Pennsylvania Lines West.—See Pittsburg, Cincinnati, Chicago & St. Louis.

Pittsburg, Cincinnati, Chicago & St. Louis.—J. L. Mason has been appointed Assistant Secretary of this road and of the Vandalia and of the Pennsylvania Company, which operates the northwest system of the Pennsylvania Lines West.

Temiskaming & Northern Ontario.—A. J. McGee, General Accountant, has been appointed Secretary, succeeding H. W. Pearson, resigned.

Vandalia.—See Pittsburg, Cincinnati, Chicago & St. Louis.

Operating Officers.

Atchison, Topeka & Santa Fe Coast Lines.—J. A. Christie, Trainmaster at Barstow, Cal., has been appointed Acting Superintendent of the Valley division, with office at Fresno, Cal., J. W. Walker having been granted leave of absence.

Canadian Pacific.—G. P. Bury, General Superintendent at Winnipeg, has been appointed to the new office of Assistant General Manager of western lines. A. Price, Superintendent of Transportation of western lines, succeeds Mr. Bury, and the office of Superintendent of Transportation has been abolished.

Grand Trunk.—J. J. Connelly, Trainmaster of the Fourth and Fifth districts, with office at Montreal, has been appointed Trainmaster of the Second and Third districts, with office at Richmond, Que., and the office of Trainmaster of the Fourth and Fifth districts has been abolished. C. L. Mayne, Assistant Superintendent of the First, Second and Third districts, has been appointed Superintendent of Montreal terminals, including the lines to St. Lambert and Lachine, and the Jacques Cartier branch, succeeding J. L. Gogerty, resigned, and will also be in charge of the Fourth district, succeeding Mr. Connelly. Mr. Mayne's office will be at Montreal. H. F. Coyle, Trainmaster at Belleville, Ont., succeeds Mr. Mayne, with office at Island Pond, Vt. L. G. Coleman, Assistant Superintendent at Ottawa, Ont., has been appointed Assistant Superintendent of the Fifth, Sixth and Seventh districts, with office at Belleville, Ont. Stanton Ennes, Master of Transportation at London, Ont., succeeds Mr. Coleman.

Illinois Central.—A. E. Clift, Superintendent at Freeport, Ill., has been appointed Superintendent at Carbondale, Ill., succeeding C. L. Ewing, promoted. E. Dailey, Trainmaster of the Amboy division, succeeds Mr. Clift. G. E. Patterson, Trainmaster at Freeport, succeeds Mr. Dailey, with office at Freeport. S. H. Duckworth, chief despatcher at Kankakee, Ill., succeeds Mr. Patterson.

Lehigh Valley.—John F. Maguire, Superintendent at Wilkesbarre, Pa., has been appointed Assistant Superintendent of Transportation, with office at South Bethlehem, Pennsylvania.

Traffic Officers.

Baltimore & Ohio.—L. R. Brockenbrough, General Freight Agent of the lines west of the Ohio river, has resigned. O. A. Constans, division freight agent at Cleveland, Ohio, succeeds Mr. Brockenbrough, with office at Pittsburg, Pa.

Illinois Central.—C. C. Cameron, General Freight Agent of southern lines, has been appointed to the new office of General Freight Agent of the whole system. D. W. Longstreet, General Freight Agent at Louisville, Ky., succeeds Mr. Cameron, with office at Memphis, Tenn. William Smith, Jr., Assistant General Freight agent at Nashville, Tenn., succeeds Mr. Longstreet. W. E. Downing, Commercial Agent at Cincinnati, Ohio, succeeds Mr. Smith.

Union Pacific.—W. H. Murray has been appointed Assistant General Passenger Agent.

Wheeling & Lake Erie.—R. Kaser, chief clerk to the Freight Claim Agent, has been appointed Freight Claim Agent, with office at Pittsburg, Pa., succeeding C. W. Winslow, resigned.

Engineering and Rolling Stock Officers.

Central of New Jersey.—See Lehigh Valley.

Lehigh Valley.—A. H. Dakin, Assistant Engineer of the Central of New Jersey at Jersey City, N. J., has been appointed Terminal Engineer of the Lehigh Valley at New York City.

Isaac McKeever, roundhouse foreman at Lehighton, Pa., has been appointed Master Mechanic at Weatherly, Pa., succeeding Thomas Coyle, deceased.

Northwestern Pacific.—W. C. Edes, District Engineer of the Southern Pacific at San Francisco, has been appointed Chief Engineer, with office at San Francisco, of the Northwestern Pacific, a new company which is a consolidation of several Southern Pacific and Santa Fe lines in northern California.

Southern Pacific.—See Northwestern Pacific.

Wheeling & Lake Erie.—C. A. Steele has been appointed Assistant Engineer, with office at Canton, Ohio.

Special Officers.

Pennsylvania.—E. A. Sterling, formerly Assistant Forester in the Department of Agriculture at Washington, has been appointed to the new office of Forester of the Pennsylvania, effective March 1.

LOCOMOTIVE BUILDING.

The St. Louis & San Francisco expects to buy in the near future 45 consolidation (2-8-0) locomotives.

The Western Pacific denies being in the market for 10 locomotives, as reported in our issue of January 25.

The Great Northern expects to order 15 locomotives in addition to the 140 locomotives reported in our issue of January 4.

The Missouri & North Arkansas, as reported in our issue of January 18, has ordered five simple consolidation (2-8-0) locomotives from the Baldwin Locomotive Works, for June delivery. The specifications are as follows:

General Dimensions.

Type of locomotive	Consolidation
Weight, total	182,000 lbs.
Weight on drivers	164,000 "
Diameter of drivers	56 in.
Cylinders	22 in. x 28 in.
Type of boiler	Straight
Boiler, working steam pressure	180 lbs.
" number of tubes	344
" material of tubes	Spang-Chalfant charcoal iron
" diameter of tubes	2 in.
" length of tubes	14 ft. 6 in.
Firebox, length	121 "
" width	41⅝ "
" grate area	34.9 sq. ft.
Heating surface, total	2,702 "
Tank capacity	6,000 gals.
Coal capacity	14 tons.

Special Equipment.

Air brakes	Westinghouse
Couplers	Climax
Headlights	U. S.
Injector	Monitor
Sanding devices	Leach
Tires (driving wheels)	Midvale
Other specialties	Walschaert's valve gear and Richardson's balanced slide valve.

CAR BUILDING.

The Erie has ordered three postal cars.

The Chicago & North-Western has ordered 8,000 freight cars.

The West Jersey & Seashore has ordered 21 electric passenger cars.

The Nashville, Chattanooga & St. Louis is reported as in the market for 500 cars.

The Norfolk & Western will build 1,000 gondola cars at its Roanoke, Va., shops.

The Chesapeake & Ohio has ordered 4,000 steel cars from the Pressed Steel Car Co.

The Seaboard Air Line is reported to be in the market for 1,500 box cars and 1,000 coal cars.

The Chicago, Burlington & Quincy is asking prices on 4,000 box cars and 2,000 steel gondolas.

The Missouri Pacific has ordered 1,000 additional cars from the American Car & Foundry Co.

The Colorado & Southern, it is reported, has ordered 600 ore cars from the American Car & Foundry Co.

The Mexican National Packing Company, 1133 Broadway, New York, is about to order 50 refrigerator cars.

The Valley Lumber Company is reported to have ordered 15 logging cars from the Beaumont Iron Works.

The Interoceanic of Mexico has ordered some flat cars and passenger coaches from the Mexican Car & Foundry Co.

The Duluth, South Shore & Atlantic has ordered 50 box cars, of 80,000 lbs. capacity from the American Car & Foundry Co.

Fox Bros. & Co., 126 Lafayette place, New York, have secured an order for six passenger coaches for a Cuban plantation railroad.

Fox Bros. & Co., 126 Lafayette place, New York, are in the market for 150 cane cars and 60 fruit cars for Cuban plantation railroads.

The Foreman-Blades Lumber Company, Elizabeth, N. C., has ordered six logging cars from the Norport Car & Locomotive Works, Norfolk, Va.

The St. Louis & San Francisco expects to buy in the near future 3,000 box cars, 1,000 stock cars, 1,000 coal cars, 500 flat cars, 88 passenger cars and two steam motor cars.

The St. Louis Refrigerator Car Co., St. Louis, Mo., as reported in our issue of January 18, has ordered 200 steel underframe refrigerator cars of 80,000 lbs. capacity from the American Car & Foundry Co., for April, 1908, delivery.

The Louisiana & Arkansas denies having ordered 503 freight cars from Barney & Smith, but has ordered three passengers cars from Barney & Smith; also has asked bids on 500 box cars, and will probably shortly ask bids on 100 coal cars.

The General Chemical Company has ordered 25 steel underframe tank cars of 6,600 gallons capacity from the Bettendorf Axle Company for March delivery. These cars will be 31 ft. long, 9 ft. wide and 12 ft. 6 in. high, over all. The special equipment includes:

Bolsters	Bettendorf
Brake beams	Monarch
Brake-shoes	Walsh
Brasses	Camel
Couplers	Climax
Draft rigging	Miner
Dust guards	Harrison
Trucks	Bettendorf

The Mineral Point Zinc Company, Chicago, has ordered 25 steel tank cars of 80,000 lbs. capacity from the Bettendorf Axle Company for March delivery. These cars will be 31 ft. long and 9 ft. wide, over all. The special equipment includes:

Bolsters	Bettendorf
Brake-beams	Monarch
Brake-shoes	Walsh
Brakes	Westinghouse
Brasses	Camel
Couplers	Climax
Draft rigging	Miner
Dust guards	Harrison
Trucks	Bettendorf

The Kingan Refrigerator Line, Indianapolis, Ind., has ordered 55 refrigerator cars of 60,000 lbs. capacity from the American Car & Foundry Co. These cars will be 36 ft. long and 8 ft. 11 in. wide over all, and 7 ft. 2½ in. high between sill and plate. The special equipment is as follows:

Bolsters	Common Sense
Brake-beams	Simplex
Brake-shoes	American Brake-Shoe & Foundry Co.
Brakes	Westinghouse
Brasses	Solid
Couplers	Gould
Draft rigging	Cardwell
Journal boxes	National Malleable Castings Co.
Roofs	Torsion proof
Springs	Pittsburg Spring & Steel Co.

The Chicago & Milwaukee Electric, as reported in our issue of January 25, has ordered 20 motor cars from the Jewett Car Co., for June to September delivery. These cars will weigh 77,000 lbs., and will measure 52 ft. 3 in. long, 8 ft. 10 in. wide and 13 ft. 1¾ in. high, over all. The special equipment is as follows:

Brake beams	Baldwin
Brakes	Peacock hand and Westinghouse
Brasses	Ajax
Couplers	Van Dorn
Curtain fixtures	Forsyth
Curtain material	Pantasote
Door fastenings	Stearns
Dust guards	Symington
Heating system	Peter Smith
Journal boxes	Symington
Paint	Pullman new color
Springs	Pittsburg Spring & Steel Co.
Trucks	Baldwin

The Missouri & North Arkansas, as reported in our issue of January 18, has ordered two first class coaches from the American Car & Foundry Co., for April delivery. These cars will be 72 ft. 8¼ in. long, 10 ft. ¼ in. wide and 14 ft. 7 in. high, over all. The special equipment is as follows:

Bolsters	Commonwealth
Brake-beams	National-Hollow
Brake-shoes	Christie
Brakes	Westinghouse
Brasses	Eureka Brass Co.'s
Couplers	Tower
Curtain fixtures	Curtain Supply Co.
Curtain material	Pantasote
Dust guards	Harrison
Heating system	Safety Car Heating & Lighting Co.
Journal boxes	McCord
Light	Pintsch gas
Vestibules	Pullman

The Intercolonial, as reported in our issue of January 11, is building at its Moncton shops the motive power parts of three motor cars, the car bodies of which are being built by Rhodes, Curry & Co. These cars will seat 52 persons, and will also have baggage compartments. They will weigh about 115,000 lbs. and will measure 65 ft. 1⅝ in. long, and 7 ft. 3¾ in. high, inside measurements, and 66 ft. long and 8 ft. 11⅝ in. wide, over all. Bodies and underframes will be of wood. The special equipment includes:

Bolsters	Steel plate
Brake beams	Simplex
Brake shoes	Christy
Brakes	Westinghouse
Curtain fixtures	Pantasote
Curtain material	Pantasote
Heating system	Safety Car Heating & Lighting Co.
Light	Safety Car Heating & Lighting Co.
Platforms	Standard Coupler Co.
Vestibules	Pullman

The Nashville, Chattanooga & St. Louis, as reported in our issue of January 25, will build, at its Nashville shops, 25 beer cars of 60,000 lbs. capacity. These cars will weigh 40,000 lbs., and will measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements, and 36 ft. 8⅝ in. long, 9 ft. 11¾ in. wide and 13 ft. 11½ in. high, over all. Bodies and underframes will be of wood. The special equipment includes:

Axles	Iron
Bolsters	Simplex
Brake-beams	Simplex
Brakes	Westinghouse
Brasses	N., C. & St. L.
Couplers	Tower
Door fastenings	N., C. & St. L.
Doors	N., C. & St. L.
Draft rigging	Thornburg
Dust guards	Wooden
Journal boxes	Cast-iron
Paint	Long's, Louisville
Roofs	Winslow
Springs	Railway Steel-Spring Co.
Trucks	Arch Bar
Wheels	Louisville Car Wheel Co.

RAILROAD STRUCTURES.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company announces that the capacity of its power plant at Kent and Division avenues is to be doubled. Contracts for additions to the power house, which is to be ten stories high, have been let, and work is to be started at once. The cost of the improvements will be about $5,500,000.

CALGARY, ALB.—Plans for a new station and office building for the Canadian Pacific are being made. Estimated cost $200,000.

DAVENPORT, IOWA.—Surveys are being made by the Chicago, Milwaukee & St. Paul of a site for a new freight house; also in connection with the proposed union passenger station.

HALIFAX, N. S.—Bids are wanted January 31 by D. Pottinger, General Manager of the Intercolonial at Moncton, N. B., for putting up car shops and a planing mill at Halifax.

KANSAS CITY, KAN.—The Edgewater Terminal Railway Company in return for franchises to be granted by this city proposes to build a passenger station to cost $35,000.

MILWAUKEE, WIS.—The Milwaukee Light, Heat & Traction Company is planning to put up car shops, in which to build its cars.

MINOT, S. DAK.—Plans, it is said, have been made by the Minneapolis, St. Paul & Sault Ste. Marie for a stone and brick passenger station, to cost with other improvements $100,000.

MONROE, N. C.—Plans are being made by the Seaboard Air Line for a freight house and for other improvements to cost $60,000.

MONTREAL, QUE.—The Grand Trunk, it is reported, has decided to improve its main line between this place and Toronto at a cost of $10,000,000. The work will include a bridge over an arm of Lake Ontario.

The Grand Trunk and the Grand Trunk Pacific, it is said, are back of a project to put up a new hotel here to cost $3,000,000.

NEEDLES, CAL.—Contracts have been given by the Atchison, Topeka & Santa Fe (Coast Lines) for a new passenger station at a cost of about $175,000 to replace the one burned last summer.

OTTAWA, ONT.—The Grand Trunk, it is said, has obtained from the Canadian Government a lease of the canal reserve in Ottawa for 999 years. The ground will be used for a new passenger station to cost $250,000.

READING, PA.—According to local reports, the Philadelphia & Reading has given contracts to Enos L. Seeds for putting up a steel freight house 30 ft. x 194 ft., and a two-story brick office building 20 ft. x 30 ft.

SACKVILLE, N. B.—Bids are wanted February 4 by D. Pottinger, General Manager of the Intercolonial at Moncton, N. B., for putting up a passenger station here.

SCRANTON, PA.—It is announced that the Delaware, Lackawanna & Western will build locomotive shops here on the site of the Lackawanna Iron & Steel Company's north mills. The cost of the improvements will be about $2,000,000.

SEATTLE, WASH.—Plans are being made for freight terminal facilities for the Harriman lines on ground 600 to 800 ft. wide and about a mile long which it already owns at Duwanisch avenue. The work includes new tracks, round houses and freight sheds; when completed this will be one of the largest terminals on the Pacific coast.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATLANTA, BIRMINGHAM & ATLANTIC.—This company is to open its line between La Grange, Ga., and Brunswick for regular freight and passenger service about March 1, and will inaugurate a through passenger service between Brunswick and Atlanta over the Atlanta & West Point.

BOSTON SUBWAYS.—Application has been made for permission to build a subway and tunnel from Park street under the Charles river embankment back of Beacon street to the junction of Beacon street, Commonwealth avenue and Brookline avenue.

BUFFALO & SUSQUEHANNA.—Plans for rebuilding portions of this road from Jeneau south toward Pittsburg and for building new yards have been made. Bids for the work may shortly be asked.

CANADIAN PACIFIC.—According to a statement of Second Vice-President William Whyte, this company has plans for building 350 miles of new line in the west during 1907 at a cost of about $6,000,000. This includes completion of the line from Winnipeg via Saskatoon to Edmonton, a great part of which is already completed. The Pheasant Hill branch, which is now built about 17 miles west of Strassburg, is to be extended to connect with the Edmonton line, and a 50-mile extension is also to be built from Moose Jaw northwest towards the Saskatchewan river. In addition to this work, the company expects to finish about 300 miles of double-tracking between Fort Williams and Winnipeg during the year.

CHICAGO, BURLINGTON & QUINCY.—Maps have been filed by this company for an extension of the Big Horn Railroad from Worland, Wyo., south to Thermopolis, thence along the Big Horn river to a point where the line will turn west toward Salt Lake City, which, it is said, will be its ultimate destination.

CHICAGO, LAKE SHORE & SOUTH BEND (ELECTRIC).—An officer writes that contracts for the entire construction and equipment of this proposed electric line from South Bend, Ind., to Kensington, which is within the city limits of Chicago, have been let. Ninety per cent. of the right of way has been bought. This is to be 50 ft. wide for the first 15 miles, and beyond that at least 66 ft. wide. In some places it will be 120 ft. wide. Work has already been begun on two bridges over the Calumet river. Track has been laid for 10 miles out of South Bend, Ind. Grading work is under way west of New Carlyle, Ind., and tracklaying will be started within the next two months from Gary, Ind., west to the terminal of the road. The company has bought five acres of land in Chicago as a site for terminals and has also secured a site at Michigan City for its power house. The South Bend Construction Company are the contractors. J. B. Hanna, President, South Bend, Indiana.

CINCINNATI & BIRMINGHAM AIR LINE.—Application will be made for a charter by this company to build a line from Paintsville, Ky., where connection is to be made with the Norfolk & Western and the Chesapeake & Ohio to Jeff, Ala., approximately 420 miles. J. H. Connors, formerly of the projected Nashville & Huntsville, is interested.

FREEO VALLEY.—An officer writes that contracts have been let to S. R. Neu, of Princeton, Ark., for extending this road from mile post 22 to mile post 26.

FRONT ROYAL, RAPPAHANNOCK & TIDEWATER.—Preliminary surveys have been made for this proposed line from Front Royal, Va., to Griglersville, 50 miles. Hugh E. Naylor, Secretary, Front Royal.

GRAND TRUNK PACIFIC.—Hon. H. R. Emmerson reports that on the section of the National Transcontinental between Winnipeg and Superior Junction the excavation will amount to 11,233,247 cu. yds. of earth and 3,696,336 cu. yds. of rock. Of this 282,009 cu. yds. of earth and 179,920 cu. yds. of rock have been completed. J. D. McArthur, contractor.

On the section between La Tuque and Quebec there are 6,303,682 cu. yds. of earth and 1,169,150 cu. yds. of rock. Work to date amounts to 664,995 cu. yds. of earth and 322,367 cu. yds. of rock. Contracts call for the completion of these sections by Sept. 1, 1907.

GRAY'S HARBOR & PUGET SOUND.—An officer writes that this company has been incorporated in Washington to build a line from Aberdeen and Hoquiam, Wash., west to Centralia, 75 miles. Most

of the surveys have been made, and construction is under way on part of the line. The office of the company is at Aberdeen. The officers are: A. J. West, President; J. B. Bridges, Counsel; W. J. Patterson, Treasurer and General Manager; J. F. Richards, Purchasing Agent and Assistant Auditor, all of Arbedeen, and J. M. Clapp, Chief Engineer and Auditor, of Seattle.

INTERNATIONAL OF NEW BRUNSWICK.—This company has completed 33 miles out of Campbellton, N. B., Thos. Malcolm, contractor. The road is to be extended to St. Leonards, on the St. John river, 110 miles, from Campbellton. Additional contracts for 60 miles are to be let early in March.

KANSAS CITY & SPRINGFIELD SOUTHERN.—An officer writes that surveys have been made for this road from Springfield, Mo., to Richards, 95 miles, and from Sylvania to Stockton, 18 miles. Office at 2975 Michigan avenue, Chicago.

KENTUCKY & TENNESSEE.—Contracts have been given by this company to C. B. Donaghy, for extending its road from Yamacraw, Ky., six miles. Surveys are being made for an extension from Yamacraw to Bellfam, 12 miles.

LAKE ERIE & PITTSBURG.—See Lake Shore & Michigan Southern.

LAKE SHORE & MICHIGAN SOUTHERN.—An officer writes that contracts have been let to the Carter Construction Co. to extend the Lake Erie & Pittsburg from Mill Creek Junction, near Cleveland, Ohio, to Kent, 26 miles. The line is projected beyond that place to a point not yet decided on. Samuel Rockwell, Chief Engineer, Cleveland, Ohio.

MASCOUTAH & BELLEVILLE (ELECTRIC).—This company has projected a line from Mascoutah, Ill., to Belleville, 11 miles. Peter W. Lill, Secretary, Mascoutah, Ill.

MISSOURI & NORTH ARKANSAS.—Contracts have been given by this company, formerly the St. Louis & North Arkansas, to Burke & Josephs, of Cape Girardeau, Mo., for building an extension from Leslie, Ark., southeast to Pangburn, 75 miles. Surveys are being made from Pangburn to the Mississippi river, about 100 miles, and from Seligman, Mo., northwest to Joplin, 60 miles.

MOBILE & WESTERN.—An extension of this road is projected from Mission Church, Ala., to which point the road was built last year, west to the Mississippi river.

MOREHEAD & NORTH FORK.—Contracts let to the Snyder Construction Co., of Morehead, and the Rinehart & Dennis Co., of Washington, S. C., for building this line from Morehead, Ky., to Paragon, 10 miles. E. W. Hess, Clearfield, Pa., is interested.

NEW RIVER, HOLSTON & WESTERN.—Contracts have been given to the Sale Construction Co., of Narrows, Va., for extending this road from Boxley, Va., to Day, two miles.

NEW YORK CITY ROADS.—Plans for a four-track subway loop by the city of New York at a cost of $5,245,000 to connect the Brooklyn and Williamsburg Bridges, has been approved and bids will be asked shortly. The work will take about three years.

NORFOLK & WESTERN.—Contracts are reported let for six tunnels aggregating 6,100 ft. on the West Virginia division, to cost about $3,000,000. The work, which is to be completed within three years, will reduce the curves and shorten the distance about 15 miles.

OPELOUSAS, GULF & NORTHEASTERN.—An officer writes that contracts have been let to Myrick & Andrews, of Opelousas, La., for extending this road from Melville, La., to Crowley, 58 miles. C. C. Genung, Chief Engineer, Opelousas, La.

PONTIAC CENTRAL.—Application will be made to the Quebec Legislature by Ryan & Bickerdyke, attorneys, Montreal, to incorporate this company to build from Bryson, Que., to a point on James Bay, Ontario.

RALEIGH & WESTERN.—An officer writes that surveys are being made for an extension from Cumnock, N. C., to Greensboro, 50 miles.

SOUTH & WESTERN.—An officer writes that this road is now under construction from Fink, Va., south to Johnson City, Tenn., 82 miles, and from Altapass, N. C., to which point it was extended last year south to Bostic, 62 miles.

STEUBEN TRACTION COMPANY.—The New York State Board of Railroad Commissioners has given authority to this company to issue a mortgage for $500,000 and increase its capital stock from $370,000 to $630,000. The company, which is a consolidation of the street railroads in Hornellsville, N. Y., and Canisteo, proposees to build south about 15 miles to Jasper.

TECUMSEH-NORMAN TRACTION.—An officer writes that surveys are now being made, and when these are completed contracts will be let for building this electric line from Tecumseh, Okla., west via Brown, Waco and Denver to Norman, about 40 miles. W. F. Powell, Tecumseh, is President. (Nov. 30, p. 159.)

TEMISKAMING & NORTHERN ONTARIO.—An officer writes that construction work is now under way from McDougalls Chute, Ont., north seven miles. Contracts have been let for branches from Cobalt to Kerr Lake, four miles; from Engleheart to Charlton, eight miles, and from Haileyburg to Haileyburg wharf, one mile. A. R. McDonnell, of New Liskeard, has the contract for work on the main line. Surveys are being made for a 45-mile extension from seven miles north of McDougall to a connection with the National Trans-Continental (Grand Trunk Pacific).

WINNIPEG & NORTHWESTERN.—Application is to be made by A. T. Drummond, of Winnipeg, at the present session of Parliament at Ottawa, for a charter for this company, which proposes to build a line from Winnipeg north between Lake Manitoba and Winnipeg, then west by way of Fort La Corne and the north side of Saskatchewan river to Lopstick river. Branches are also to be built to connect with Battleford, Lac la Biche, Edmonton and Athabasca Landing.

RAILROAD CORPORATION NEWS.

ALABAMA CENTRAL.—Bradford Dunham has been appointed Receiver on application of the General Manager. The company owns nine miles of road from Booth's Station, Ala., to Autaugaville.

ATCHISON, TOPEKA & SANTA FE.—Gross earnings for the six months ended December 31, 1906, were $45,576,512, an increase of $5,708,070; net earnings, $17,781,010, an increase of $2,352,491. The average mileage operated increased from 9,130 to 9,237.

ATLANTA, BIRMINGHAM & ATLANTIC.—Clark, Dodge & Co., New York, and the Trust Company of America are offering at a price to net 6.15 per cent. $2,000,000 first collateral trust four-year 5 per cent. coupon joint notes of May 1, 1906, of the Atlantic & Birmingham Construction Co. and the Atlanta, Birmingham & Atlantic Railroad, being part of an issue of $8,000,000. (June 8, p. 168.)

CANADIAN PACIFIC.—Gross earnings for the six months ended December 31, 1906, were $37,464,474, an increase of $6,082,497; net earnings $14,585,867, an increase of $2,398,468.

CENTRAL OF GEORGIA.—Gross earnings for the six months ended December 31, 1906, were $6,127,246, an increase of $247,157. The operating ratio rose from 69 per cent. to 76 per cent., leaving net earnings of $1,473,999, a decrease of $376,645.

CHICAGO, MILWAUKEE & ST. PAUL.—The chairman of the board is quoted as follows concerning the Pacific extension of this road:

> "The line will be 150 miles shorter from Chicago to Seattle than the Northern Pacific, and about 80 miles shorter than the Great Northern. Over the mountains the grades will be from 1⅔ per cent. to 1⅘ per cent. compensated. The Northern Pacific grades are in all cases 2⅕ per cent., any many of them are not compensated, and therefore average as high as 2⅖ per cent. Aside from mountain grades, the St. Paul road has a much lower grade than the Northern Pacific, and the mountain grades are so bunched that they will not impede traffic. The extension is compelled to run along the Northern Pacific for a considerable distance, and to cross the Northern Pacific several times by reason of the physical conditions. This, however, does not apply to much territory which produces a large business, and therefore the competition will not be severe. The estimated cost of the extension will be $40,000 a mile for the main line, which includes equipment, and $30,000 a mile for branches. This contemplates a strictly first-class road in all respects. It is expected to have the road in operation to Butte, Mont., by the end of 1907, and the entire line in about three years."

CHICAGO, ROCK ISLAND & PACIFIC.—Gross earnings for the six months ended December 31, 1906, were $29,957,274, an increase of $2,946,496; net earnings, $10,041,879, an increase of $1,475,806.

CHICAGO, SOUTH BEND & NORTHERN INDIANA (ELECTRIC).—The Northern Indiana, which operates 77 miles of road, consisting of street railways in South Bend, Ind., Mishawaka, Elkhart, Goshen, La Porte and Michigan City, and interurban lines between these points, has been sold for $4,000,000 to the Dieterich-Murdock syndicate. The Chicago, South Bend & Northern Indiana has been incorporated with $7,000,000 capital to take over the property, and it is intended to at once begin an extension from South Bend via Michigan City to Chicago.

CORNWALL & LEBANON.—A dividend of 4 per cent. on the $8,000,000 capital stock has been declared payable January 31. A semi-annual dividend of 3 per cent. was paid July 31, 1906, the annual rate having been 6 per cent. since 1901.

GREAT NORTHERN.—The Attorney-General of Minnesota has brought suit to have the charter of the St. Paul, Minneapolis & Manitoba forfeited. This road runs from St. Paul, Minn., to Lowell, Wash., 1,790 miles, and forms part of the main line of the Great Northern, which leases it for 999 years from 1890. The Great Northern has assumed the funded debt of the St. P., M. & M., and the greater part of the capital stock of the last named company has been exchanged for Great Northern stock.

Green Bay & Western.—The reorganization plan proposed by the holders of the debenture "B" income bonds last October has been withdrawn, and the bonds deposited under its provisions have been returned to the holders. The plan provided for the purchase of the capital stock by the debenture holders, the reorganization of the road under the name Green Bay & St. Paul, an issue of new first mortgage bonds of the new company, and an extension of the line to St. Paul. (Oct. 26, p. 116.)

Hocking Valley.—Gross earnings for the six months ended December 31, 1906, were $3,504,042, an incerase of $82,222; net earnings $1,198,037, a decrease of $125,761.

Hudson & Manhattan.—The enterprises planned by this company include a tunnel from Jersey City to Christopher street, New York, already built; a tunnel from Jersey City to Cortlandt street, New York, to be finished in 1908; a subway line connecting the Manhattan terminals of these tunnels with Herald Square; an office building at Herald Square, and a terminal and office building, which, it is reported, will be the largest skyscraper in the world at Cortlandt, Church and Dey streets, New York, for which the steel caissons are now being sunk. The Hudson & Manhattan Railway, which is the holding company controlling the various subsidiary companies incorporated to carry out these different projects, has sold $40,000,000 4½ per cent., 50-year, convertible bonds to a syndicate of the bankers who control the property, principally represented by Harvey Fisk & Sons. The whole cost of the enterprise has been estimated at $60,000,000. The work is being done by the Hudson Companies, which is the construction company for the Hudson & Manhattan. There has recently been a report that a controlling interest in the Hudson & Manhattan has been acquired by the Interborough-Metropolitan Company, but this is not confirmed, although several directrs of the Hudson & Manhattan are also directors of the Interborough-Metropolitan. It is announced that the line from Fourteenth street and Sixth avenue to Christopher street and under the Hudson river to Jersey City will be put in operation this September.

Interstate Railways Company.—This company, which controls, through subsidiary companies, 515 miles of electric road in New Jersey and Pennsylvania, is to begin on February 1 the operation of the Philadelphia, Bristol & Trenton, the control of which it acquired last September. The P., B. & T. owns 21 miles of road from Torresdale, Pa., to Morrisville. Heretofore it has reached Trenton, N. J., by trackage rights with the Pennsylvania & New Jersey Traction Company, but it is now expected that the line will be extended from Morrisville to Trenton.

Kansas City Southern.—Gross earnings for the six months ended December 31, 1906, were $4,389,773, an increase of $776,593; operating expenses decreased $28,799, leaving net earnings of $1,732,463, an increase of $805,392.

Lake Shore & Michigan Southern.—See New York Central Lines.

Lehigh Valley.—Gross earnings for the six months ended December 31, 1906, were $18,374,244, an increase of $801,997; net earnings $7,617,881, an increase of $390,205.

Maine Steamship Co.—See New York, New Haven & Hartford.

Michigan Central.—See New York Central Lines.

Metropolitan West Side Elevated (Chicago).—A quarterly dividend of three-quarters of 1 per cent. on the $8,708,000 outstanding 5 per cent. non-cumulative preferred stock has been declared payable March 30 to holders of record on March 21. This is the first dividend since February, 1903, when 1½ per cent. was paid.

New York Central & Hudson River.—See New York Central Lines.

New York Central Lines.—J. P. Morgan & Co. have sold $50,000,000 three-year 5 per cent. notes recently bought from three New York Central lines. Of this amount, $25,000,000 were New York Central & Hudson River notes, the proceeds to be used, it is understood, to pay for electrification in and near New York City; $15,000,000 Lake Shore & Michigan Southern, for four-tracking and other improvements; and $10,000,000 Michigan Central, probably to be used for the Detroit tunnel.

New York, New Haven & Hartford.—The report that this company had obtained control of the Maine Steamship Company, which operates a line of steamboats between New York and Portland, Me., has been confirmed. (Jan. 25, p. 130.)

Northern Indiana (Electric).—See Chicago, South Bend & Northern Indiana.

Northwestern Pacific.—A meeting of the shareholders has been called for March 12 to vote on an issue of $35,000,000 mortgage bonds, part of which are to be used to retire bonds of constituent companies. The Northwestern Pacific, which was recently incorporated, is a consolidation of several Southern Pacific and Atchison lines in northern California, aggregating about 500 miles. Of the nine directors, five represent the Southern Pacific and four the Atchison. Each of the controlling companies is to be in control in alternate years. (Jan. 18, p. 96.)

Panama Railroad.—The annual report for the year ended June 30, 1906, shows gross earnings of $2,570,828, an increase of $311,990. Operating expenses, however, increased $552,944, particularly because of the greatly increased cost of conducting transportation due to the interference with traffic when strict quarantine measures were enforced in the latter part of 1905, and also because of the heavier equipment used and the increased cost of labor and supplies. The net earnings were $838,939, a decrease of $240,953. Concerning the condition of the road at the close of the preceding year, the report quotes from a recent letter from Vice-President John F. Stevens, part of which follows:

"The Panama Railroad Company had practically nothing more than a right-of-way with a fair roadbed which had, however, already proven unequal to the heavy traffic it was called upon to bear. Its rolling stock was limited in quantity, small in capacity, and of antiquated type and entirely unsuited to the demands put upon it. It had not the requisite sidings either for handling through or local business, and those that were in existence were at the end of their lives and had to be rebuilt. From Colon to Panama there was not a single station building which was adequate to the requirements of the service, and not to exceed two telegraph operators between terminals, with no telegraph lines over which a train order could be sent with any certainty that it would reach destination inside of twenty-four hours. Its ocean terminals were neither commodious, well arranged nor had they been maintained in a safe condition. The personnel of the road, while in the main consisting of well-meaning parties, had grown up under conditions which, instead of inducing development and progress, had practically kept it at a standstill for years. The throwing upon the road of the immense amount of back business which resulted from the occupancy of the Zone by the United States, and the commencement of the work of preparation for building the Panama Canal made the railroad proposition an almost impossible and disheartening one from the start, it being necessary in every department, without one single exception, to build from the ground up to get the property in shape, while handling not only the current affairs but disposing of the vast amount of business which had been delayed owing to various causes for months. The work of reorganization and reconstruction and the carrying on of the current business, as well as catching up the past, has been conducted during the past fiscal year. The ocean terminals have been more than trebled and terminal yards, with all needed accessories, have been constructed, so that we can now point to the fact that business in the port of Colon over the Company's docks is handled at a cost, considering the local labor conditions, which is unequalled and at a rate of speed that is not exceeded by any port in the world. In fact, the handling of cargo across the docks at Colon is being done quicker and with less trouble than cargoes are handled over the docks in New York City."

Philadelphia, Bristol & Trenton.—See Interstate Railways Company.

Pittsburg, Fort Wayne & Chicago.—According to press despatches, a mortgage for $12,500,000 has been filed in Indiana, the proceeds of the bonds to be used for improvements. The road is operated by the Pennsylvania Company.

Rochester, Syracuse & Eastern (Electric).—The New York State Railroad Commission has authorized this company to issue $3,000,000 first mortgage bonds of 1945, being part of an authorized issue of $7,500,000, of which $2,000,000 are now outstanding. The company operates a duble-track road from Rochester, N. Y., to Lyons, 37 miles, and work is under way on an extension to Port Byron, 58 miles; it is eventually to be extended to Syracuse.

St. Louis & San Francisco.—Gross earnings for the six months ended December 31, 1906, were $24,391,262, an increase of $2,779,855; net earnings, $8,561,365, an increase of $1,161,477.

St. Paul, Minneapolis & Manitoba.—See Great Northern.

Santa Fe, Liberal & Englewood.—E. D. Shepard & Co., New York, are offering a block of the $8,000,000 authorized first mortgage 5 per cent. gold bonds of 1936. The issue is secured by a mortgage covering 321 miles of road under construction from a connection with the Colorado & Southern at Des Moines, N. Mex., to connections with the Atchison, Topeka & Santa Fe at Englewood, Kan., and Woodward, Okla., and will also cover, it is said, 16 locomotives and 2,398 cars. The company has leased the Santa Fe, Raton & Des Moines, now under construction, and the Santa Fe, Raton & Eastern, which is in operation, for 99 years. (Jan. 18, p. 96.)

Seaboard Air Line.—This company is to extend to May 1, 1911, the $4,665,000 5 per cent. guaranteed collateral trust and general lien mortgage bonds due March 1, 1907. The holders of these bonds may exchange them for their face value in extended bonds and $20 cash additional per bond. The President of the Continental Trust Co., Baltimore, is the manager of a syndicate which has arranged to buy any part of this issue which is not extended.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Michigan Taxes 165
- The New Haven Debentures 165
- Unique Forces of Railroad Prosperity 166
- Is Reciprocal Demurrage Just? 166
- Scientific Railroad Operation in Australia 167

ILLUSTRATED:
- A German Motor Car 169
- Electric Operation of the Simplon Tunnel 170
- New Lehigh Valley Bridge over the Susquehanna River, near Towanda, Pa. 174
- The Railroads of Victoria 177
- The Atlantic Shore Line Railroad 178
- Foot-Power Generator for Controlled Manual Block Station 180
- Locomotive Superheaters 181

CONTRIBUTIONS:
- The Profitable Weight and Speed of Freight Trains 168
- Substitution of Electric Motor for Steam Locomotive 168

MISCELLANEOUS:
- Fuel Tests on the Wheeling & Lake Erie 169
- Legislative Centralization 172
- Safety by Legislation 177
- Interstate Com. Commission Tariff Rulings 178
- Railroad Decisions in January 179
- The Early Use of Balanced Slide Valves 180
- National Characteristics in Locomotive Building 186
- Foreign Railroad Notes: Japanese Railroads 188

GENERAL NEWS SECTION:
- Notes 189
- Obituary 191
- Meetings and Announcements 191
- Elections and Appointments 191
- Locomotive Building 193
- Car Building 194
- Railroad Structures 194
- Railroad Construction 195
- Railroad Corporation News 196

VOL. XLII., No. 6. FRIDAY, FEBRUARY 8, 1907.

The state of Michigan, judging by an editorial in one of its local papers, is beginning to suspect a fly in the ointment of heavy taxes on railroad gross earnings, under the law which after being bitterly contested by the railroad companies in the courts, was definitely decided last year in favor of the state. This tax is a splendid revenue producer. Under it railroad taxes are greatly increased. This is all very well as far as the state treasury is concerned, but the effect of the heavy tax is being felt in quite another way by the people of the state. There is need for new railroads in certain undeveloped parts of the state, but in spite of the remarkably high prosperity of the last two or three years, no new steam or electric lines are being built nor are existing railroads extending their lines into undeveloped districts. The cause for this standstill in railroad development is clear if the opinions of two railroad officers, quoted in the editorial referred to, can be taken as typical. One of these men is Treasurer of the Grand Rapids, Grand Haven & Muskegon Railway, a third rail electric road with 48 miles of line connecting the cities named in its title, handling both passenger and freight traffic. According to his statement this company has, under the new tax law, paid 8 per cent. of its gross earnings to the state, besides paying local taxes on a assessment of $12,000 a mile in 1905, $8,000 a mile in 1906, and $10,000 a mile in the present year. Under the highest of these assessments, the 33-ft. right of way of the electric road running through a 160-acre farm pays more taxes than are paid on the whole farm, including improvements. These heavy payments are required for the privilege of running a line which is building up the territory through which it runs and increasing the value of all adjoining property. Similar views come from J. D. Hawks, President of the Detroit & Mackinac, who says:

> The electric lines are not the only ones that suffer from excessive taxation. The Detroit & Mackinac pays to the state $80,000 a year for taxes, and all it is paying to its stockholders is $46,000 a year; and for what? For building up and developing a part of Michigan that otherwise would be a wilderness. The stockholders are receiving a little more than half of the amount paid to the state, and yet capitalists are asked to put more money into Michigan railroads so that the state can get the lion's share, while furnishing none of the capital, none of the risk, and none of the nerve necessary for the building and operation of the lines. People will not build railroads nor furnish the money to build them unless the population and the business is in sight, especially in a state where such enterprises are penalized, and you can make up your mind that roads which are being built on paper will not get any farther than the paper plans until a change is made in the policy of the state toward the railroads. We would not object to paying a fair amount of taxes, being taxed for the physical property only, as other taxpayers are, but paying on the so-called intangible values is coming it too strong.

These opinions sum up briefly the effect of the heavy state taxation on the investment of capital in railroads. It is evident that Michigan is feeling the effects of imposing heavy burdens on railroads in much the same way that the states prominent in the Granger legislation of the seventies found that capital would not be provided for the extension and development of railroads overburdened with public restrictions.

Issues of new stock at par by prosperous American railroad corporations and the consequential "rights" of the shareholder are bringing up some novel questions as to both equities and law relating to those rights. Some time ago we called attention to a curious set of such questions raised by the New Haven company when it renewed the convertibility of the balance outstanding of a large issue of debentures some years after convertibility had expired. The same company has now brought up another interesting point. It has outstanding $30,000,000 of debentures convertible into stock some four years hence in the ratio of $150 in debentures to one share (par $100) of stock; and the company plans a large issue of stock within a few months. It has a bill before the Connecticut legislature allowing the debentures to come in for the new stock and stock rights on the basis of the two-thirds privilege. So far all is clear enough, though it is to be noted that the company must appeal in the matter for special legislation and apparently has not the "debenture" powers under charter or general statute. But on some $12,000,000 of the convertible debentures only 50 per cent. has been paid in, and the new issue of stock will find them only partly paid. Hence arise such queries as these: In regard to the new stock and its "rights" shall the debenture holder who has paid up 50 or 75 per cent. be equalized with the holder who has paid up in full? Ought the company, after issuing the debentures under certain terms as to payment of installments, by restricting the new stock to "full" payers use a kind of a fiscal club to compel full

payments?—which, by the way, would for a short time secure some millions at a low interest rate. And, finally, has a railroad corporation a right, legally speaking, to give stock rights to a promise to pay? Special legislation may answer the last question affirmatively, but how would it be answered in the absence of such legislation? The foregoing is only one of many novel phases of the status, forms, methods and times of issue, and questions of equity, law and expediency, raised and to be raised by the present striking period of high rate railroad borrowing, when by dividend paying corporations, earning fixed charges several times over, are well nigh at their wits' end in devising expedients to reduce the interest rate. For some years to come it is highly probable that corporations with outstanding convertibles will issue new stock with rights. How will they deal with the convertible bond holder who is a stock holder *in futuro*. Will they recognize him or will they ignore him, and if they recognize him, to what extent?

UNIQUE FORCES OF RAILROAD PROSPERITY.

In some important respects the present railroad period stands unique in the annals of American transportation by rail. We have had, relatively and absolutely, more active periods of new railroad construction. We have had times when in certain regions or on certain trunk lines, owing to local and temporary causes, there has been a heavy surplusage of traffic resting on the affected companies; and we have had, in years comparatively recent, periods when the market value of not a few railroad stocks has reached a higher level than now. But never before in the history of railroads in this or any other land has there been such a tense and universal pressure of railroad traffic on railroad facilities; when new tracks, new yards, new passenger terminals and new cars, especially the latter, have been so craved; when the call for extensive railroad betterments has been so imperative and has had to interpret itself in new financing, not only on a vast scale but in high interest rates paid to secure the needed funds. Some phenomena, on their face paradoxical, such as the apparently depressing influence on stocks of rights and of increased dividends may be passed by. They are, in fact, not so irrational as they seem, but rather the logical consequence of the higher law of supply and demand superseding for a time the law of intrinsic values. It is more instructive to refer to some of the remoter forces which bear upon the present era of railroad prosperity—forces not less important because a number of them promise to be permanent.

The first of these forces may be called a local one, though it is hardly just to apply such an adjective to an immense section of the Union. We refer to the great natural development of the country and of railroad business and enterprise on the Western periphery of our national railroad system—in that great region represented by the far West, the Northwest and, to a slightly less degree, the Southwest, and covered in the main by the Harriman, Hill and Santa Fe systems. The reorganization of the Union and Central Pacific roads eight years ago was a kind of starting point of this far Western railroad prosperity. President Mellen, after coming to the New Haven, emphasized this upward movement when, in one of his talks, he spoke of the contrast between the development of his former Northern Pacific line and that of an Eastern road—the small new station on the Northern Pacific growing quickly to a village and large business point in contrast with the lack of new separate points of railroad traffic in the densely populated railroad territory of southern New England. When the historian of railroad affairs in years to come analyzes our present epoch of railroad uplift he will hardly fail to rank among its leading components, both in time and strength, this far Western initiative resting on new material development with immigration as its backbone. Conspicuous in itself, as it has been and is, it has hardly been given its due place as a factor in the existing railroad situation.

Two other forces may be bracketed together, namely, the readjustment of labor so as to be more efficient and the enormous expansion of special industries. The beginnings of real prosperity which may be roughly dated about seven years ago, found not only a considerable group of the unemployed workingmen but others employed in a desultory and temporary fashion. The high demand for labor, which to these has supplied steady work, has had, to be sure, to encounter many obstacles—strikes, shorter nominal hours, closer organization of the unions, demands often dictatorial and much higher wages. But the obstacles appear to have been more than offset by two agencies of added production—quicker labor in piecework, stimulated by better pay and the employer's demand for overtime; and the better industrial organization that characterizes a period of high production. Add to these the expansion of special products such as structural steel and, more noteworthy, the enormous demand for raw and manufactured copper, stimulated by electrical invention and its new utilities, all of them bearing positively on railroad business, and one finds other unique elements of railroad prosperity or at least unique in that earlier periods have had them in much lesser degree.

To the foregoing, as an influence in the present railroad status, is to be added another, unique for our times—the telephone. Its great increase, its multiplied uses, its established place as an instrument of first necessity in business and household are attested by the returns of the telephone companies and by everyday experience. In a commercial sense and in actual practice the telephone is not exactly a labor saver. Men work as hard or harder than they did before they had it. But with the wonderful device men become much greater producers. In its relation to the railroads, the invention has had a two-fold bearing. Its long distance operation has undoubtedly cut off some of the passenger traffic which the roads would otherwise have gained. But they have gained passengers nevertheless; and in its relation to freight traffic the telephone has been the same stimulant that it has been in general commerce and a powerful agency of production not to be rated lower because its results cannot be reduced to figures. Indeed, remembering that any stimulus to production is also a stimulus of travel, it is doubtful whether the direct effect negatively of the telephone or passenger traffic is as great as its indirect and positive effects as a promoter of that branch of railroad business.

Reviewing all the foregoing elements in our railroad situation, one finds that most of them are in their intrinsic nature permanent. Industrial depression will affect seriously labor and such branches as structural steel; much less electrical industry; and the growth of the West and the productive power of new invention, including the telephone, hardly at all. We must reckon up all such co-efficients and strike the balance in any estimate—apart from Wall street—of the endurance of the present remarkable epoch of railroad business.

IS RECIPROCAL DEMURRAGE JUST?

Under the old competitive conditions there grew up the abuse of delaying cars in loading and unloading far beyond the time necessary for these operations. Cars were used for storehouses or ordered when not immediately needed to such an extent that terminals were badly congested, the roads were short of cars and were suffering great losses as a result. More than this, the conscientious shipper or consignee, who handled his cars promptly, had to suffer from the slow movement and car shortages which resulted from the dilatory methods of his less scrupulous competitors. A few years ago the railroads put in force a "demurrage rule" under which, after a reasonable time allowed for loading or unloading a car, a charge of $1.00 a day thereafter is made for detention of the car. This charge does not cover the loss which a railroad suffers by delays to its cars, as a moving car is generally worth many times one earning only $1.00 a day, but it served to do away with the worst abuses of the old system. This charge made by the carrier is really not a penalty but a rental paid by the shipper for the use of the railroad's property while in his possession after a reasonable time for loading or unloading has passed. It has been sustained by the courts as a legitimate, reasonable and constitutional charge and a public benefit in that it results in quicker car movement and a larger available car supply. Without the demurrage rule the unusual car shortages of the last two years would have been far worse. It is easy to conceive that during the extreme conditions of the past few months the commerce of the country might have been absolutely paralyzed if all consignees or shippers had been at liberty to hold cars as long as suited their individual convenience.

As a direct result, however, of the recent car shortage, the idea has been suggested that there should be an arrangement by which, just as shippers are penalized for delay in handling their cars, the railroads should be penalized for failure to furnish cars promptly when ordered by the shipper. This is called reciprocal demurrage. It sounds like a fair arrangement at first, but it is not. One vital objection to such a rule is that a large shipper, who could often hold or forward his shipments equally well, would be in a position

to wait until the railroad which served his plant was particularly short of cars and then demand a large number of cars, knowing full well that they could not be supplied. He would then, under such a rule, be able to collect from the railroad a sum which would represent no service of any sort rendered by him to the railroad, but which would in effect be a rebate on his past or future shipments. Again no rule can compel a railroad to furnish cars for traffic destined for points off its line. Under a reciprocal demurrage law all shipments would be transferred from car to car at junction points in order that each railroad might keep its own cars at home to protect itself in case of demands for cars. This would be a distinct backward step in the art of transportation. It would naturally result in great delays to traffic and increased charges for transportation. Reciprocal demurrage, if carried into effect as now proposed, would not in any way directly help to expedite the handling of traffic but would, on the contrary, hinder it.

Some states have enacted a reciprocal demurrage law. In each case the railroads have promptly protested and, so far as is known, the law has come to be a dead letter. It is hardly fair to call such a law "reciprocal." Reciprocity implies a return of like for like, yet this law would impose a charge for something which may have no existence, whereas the cars for which the railroads charge demurrage to shippers are actual pieces of railroad property in the hands of others. For this reason the fundamental principle of the law is believed to be unconstitutional. The shipper offers no property and, therefore, is not entitled to any compensation. If he is unable to obtain cars, the redress open to him is an action for damages, which is a distinct and separate issue. This is a question which has been decided by state and federal courts and by the Interstate Commerce Commission, which rule that it is the duty of the railroad to provide reasonable facilities for handling the traffic offered to it. Not even a railroad can be constitutionally required to perform an impossibility, and when a flood of traffic, such as that of the fall months of 1906, comes, surpassing all reasonable estimates, the carrier cannot be held to have failed in its duty if it has supplied without discrimination such facilities as, after reasonable increases in its rolling stock, it has at hand. To penalize the railroads under a reciprocal demurrage law would be to take away its property without due process of law and would be, therefore, unconstitutional. Unconstitutional or not, the reciprocal demurrage law proposed would compel railroads to make large investments in equipment which, during two-thirds of the year, would be lying idle on side tracks where depreciation is as fast or faster than in active service.

Yet there is no doubt that there can be an improvement in present car service conditions. Reciprocal demurrage will not solve the present problems. What will solve them is a hearty co-operation between railroads and shippers, the former providing ample facilities and expediting its traffic, the latter making provision for properly handling their business and using reasonable despatch in loading and unloading their traffic. Shippers and consignees can do more to relieve the extreme conditions of car shortage which have prevailed during the past two months than any other one class. The railroads are doing their best; the equipment companies are doing theirs. To lay all the blame on the railroads for the present congestion of traffic is highly unjust. It is the prosperity of the country which is to blame. Railroads have spent great sums in improving their facilities, but the tremendous rush of traffic which has come to them could not have been foreseen as a probability, much less as a certainty. The shipper is extravagant in the use of transportation facilities. From 30 to 60 per cent. only of the country's car capacity is now fully employed; this as a result of business customs in ordering, packing and loading which, if reformed, would increase the car supply by an amount large enough to do away with car shortages, as such, even in times like the present.

SCIENTIFIC RAILROAD OPERATION IN AUSTRALIA.

On July 1, 1903, Mr. Thomas Tait began his work as Chairman of the Commissioners of Railways of the colony of Victoria, Australia. Mr. Tait had had a thorough training in American railroad methods. He resigned the position of Manager of Transportation of the whole Canadian Pacific railroad system, which he had reached after some 23 years of railroad service, beginning as a clerk in the accounting department of the Grand Trunk at Montreal, and including a large amount of experience in the operating department of the Canadian Pacific. Victoria occupies the southernmost part of Australia and is bounded on the north by New South Wales and on the east by South Australia. Melbourne is the principal city. The railroads are owned by the colonial government and, as shown on the map in another column, radiate from Melbourne, about which centers an extensive suburban system. Railroad development in Victoria has been much like that in the western part of the United States. Lines have in general been laid out to create traffic rather than to take care of existing business, and in many cases the country has not yet grown up to its railroad facilities. The lines are mostly single track and depend for their best traffic on agricultural products, particularly wheat. The average mileage worked is 3,394 miles, of which 82 miles is 2½-ft. gage and the rest 5¼-ft. gage. In the year ended June 30, 1903, the year immediately preceding the present administration, there was a deficit after charges from the operation of the Victorian Railroads of about $1,800,000, following a deficit of nearly $1,000,000 in the year ended June 30, 1902, when gross earnings were the largest under the previous administration. The Victorian government, alarmed at the rising deficit, decided to see what could be done under American methods, and Mr. Tait was appointed Chairman of the Railway Commissioners. He is the actual working head of the roads, reporting to the Minister of Railways. The other two commissioners are working departmental officers, whose combined authority can at any time be overruled by the Chairman, so that the new American officer was given authority commensurate with his responsibility. Besides the actual difficulties of reorganization and management which he had to meet, there were accumulated extraordinary liabilities of $3,850,000 made up of belated repairs, deficiency in rolling stock, overvaluation of stores and loan funds advanced for works which should have been paid for out of revenue.

At the end of the first year under Mr. Tait's administration, ended June 30, 1904, the Victorian Railroads, for the first time in 15 years, showed a surplus over all charges—a small one to be sure, only $2,500, but enough to show a healthy change in the condition of the roads. Results since that time have been what the Melbourne *Argus*, reviewing the report for the year ended June 30, 1906, calls "a story of almost romantic success." Gross earnings have increased from $14,800,000 in 1903 to $18,400,000 in 1906, and net earnings from $5,900,000 to $8,700,000. Against a deficit after charges of $1,700,000 in 1903 the past year shows a surplus of $968,960. Taking the year ended June 30, 1902, the most prosperous year under previous administrations, as a fairer standard of comparison, there is still a noteworthy series of increases. Gross earnings in 1906 increased more than $2,000,000 over 1902 and net earnings nearly $2,300,000. The 1906 surplus is almost exactly the same as the 1902 deficit. It must be remembered also that the surpluses of the years 1904, 1905 and 1906, under Mr. Tait's administration, have been obtained after providing for a large part of the extraordinary liabilities already referred to. On July 1, 1906, the unpaid balance of these deferred payments, instead of amounting to $3,850,000, was about $950,000. Not quite $3,000,000 has been appropriated out of earnings during the last three years for this purpose. This is a record of achievement of which Mr. Tait and America for him may be proud. It is pleasing to see that it is also appreciated in Australia.

These are the general financial results. The detailed unit figures of operation show the same success just as concretely. In 1902 and 1903 the gross earnings per traffic train mile were about $1.44; in 1906 they were $1.95, an increase of 51 cents. In this same time, operating expenses per train mile increased about 15 cents, leaving net earnings per train mile 92 cents in 1906 against 56 cents in the two earlier years, an increase in net earnings for each mile run of 35 cents, or over 60 per cent. in this vital unit of operating profit. The net earnings per traffic train mile in 1906 were the largest in 26 years. The operating ratio meanwhile has decreased from 60 per cent. to 53 per cent. That maintenance expenses have not been skimped to bring about a reduction of this working ratio is proved by the cost of maintenance of way per mile of road which, in 1903, was under $600 a mile and in 1906 about $750 a mile.

Considerable reductions in freight rates were made during the year amounting to from 8 to 16 per cent. for different classes, and also including new and lower classifications. The Commissioners strongly recommend a plan for application of the surplus revenue which, in their judgment, will make it practicable to further gradually reduce rates as may appear to be advisable for development of production and trade. This recommendation is to the effect that surplus revenue after all charges shall be devoted, first, to liquidating the remaining $950,000 of extraordinary liabilities; second, for additions and improvements, including rolling stock, thus obviat-

ing the borrowing of additional money by the state for such purposes, and, third, to building up a revenue reserve fund, so that when by reason of unfavorable seasons or other causes the net revenue of the roads is not sufficient to pay in full the interest charges on the railroad debt of the state, the deficiency may be made good out of this reserve fund. These recommendations are aimed at carrying out the ideal conditions of government owned railroads, that is, to furnish the best possible service at the least practicable cost without either bringing high returns to the state on its investment or becoming a charge on the general revenue.

The record of Mr. Tait as manager of this 3,000-mile system of government railroads, long inefficiently managed, is a striking example of the success of scientific railroad methods. It is of more than ordinary interest to American railroad men at present, because a similar position in the neighboring colony of New South Wales is now vacant. The New South Wales railroads are to be managed by Commissioners with powers similar to those of the Victorian Commissioners, and the government of that colony is advertising for a man who can follow Mr. Tait's example in Victoria.

CONTRIBUTIONS

The Profitable Weight and Speed of Freight Trains.

Baltimore, Md., Jan. 29, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The recent trouble arising from car shortage has induced many inquiries as to the seat of the trouble, and the statement has been made in several quarters, notably by Interstate Commerce Commissioner Lane, that the railroads have aggravated the shortage by an alleged practice of holding freight until a big train load can be secured and by giving it slow movement after it has once been started on its way.

It is probably open to question whether much actual delay has occurred in yards from holding cars for big train loads, but there is considerable room for discussion whether the big train load is proving as profitable as it is undeniably shown to be when consideration is given to the simple fact that many cars handled behind a large engine is a more profitable operation than a few cars handled behind a smaller engine. It so happens that this is not a fact, or at best is a dangerous half-truth on railroads of sufficient density of traffic to require the continuous movement of freight trains between any two points or when it is applied to the relief of yard congestion; and it is so because one of the most important elements of profit in railroad operation is speed of movement, for the main reason that a large proportion of a railroad company's expenses are fixed in amount regardless of the quantity of freight and passengers moved, and for the secondary reason that slow speed implies great weight, a consumption of fuel and stores disproportioned to the gain in weight and seriously rapid wear and tear and depreciation of implements.

Under conditions of traffic scarcity where a train can pursue the even tenor of its ways, disturbing nothing and by nothing disturbed, and with no cars waiting for movement—under such conditions the governing law for profitable movement may be said to be the avoidance of overtime, but even here the law should not be accepted without certain reservations in respect to wear and tear to equipment, especially the locomotive. But when it is a case of traffic waiting movement and numerous trains in movement, all treading on each other's heels, then indeed the simple idea of the big load becomes the compound idea of the big load plus movement.

I have prepared and send you herewith a table arranged to show the net earnings after the payment of certain expenses from the continuous operation through 5,000 hours of trains of various numbers of cars at various practicable speeds. This table requires for acceptance the admission of the following premises:

(a) That the increases in speed as shown in line B can be secured from the decreases in cars per train, or per train-mile as shown in line C.

(b) That the decreases in cost as per line H, are properly proportioned to the decrease in cars per train or per train-mile, as per line C.

If these premises are approximately correct, the conclusion is inevitable that there is more net money in speeds of 15, 20 and 25 miles per hour than in speeds above or below these rates.

It appears to be generally accepted that a reduction of 10 per cent. in a heavy load which permits a movement at about 10 miles an hour will immediately produce a possible increase of 50 per cent. in speed; that if the load be cut 30 per cent. the speed can be doubled, etc. As it may be questioned whether a 10 per cent. reduction in load (the table makes the reduction 12½ per cent.) will admit of an increase of 50 per cent. in the speed, the last column in the table gives a reduction of 30 per cent. in the load for an increase of 50 per cent. in the speed, and still it will be observed that after this heavy cut in the load the net revenue is much larger than at the speed of 10 miles an hour. The misfortune is, however, that it is questionable whether it is safe to run such heavily-weighted cars at the speeds requisite to give the inclusive speeds indicated as the most profitable. If the reduction in the weight of train were made partly in cars and partly in load in cars the relative showing in line E, would not be affected, as the earning per loaded car-mile there shown is a general average covering all cars.

The costs included in line H, cover wages of enginemen, firemen and train crews, fuel, train supplies, enginehousemen, operation of fuel and water stations and stores for locomotives; also cost of maintenance and repairs of equipment. These are the expenses which are generally considered to have been most favorably affected by the big train load. They are also the expenses that for the most part are directly attributable to the train mileage and vary most directly with the train mileage. The present cost of the stated items appears to run somewhere in the neighborhood of 75 cents per train-mile. In making this table, reduction in cost has been made chiefly to take account of the reduction in car mileage per train-mile (8 mills per car-mile), but there is no doubt that the quickening of the movement would be attended with decreased consumption of fuel per train-mile and material decreases in wear and tear. Hence, I do not believe the reductions of expense per mile made in the table will be found exaggerated. I submit this table and invite the severest criticism of it in the hope of advancing the cause of truth and ascertaining really what is sound in the mass of theories relative to railroad operation that afflict us in the present day. We certainly do know that Germany has had the problem of the heavy train load before it, and has decided adversely to it; and we also know that English train loads have been and are likely to continue to be feather-weights in comparison with our own. Meantime we are laboring along under the exceeding difficulty of keeping up the car supply and taking care of bills for depreciation which are little short of appalling.

Under the influence of recent congressional legislation it is becoming more than ever necessary that the railroads should get more train mileage for the wages paid the train crews. It should, therefore, be gratifying if it is found that the accompanying table approximates the truth.

M. B. WILD,
Statistician, Baltimore & Ohio Railroad.

Statement Comparing Net Revenue Derivable from Various Train-Loads. Run at Various Speeds Throughout 5,000 Hours.

A Required accomplishment of loaded car miles	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
B Miles per hour, inclusive of delays	10	15	20	25	30	35	15
C Cars per train, or per train-mile	40	35	28	24	20	15	28
D Number of train-miles, A ÷ C	50,000	57,143	71,429	83,333	100,000	133,333	71,429
E Value of train-mile at 10 cts. per loaded car-mile	$4.00	$3.50	$2.80	$2.40	$2.00	$1.50	$2.80
F Gross revenue	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000
G Number of hours in which accumulated D ÷ B	5,000	3,810	3,571	3.333	3.333	3.810	3.810
H Cost per train-mile for train expense, roundhouse expense, and M. of E.	$0.75	$0.71	$0.66	$0.62	$0.59	$0.55	$0.66
I Total cost for train expense, roundhouse expense and M. of E., H x D	$37,500	$40,572	$47,143	$51,666	$59,000	$73,333	$47,143
J Net revenue	$162,500	$159,428	$152,857	$148,334	$141,000	$126,667	$152,857
K Hours gained over longest period in line G	.....	1,190	1,429	1,667	1,667	1,190	1,190
L Train mileage run in hours gained, B x K	.....	17,850	28,580	41,675	41,675	41,650	17,850
M Revenue from train mileage run in hours gained, L x E	.....	$62,475	$80,024	$100.020	$83,350	$62,475	$49,980
N Cost of train mileage run in hours gained, L x H	.....	$12,674	$18,863	$25,839	$24,588	$22,908	$11,781
O Net revenue from train mileage run in hours gained	.....	$49,801	$61,161	$74,181	$58,762	$39,567	$38,199
P Total net revenue of each train in 5,000 hours	$162,500	$209,229	$214,018	$222,515	$199,762	$166,234	$191,056

Substitution of Electric Motor for Steam Locomotive.

New York City, Feb. 2, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to the brief report of discussions on the Stillwell-Putnam paper in your issue of February 1st, permit me to correct a statement concerning my own part in that discussion which, as it stands, puts me in a somewhat false position.

I did not make the general statement: "Direct-current at 1,200 or 1,500 volts transmitted through a third rail would give better results in every way than high potential alternating current, using the overhead system." What I did say was that on many of the roads which could properly consider electrification at the present

time, as typified, for example, by the New York & Philadelphia division of the Pennsylvania Railroad, the high potential direct-current motor equipment would be more satisfactory, and would give better results than those indicated by any present development of the alternating-current motor and an overhead installation.

FRANK J. SPRAGUE.

Fuel Tests on the Wheeling & Lake Erie.

A number of comparative tests were recently made on the Wheeling & Lake Erie to determine the economy of using three-quarter lump coal as against run of mine coal. The three-quarter lump coal costs at the mine about 8 per cent. more than run of mine coal, and the tests were made to determine whether the higher priced fuel gave a corresponding gain in ton-miles per pound burned. The coal of both grades is bituminous steam coal obtained from the same mine in the southeastern Ohio fields from what is known as the No. 8 Pittsburg seam. Great care was taken that the quality of the fuel should be as uniform as possible at all times during the tests. It was fresh mined and the lump coal carried only about 5 per cent. of slack while the run of mine carried about 15 per cent.

The tests were made in freight service between Nov. 21 and Dec. 21, 1906, on the line from Columbia yard to Ironville, Ohio, 133 miles. Five runs were made for each grade of coal, the same locomotive being used in all tests but with the grates changed to get the best results from each grade. Measurements of water evaporated were made by water glasses and graduated scales and the coal weights given are scale weights taken at Ironville, Norwalk and Columbia. The following table is a summary of the tests made:

Kind of coal	¾-in. coal.	Run of mine.
Location of tests	Ironville-Columbia.	Ironville-Columbia.
Date of tests	Nov. 21-Dec. 2, 1906.	Dec. 13 to 21, 1906.
Total time of tests	69 hrs. 10 mins.	83 hrs. 35 mins.
Average length of test—westbound	10 " 25 "	13 " 48 "
" length of test—eastbound	19 " 28 "	18 " 40 "
" time on road—eastbound	18 " 5 "	17 " 23 "
" time on road—westbound	9 " 49 "	13 " 30 "
Actual running time—eastbound	7 " 45 "	6 " 23 "
Actual running time—westbound	7 " 00 "	7 " 36 "
Time lost during test, standing	31 " 16 "	43 " 31 "
Mean running speed, bet. terminals	18.51 miles per hr.	18.64 miles per hr.
Total number of stops made	52	75
Maximum steam pressure (gage)	200 lbs.	200 lbs.
Minimum " " "	160 "	170 "
Average " " "	187.5"	186 "
Mean temperature—feed water	48.6°	41°
Gallons water evaporated	101,185	114,539
Pounds of water evaporated	843,208	954,492
Pounds coal burned	128,800	138,700
Money value of coal burned	$86.26	$86.57
Pounds water evaporated per lb. coal	6.54	6.88
Equivalent evap., from and at 212	7.848	8.31
Lbs. coal brnd per sq.ft. grate area/hr	60.61	55.65
Engine miles run per ton of coal	10.51	9.57
Engine mls. run per 1,000 gals water	9.59	5.79
Average No. loaded cars in train	33.1	30.5
" " empty cars in train	3.4	4.6
" " cars in train	36.5	35.1
" weight of train, tons reported	1,405.4	1,365.2
" weight of train, tons actual	1,387.6	1,327.7
Distance run, miles	664.0	664.0
Total ton-miles	914,012	881,615
Ton-miles per lb. of coal	7.366	6.356
Ton-miles per gallon of water	9.498	7.68

The striking feature of the tests is that the gain in ton-miles per pound of coal in using three-quarter coal amounted to 15.9 per cent., and the gain in ton-miles per gallon of water in favor of the three-quarter coal, was 23.6 per cent. Therefore notwithstanding the saving of 8 per cent. in the first cost of coal at the mines, the gain in ton-miles per pound of coal is considerably in excess of the saving in the price per ton. Furthermore, if the road were to change to run of mine coal it would necessitate the changing of the grates in the locomotives, which would cost $33.90 net per engine.

We are indebted to Mr. B. A. Worthington, Vice-President and General Manager of the Wheeling & Lake Erie for the above data.

A German Motor Car.

The Bavarian State Railroads have recently put in service the steam motor car illustrated herewith. The engine is carried on a bogie independent of the carriage frame. The principal peculiarity of the car is to be found in the cylinders and their arrangement. There is one cylinder upon each side, and in each of these there are two pistons working in opposite directions and driving the front and rear axles of the motor truck, respectively. The ostensible object of this method of working is to eliminate the perturbations due to the unbalanced thrust of the reciprocating parts. By this means a four-cylinder engine is obtained, together with a virtual balance, as the cranks are on all four quarters, those on each side being set opposite each other, and at right angles to those on the other side. Owing to this arrangement and to the limited wheel-base, the connecting rods are very short, being only 26½ in. long, with a piston stroke of 10¼ in. This ratio of 2.58 to 1 between the connecting rod length and the stroke makes the angle at the point of maximum turning moment rather sharp, and when added to the fact that the pistons are moving in opposite directions and driving axles that are coupled together, it brings it about that there is a difference of 23 deg. between the points of maximum crank effort of the two cranks that are driven from the same cylinder. Then, as the velocities and location of the two pistons are different for every point of the stroke except at the centers, it also follows that the point of cut-off differs for the two pistons and with it the amounts of power developed.

The Walschaert valve gear driving piston valves is used, and this is operated by a single eccentric instead of the usual return crank. The lap and lead lever, which is usually driven by a connector from the cross-head arm, is, in this case, operated from a link attached directly to the center of the crosshead.



Steam Motor Car for the Bavarian State Railroads.

The connecting rods are made with forked ends and take hold of the crankpin close to the wheels. Side rods are placed on pins outside the connecting rods, and it will be seen that, owing to the fact that the main crankpins approach and recede from each other, it is impossible to put the side rods on the main pins. They are, therefore, put on return cranks, whose centers are 90 deg. from each of the main crankpins, thus dividing the distance between the two, which, in the matter of rotation is 180 deg. It is on one of these return cranks that the eccentric is placed.

The boiler is of the locomotive type and is fitted with a superheater. At the back end of the firebox there is a bunker set above the door opening, from which the coal falls down upon the fire, the rate of feed being regulated by suitable traps, and peep holes are placed in the firedoors, through which the condition of the fire may be observed.

The car is worked by one man, the driver always remaining with the engine, no compartment being provided for him at the other end of the car. The car can seat 55 passengers and accommodate 35 standing in addition.

The tractive power is put down at 3,590 lbs. and the hauling capacity is equivalent to moving two supplementary cars, each with the same seating capacity as the motor car itself, at a speed of 40 miles per hour. The engines are capable of developing 350 h.p. as a maximum and driving the car at 47 miles per hour on a level. When running under these conditions, the coal consumption varies from 17 to 21 lbs. per mile, that used being of the comparatively inferior character obtained in the north of Germany. A plan of the car would show it divided into four compartments. Two of these are for passengers, one for smokers and one for those who wish to avoid these conditions. Both are for third class travelers. A third compartment is for baggage and parcels, and the fourth, which is at the front, is for the boiler and engineman. The boiler is set back of the foot-plate, at the front of which are the usual

levers and gages used in the control of the machine. The principal dimensions of the car and engine are:

Engine.

Working pressure	225 lbs.
Cylinders, diameter	8 in.
Cylinders, piston stroke	12 x 10½ in.
Driving wheels, diameter	39 "
Tractive power	3,590 lbs.
Grate area	5.3 sq. ft.
Heating surface (inside): Firebox	37.3 sq. ft.
" " tubes	405.6 "
" " Total	442.9 "
Superheater surface (fire contact)	74.8 "
Aggregate surface	517.7 "
Engine, weight, empty	35,840 lbs.
Engine, weight, loaded	40,320 "
Tank capacity	880 gals.

Car.

Wheel diameter	39 in.
Wheel base (motor bogie)	9 ft. ¾ in.
Wheel base (coach)	8 " 2 "
Total wheel base	51 " 6 "
Minimum curve radius	600 ft.
Total length of car	78 ft. 7 in.
Greatest breadth	9 " 6 "
Greatest height	14 " 9 "
Motor car weight, empty	100,800 lbs.
Motor car weight in working order	114,240 "
Trailing car, weight	88,480 "
Space for baggage	39 sq. ft.

Electric Operation of the Simplon Tunnel.

The Simplon tunnel is a double-track tunnel, 12 miles long, between Brigue on the Swiss side of the Alps and Iselle on the Italian side, these two towns being each a short distance from the tunnel



Suspension of Overhead Conductor at Switch.



Overhead Construction Spanning Six Tracks Near Brigue Portal of the Simplon Tunnel



Yard and Station at Brigue, Switzerland.



Suspension of Trolley Wires in the Simplon Tunnel.

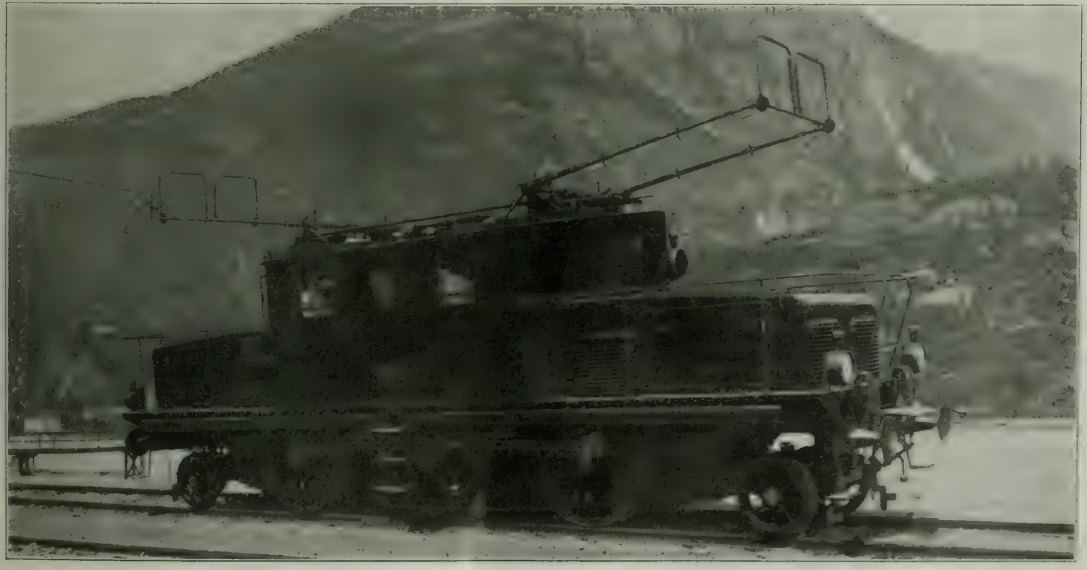
steam discharged in the tunnel formed so densely in the southern end that the signal light was invisible at a greater distance than 60 yards. About this time the Swiss firm of Brown, Broveri & Co., who were the contractors for building the tunnel, offered to undertake the installation of the necessary electric plant at their own



South Portal of the Simplon Tunnel at Iselle.

portals. It was built under great difficulties, particularly on account of the heat at so great a depth under the surface of the ground. Streams of hot water poured out into the cuttings and had to be pumped out before work could be carried on. It was early believed by engineers that the tunnel must be worked by electricity rather than with steam locomotives, but the Swiss Federal Railroad authorities took an exceedingly conservative position on this subject, since they regarded electric operation as much of an experiment. When the tunnel was open to operation steam locomotives were run through it, but it was found that the blast from the exhaust loosened the roof, and on every trip glass on the engine was smashed by the stones dislodged; furthermore, the smoke and

risk, and to put it for a year at the disposition of the Federal Railway Administration so that comparison on a large scale could be made between steam and electric traction. One of the locomotives used in the tunnel is shown in the accompanying photograph, which also illustrates the method of taking the current from the trolley wires. The method of suspension of the conductor at a switch is shown, and also a general view of Brigue station and of the six tracks electrified between Brigue and the mouth of the tunnel, as well as a view of the tunnel portal and of the suspension of the wire inside the tunnel. These photographs illustrate the information given in regard to the electrification in our issue of December 21, 1906.



Three-Phase Electric Locomotive for the Simplon Tunnel Service.

Legislative Centralization.

BY H. T. NEWCOMB,
Of the Bar of the District of Columbia.

It is scarcely necessary to point out that within the last two decades the strong movement toward the centralization at Washington of powers formerly exercised at the several state capitals, which began with the Civil War, has gone forward with added impetus. The various steps in this advance need only to be enumerated to indicate how profoundly it must affect the lives of the American people and the character of their government. The Interstate Commerce law, enacted in 1887 and greatly strengthened in 1889, 1891, 1893, 1903 and 1906; the Sherman anti-trust law; the various safety-appliance laws; the national quarantine law; the meat inspection laws; the pure food law; the prohibitive tax on oleomargarine; the creation of the Bureau of Corporations in the Department of Commerce and Labor, and the federal employers' liability law are all steps in a progression that has already done much to destroy home-rule in the states of the American union. But the end is by no means in sight. Other plans for subtracting from the powers of the states and adding to those of the central government are even now knocking at the doors of Congress and absorbing much of the interest of the chief executive and his cabinet ministers. It is proposed that without a federal license no corporation shall be permitted to manufacture articles to be consumed beyond the boundaries of the particular state in which they are produced and that by granting or withholding these licenses the general government shall control the ownership of the factories and the conditions under which they shall operate. Further, it is urged that there shall be federal regulation of insurance, of hours of labor in various employments, of child-labor, of marriage and divorce, of accumulations of private wealth and in some cases of admission to the public schools. And from no less an authority than Secretary Root comes the announcement that the states cannot hope to retain their reserved powers unless they exercise them to the satisfaction of the central government. That is, in short, unless the results obtained by state legislation are substantially equivalent to those desired at Washington the power to legislate will be taken from the states and centralized at Washington. If this is what the people of the United States desire there need be no doubt that it will eventually be secured. If the people of the several states do not wish to regulate their domestic concerns, home rule will not long be forced upon the reluctant commonwealths.

It is to be observed that those who advocate the programme of centralization rely chiefly, if not wholly, upon the commerce clause of the Constitution. By successive advances in the interpretation of this clause they hope to so broaden its application as to bring within its scope much that has heretofore been regarded as subject merely to local control. This provision is admittedly elastic and the propriety of its extension to meet the real demands of developing conditions has already been the subject of judicial comment. Thus in Pensacola Telegraph Company vs. Western Union Telegraph Company (96 U. S.) the Supreme Court said:

"The powers thus granted are not confined to the instrumentalities of commerce, ... known or in use when the Constitution was adopted, but they keep pace with the progress of the country, and adapt themselves to the new developments of time and circumstances. They extend from the horse with his rider to the stage-coach, from the sailing vessel to the steamboat, from the coach and steamboat to the railroad, and from the railroad to the telegraph, as these new agencies are successively brought into use to meet the demands of increasing population and wealth. They are intended for the government of the business to which they relate at all times and under all circumstances."

Yet in spite of the perfectly proper latitude of interpretation, which the foregoing suggests and sanctions, there are plain limits beyond which interpretation cannot go without an obvious departure from the principles approved by the founders of the Republic. If, for example, Congress can exclude from interstate commerce the products of the labor of children below the age of 16 years, as recently proposed by Senator Beveridge, it can doubtless do much to eradicate an evil which all good men should condemn, but one that the least acquaintance with the historical development of the American system of government shows was intended to be left to the separate control of the conscience and intelligence of the several constituencies of the respective states. The broad question is whether in concentrating power at Washington the gain, by the possible correction of evils which some of the states are too short-sighted or too inefficient to control, is greater than the loss involved in the removal of authority further from the field in which it must be exercised. Of course no one will overlook the fact that this removal involves the possibility, if not indeed the probability, that throughout whole states and even larger sections, the authority may often be exercised in a manner directly opposed to the wishes of overwhelming majorities of the people.

Whoever fully realizes the fact that the movement is a direct and substantial invasion of the recognized powers of local self-government of the states must regard it as incongruous that so much of its support comes from those whose interests would seem to be most wholly on the side of the perpetuation and strengthening of the home rule principle. Yet although those who work for wages are undoubtedly most to be benefited by home rule and most likely to be injured by the broadening of the legislative or governmental area (as applied to the details of private conduct and the conditions of industrial association) the movement toward centralization has gained much of its strength from the very general support of organized labor. Consider, for example, the Employers' Liability law enacted by the present Congress. The scope of this statute is shown by the extract from the sentence with which it begins that follows:

"That every common carrier engaged in trade or commerce in the District of Columbia, or in any Territory of the United States, or between the several States, or between any Territory or Territories and any State or States, or the District of Columbia, or with foreign nations, or between the District of Columbia and any State or States or foreign nations, shall be liable to any of its employees, . . ."—Public No. 219, 59th Congress, I. Session, Chapter 3,073.

Note that this statute, by its terms, applies to "any (i. e., every) employee" of "every common carrier" engaged in interstate or foreign commerce (as well as in commerce within the District of Columbia or any territory) whether such common carrier uses a wheelbarrow on a turnpike, a sail boat on a river, a steamboat or a railroad car, as the instrument of transportation. It applies, if it has any force at all, to the ticket seller of the trans-Atlantic steamship company, although he may never, in following his vocation, leave his Broadway office except to go to his home near Central Park, and it applies to gate-tenders in the Illinois Central Railroad's local Chicago stations, although many of them may never leave the state of Illinois for any purpose and the trains for which they open the gates are suburban trains running wholly within the state. Even as applied to the employees of railroads which are actually interstate in character, statistics show that out of 1,296,121 employees (the number on June 30, 1904, the latest date for which the Interstate Commerce Commission has as yet supplied the figures) there were less than 250,000 who, by any possibility, could be required to cross state lines in the performance of their duties. Yet the law applies as much to the 46,037 general office clerks; the 154,920 station employees; the 46,272 machinists; the 53,646 carpenters; the 159,472 "other shopmen"; the 326,653 section foremen and trackmen; the 46,262 switchmen, crossing tenders and watchmen, and the 30,425 telegraph operators as it does to the engineer or conductor on the fastest express between Philadelphia and Jersey City. Why should the contract held by the carpenter who works in Omaha for the Union Pacific be regulated by a federal statute while that of the carpenter who builds a house in the same city for an officer of the same railroad is controlled by a different law enacted at Lincoln? Yet, if the federal employers' liability law is constitutional at all, that is precisely its result.

But that is not all. While there are certain matters affecting interstate commerce upon which the states may legislate unless and until Congress chooses to act upon them, the legislative power of the states is wholly ousted the moment Congress acts, and when a law is passed at Washington it has the effect of repealing every state law dealing with the same subject matter. Thus in Smith vs. Alabama the Supreme Court of the United States said:

"There are many cases, however, where the acknowledged powers of a state may be exerted and applied in such a manner as to affect foreign or interstate commerce without being intended to operate as commercial regulations. If their operation and application in such cases regulate such commerce so as to conflict with the regulation of the same subject by Congress, either as expressed in positive laws or implied from the absence of legislation, such legislation on the part of the state to the extent of that conflict must be regarded as annulled."—124 U. S. 465.

And, again, in Gulf, Colorado & Santa Fe vs. Hefty & Lewis, that august tribunal said:

"It is unnecessary to pursue this discussion further. The state statute and the national law operate upon the same subject-matter, and prescribe different rules concerning it. The national law is unquestionably one within the competency of Congress to enact under the power given to regulate commerce between the states. The state statute must, therefore, give way."—158 U. S. 104.

It is not admitted that the power to regulate interstate and foreign commerce implies the right of Congress to fix the terms of the contracts between "every common carrier" engaged in such commerce and every individual in its employ. That fundamental question has been decided in the negative by two federal courts, but it will not be set at rest until it has been passed upon by the Supreme Court. The Attorney-General of the United States, at the direction of President Roosevelt, intervened to support the affirmative side in the lower courts and will undoubtedly appear in the appealed cases. But, if Congress has the power thus claimed, attention is here directed to the fact that until Congress exercised it the states could control these contracts. And they had the power, which no one asserts reposes in Congress, to deal comprehensively with the whole subject of the liability of employers to employees within their several boundaries. The employers' liability law adopted at Lincoln, Nebraska, could control the contract held by the carpenter employed

in house-building as well as his confrere in the Union Pacific shops. When Washington acted it could, at the most, deal only with the latter but in acting, if it has power to act at all, it has ousted Lincoln from all control over him. Among the states whose employers' liability laws, presumably satisfactory to the majority of their own citizens, were thus modified or repealed by the action of the Fifty-ninth Congress are Kentucky, Georgia, Iowa, Kansas, Wisconsin, Minnesota, Florida, Ohio, Mississippi, Texas, Arkansas, South Carolina, Missouri, North Carolina, North Dakota, Alabama, Massachusetts, Indiana, Colorado, Utah, Maryland, Virginia, Oregon and Montana. Possibly some of the citizens of these states are better satisfied with the terms of the federal statute than by those of their own states, but, whether they are or not, there can be no doubt that their power over the rules by which they are controlled is much smaller when those rules are made at Washington than it is when they are made at home. If hereafter Congress refuses or neglects to satisfy their local needs, however evident, or their local wishes, however unanimously expressed, by modifying, repealing or retaining the statute, they will be practically helpless unless they can enlist the sympathy and secure the active assistance of residents of other states.

Again, if the power asserted in the employers' liability law actually exists in the Congress, the limit of interference with matters hitherto regarded as properly subject only to local control is enormously increased. For example, every state, and by lawful delegation, nearly every municipality, has the power to prescribe the materials of which buildings shall be constructed in order to limit the risks and losses from fire. But the burning of a roundhouse in (say) Philadelphia might delay an interstate train between Washington and Jersey City. Therefore the material of which roundhouses are constructed "affects" interstate commerce. It does so just as plainly as do the qualifications of the telegrapher at a New Jersey station who was hired in New Jersey, who never leaves New Jersey in the course of his duties as an employee, who is paid in New Jersey and who may spend his whole lifetime without ever leaving the boundaries of that state. And if Congress can fix the liability of the railroad corporation to the telegrapher, because the railroad is engaged in interstate commerce and the telegrapher's duties thus "affect" interstate commerce, Congress can also require the Philadelphia roundhouse to be built of fireproof materials. And if Congress can require fireproof materials it can require slow-burning materials or permit the most inflammable type of construction, and can do either even though the city of Philadelphia, for every building subject to its control and in the same vicinity, has required absolutely fireproof material. Thus if Congress can do what, in this particular, organized labor has asked it to do it can also endanger the life and property of every workman in Philadelphia by authorizing that which the citizens of Philadelphia would refuse to permit.

The employers' liability law of 1906 has been discussed at some length because it is a typical instance of a piece of completed centralizing legislation of the kind that organized labor is continuously seeking at Washington. Much the same governmental principles are at stake in the eight-hour bills, the anti-injunction bills, the telegraphers' bills, the arbitration bills and the railroad trainmen's hours of labor bills that are now pending.

The last named measure is of particular interest at the present time because it is not wholly unlikely to receive favorable action at the present session of Congress. It proposes to fix a maximum restriction upon the hours of labor and to prescribe a minimum interval of rest for every "employee engaged in or connected with the movement of any train" in which interstate commerce is "hauled" or by which it is "affected," except in the case of a very limited class of emergencies. Of course whatever power Congress may have to regulate the hours of labor of the adult males who constitute the class of workmen covered by this measure must be based upon some actual relationship between the hours of labor and the frequency of accidents. In other words, the power is essentially a police power and, therefore, must be one which state legislatures can exercise in the absence of Congressional action. If there is no such relation, no such legislative power exists anywhere in the United States. But no less an authority than Mr. E. E. Clark, now, by appointment of President Roosevelt, a member of the Interstate Commerce Commission and formerly Chief of the Order of Railway Conductors and a member of the Anthracite Coal Strike Commission, declared, in his testimony before the Industrial Commission, that the exceptional instances in which trainmen work long hours are caused by the reluctance of railroad managers to increase the "possibility of accident" by putting on too many new men when business is extraordinarily heavy.

Another peculiarity in the situation is that this restriction is being urged by labor leaders in the face of the fact that it is not wanted by the rank and file of the members of their organizations. Thus Mr. W. P. Borland, a former trainman now in the employ of the Interstate Commerce Commission, in a capacity which affords abundant opportunity to learn the views of trainmen, and an advocate of the bill, while testifying before the Committee on Interstate and Foreign Commerce of the House of Representatives, on April 20, 1906, said:

"A majority of the men do not desire this legislation, and I think if they were brought here they would say so. Now, in that connection I want to say, that before the Industrial Commission, Mr. Frank Sargent, who is now Commissioner-General of Immigration, and was then Grand Master of the Brotherhood of Locomotive Firemen, testified on this very question. In answer to a question by Mr. Phillips, of the Commission, he said, and, I think, stated the fact:

"'The men in the railroad service do not want an over production. They do not want the railroads loaded down with men, in order that they may have it easy the whole year 'round. They are willing to take it rougher and work a little harder in the busy season, and then when the dull season comes there is plenty of time to rest up and earn fair wages. The railroad employees have an understanding with the employers that there shall be no more men employed than is necessary to move the traffic with despatch, and during the busy season they take advantage of it and earn big wages, and when the dull season comes of course they earn the average wages.'

"I think that is the attitude of the great majority of railway employees."

More recently still the opposition of other railroad trainmen has been expressed in resolutions adopted by the local lodges of their great organizations. The following resolutions adopted by Thomas Dickson Division No. 171 of the Order of Railway Conductors are both strong and typical:

"Whereas, There are now pending in the Congress of the United States measures intended to take away from the men employed in the train service of interstate railroads the right to dispose of their services under conditions and upon terms satisfactory to themselves, and

"Whereas, the nature of the railroad business imposes conditions little understood by the general public; among them the fluctuations in train-movement from week to week, from month to month, and season to season which create corresponding variations in the quantity of train service required and consequently in the demand for the labor of trainmen, and

"Whereas, the efficient handling of the public business entrusted to interstate railway carriers requires the arrangement of runs of train crews so that, in many cases, the distances covered cannot always be traversed, when conditions are at all adverse, within sixteen hours and this is especially true of what are known as 'turn' runs which, however, are universally preferred by train crews because they permit the lay-overs to be spent at their homes with increased comfort and reduced expense, and

"Whereas, the restriction of the hours of labor by imposing a statutory maximum of sixteen hours, with exceptions only in case of casualties occurring after the runs begin, would require the railroads to keep upon their pay rolls a greatly increased number of men to handle the traffic at the period of its greatest volume, but many of whom would be idle much of the time during most of the year and would, thus, greatly reduce the average annual earnings of all classes of trainmen, and

"Whereas, the railroad trainmen of the United States are of full age, possessed of sound minds, equipped with an intelligent comprehension of their own interests and of the business in which they are engaged, and are fully able therefore to look after themselves in their dealings with their employers; now, therefore, be it

"Resolved, That we, the Thomas Dickson Division, No. 171, of the Order of Railway Conductors, condemn any legislative proposal for the restriction of the number of hours during which railroad trainmen shall be permitted to dispose of their labor, and we especially protest against the passage of the bill known as S. 5133, introduced by Senator La Follette, or any similar measure."

Such is the attitude of the trainmen toward centralizing and liberty-impairing legislation advocated in their name by those who claim to represent them at Washington. No one desires long hours of labor for railroad trainmen, nor is there any practice of requiring or permitting excessive hours in the transportation service. But if legislation on the subject is needed it should be enacted by the states, by those legislators who are near to and directly cognizant of the needs of different communities. If left to such legislators there would be little chance of the enactment of a clumsily drawn and ill-considered measure which, like that under discussion, would force a serious congestion of the railroad industry, with added delays, inconvenience and loss to shippers and consumers, by putting in force statutory rules which could be complied with only by vast increases in the number of men employed; in terminal, yard and side-track facilities; in motive power, and in car equipment at a time when all available men are employed and the capacity of the rolling mills, locomotive shops and car building shops is already taken up by orders most of which cannot be filled within the next 12 months.

These special objections to particular phases of the centralizing movement that is being pressed by organized labor, or its legislative agents, are parallel with those applicable to other items in the general program. How much force they will have in preventing its full execution is problematic. The best defense against too rapid centralization in these and other matters would be found in an aroused sense of the value to each individual citizen of real local self-government. Next in importance to such a sentiment is a vigorous assertion by every state legislature and every state court of last resort of the right of each state to control its domestic affairs and the exercise of such control at each state capitol, positively or negatively, as circumstances may require, in accordance with the safe and self-reliant principles which have the sanction of American history and progress.

New Lehigh Valley Bridge Over the Susquehanna River, Near Towanda, Pa.

BY PHILIP H. DE WITT, M. AM. SOC. C. E.

One of the most important improvements under way on the Lehigh Valley at the present time is the change in alinement and grades between Wysox and west of Towanda, and a new bridge over the Susquehanna river at Towanda. The entire work covers about 6½ miles. Fig. 1 shows the lines and grades adopted after careful study of the conditions. Numerous lines were projected and estimated on; including several crossings of the river into Towanda, with the idea of a more convenient location for a passenger station for the town; but the excessive cost of the crossing and of right of way caused the abandonment of the scheme and the adoption of the

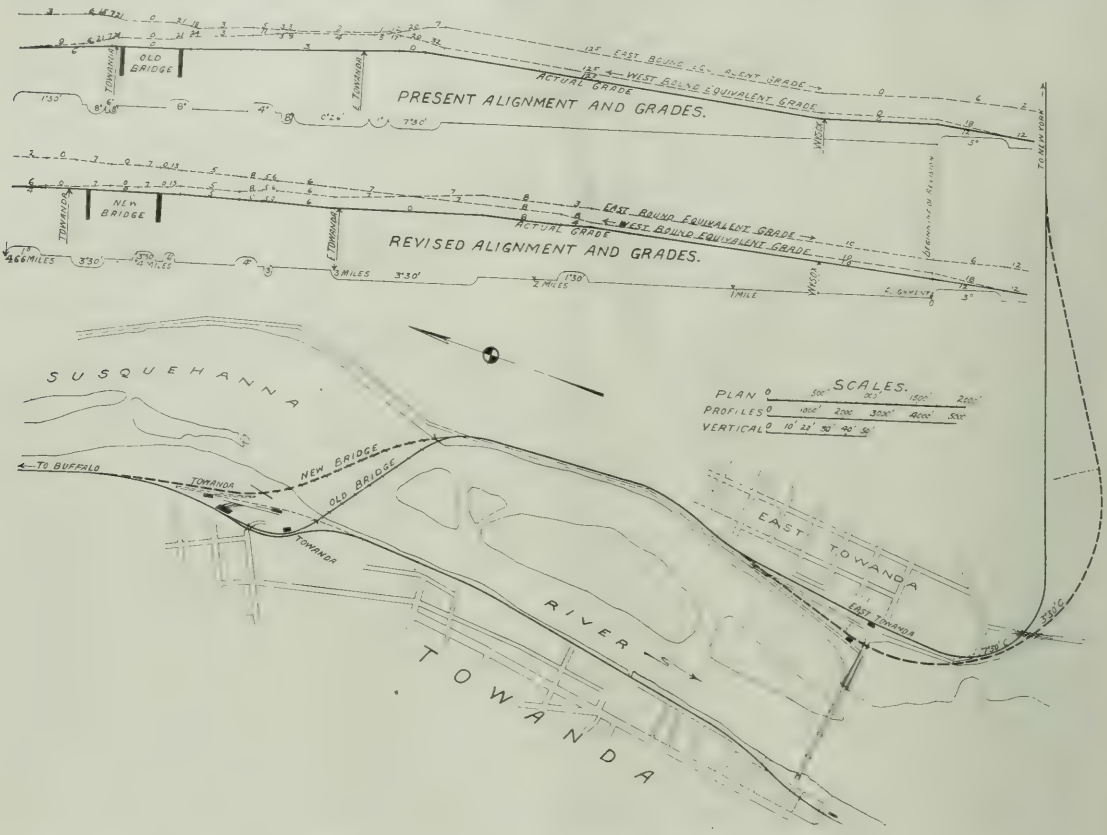


Fig. 1—Change of Line and Grade on the Lehigh Valley Near Towanda, Pa.



Fig. 2—General View of Old Lehigh Valley Bridge Near Towanda and Completed Masonry for New Bridge.

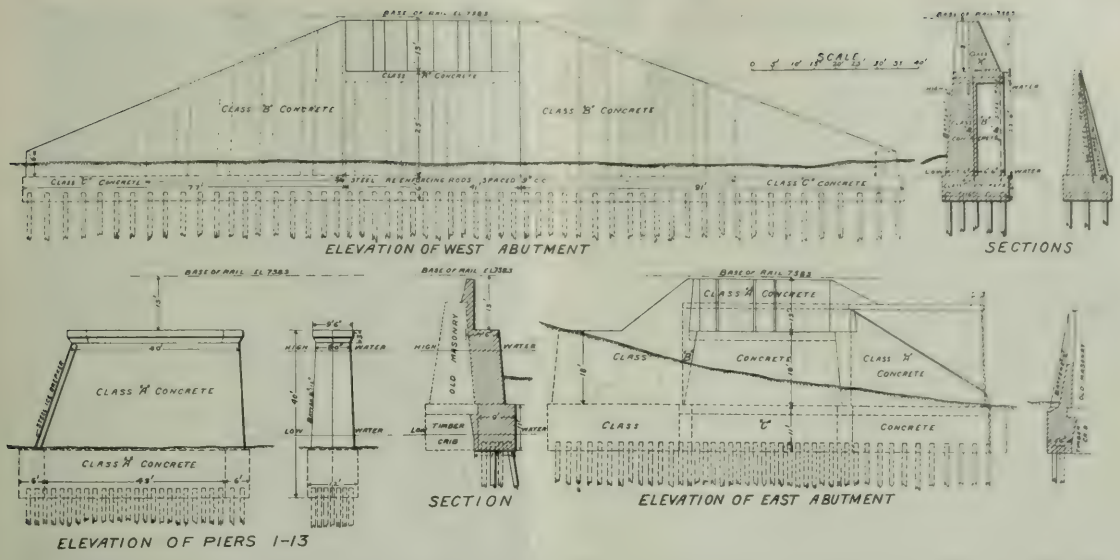


Fig. 3—Details of Concrete Piers and Abutments for New Bridge of the Lehigh Valley Over the Susquehanna Near Towanda, Pa.

line as built. The combination of grades and curvature on the present line between Towanda and Wysox make this the limiting point for train loads on the engine run between Coxton and Sayre for both eastbound and westbound trains.

The profiles on Fig. 1 show the conditions existing here before and after the changes, actual and equivalent grades being given in each case. The next limiting point on this division is at Vosburg tunnel, where the conditions are such that there is but little opportunity for their betterment. It was therefore decided that if the grades and alinement between Towanda and Wysox were reduced to such an extent as to make Vosburg the limiting point for the engine run, the improvements would be ample. Computations of the reduction in train mileage due to heavier trains that can be hauled over the revised line, including heavier motive power over the new bridge, further showed a capitalized annual saving in excess of the entire cost of the improvement, including the cost of the new bridge, which justified the outlay. Two objectionable grade crossings are also eliminated, and a new station provided for Towanda.

Fig. 2 shows a general view of the completed masonry for the Susquehanna river crossing. The old masonry of the present bridge was built in 1865, the piers being sunk in the deep water of a dam located just below it. When the dam was subsequently carried out in 1874 it left these cribs exposed to the elements.

The new bridge is built with 3 deg. 30 min. curves at each end in place of 7 deg. 30 min. curves in the old bridge, which limited the train tonnage. The piers of the new bridge are spaced closer than in the old bridge, so as to allow deck plate girders to be used in place of truss spans. The new bridge is being built without interfering with the operation of the road, which would not have been unavoidable if the old structure had been remodeled, an important condition on a busy line.

The new bridge will consist of 14 spans of deck plate girders, all of which are 129 ft. 6 in. long over all and 10 ft. 1½ in. high, except for the east span, where the spacings are odd, owing to the skew of the east abutment. The total length of the crossing is 1,801 feet from abutment to abutment. The distance from base of rail to top of masonry is 13 ft., and the girders weigh approximately 65 tons each. The girders are now being erected by the Phoenix Bridge Co., Phoenixville, Pa., the contractors for the steel



Fig. 4—Plan of Cableways and Mixers for Masonry Work on Lehigh Valley Bridge.

work. They will be erected by a cantilever traveler without the use of false work, owing to the risk from highwater and ice at this season of the year.

The masonry consists of 13 piers and two abutments, all of concrete, resting on piles. Fig. 2 shows a general view of the completed masonry, and Fig. 3 the details. The east abutment is faced against the north wing of the old east abutment. The 13 piers are all of the same general design, the principal dimensions being shown in Fig. 3.

The foundations were excavated by hand inside of clay puddled cofferdams to the specified depth below the river bed, after which the piles were driven in each foundation and cut off level two feet above the bottom of the foundation. Oak piles were used throughout and were driven with drop hammers. At first a water jet was used in driving, but it was found that the nature of the material, which consists of coarse gravel and sand was not suited to the use of the jet and it was discontinued. Piles could be driven just as deep and more rapidly without the jet than with it, and with less disturbance to the material in the bottom of the foundation. After the piles were sawed off the foundation pumps were stopped and the foundation concrete was then deposited through steel chutes of varying lengths. The pumping was unusually heavy in the pier foundations, as many as four 6-in. and 8-in. centrifugal pumps being used on a foundation owing to the large amount of water coming up through the bottom.

The west abutment is of reinforced steel construction. The back of the abutment is pocketed and reinforced with ¾-in. steel rods. The high price of lumber and labor required to build the complicated form necessary for this abutment probably counterbalanced the saving in concrete due to the pockets. The abutment rests on piles and contains about 2,000 cubic yards of concrete.

River gravel was used throughout in the concrete. The concrete was mixed in Ransome mixers in the following proportions: Piers, including foundations, 1-2-4; abutment foundations, 1-3-6; abutment neat work, 1-2½-5, with the exception of the back walls and coping, which were 1-2-4.

The contract for the masonry was awarded on April 4, 1906, preliminary and shore work was started April 15, but owing to high water the river work was not started until July 9. Notwithstanding these delays, the work was completed October 29, 1908, which was over a month before the expiration of the date for completion of the contract. In other words, the 11 river piers were completed in less than four months.

In order to complete the work within the required time, a large plant was required to take advantage of the short working season of low water, and all preliminary work possible was done so that the plant would be ready when the river was favorable for foundation work. The general layout of the plant is shown in Fig. 4. Three cableways supplemented by derricks were employed. The main cableways consisted of a double Lidgerwood plant, of 1,000 ft. span each, supported on the shore ends by 80-ft. towers containing the machinery and in the center with a 75-ft. A-frame tail tower on pile bents, guyed in four directions. This double cableway was designed for a working load of three tons, with an occasional overload of seven tons, which was sufficient to pick up and set mixers, piledrivers and hoisting-engines, in addition to regularly hauling concrete and other materials. A track was located under each cable at the shore towers so that machinery could be handled directly from railroad cars.

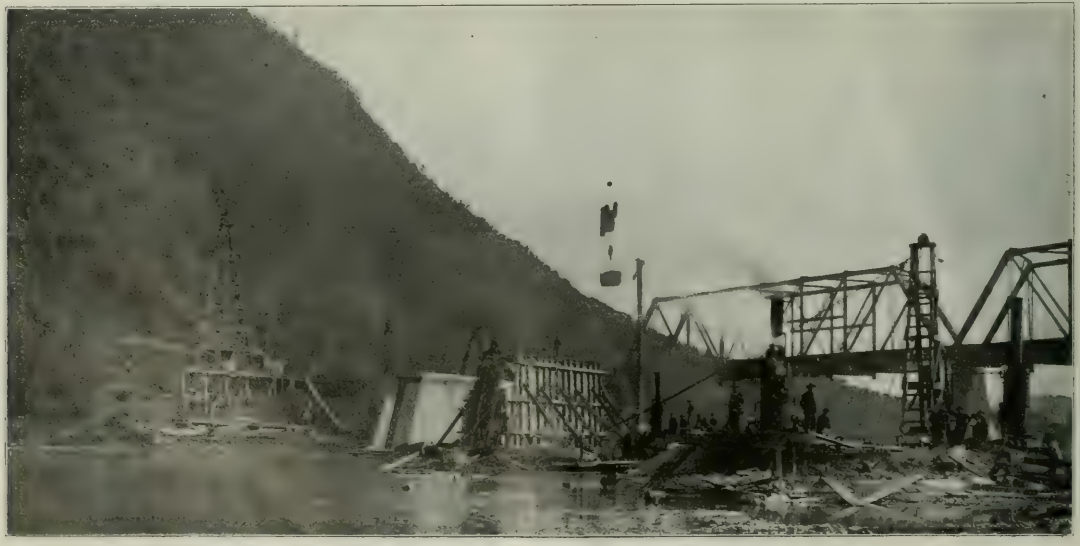


A-Frame Cableway Tower in Middle of Stream.

A smaller cableway of 500-ft. span was used to build the east abutment and piers 1 and 2 (on the east curve). The west abutment and piers 11, 12 and 13 (on the west curve) were built with derricks. This arrangement of the plant made it possible to carry on the work simultaneously at four independent points.

Two piledrivers, three mixers and six centrifugal pumps were required. The various positions of the derricks and mixers are shown in Fig. 4. The plant in the river was blocked up sufficiently high and guyed to provide for an ordinary summer rise in the river.

The entire work proved to be well suited for cableway construction, and it is doubtful whether any different equipment would have done the work within the time without considerable additional ex-



Working Plant for Building Concrete Piers of New Towanda Bridge.

pense. The double-span Lidgerwood cableway, attached to the A-frame tail tower, is believed to be a novel arrangement. The A-tower was guyed rigidly in four directions in order to prevent the vibration of one side of the cable being transmitted to the other and interfering with the independent operation of the two plants.

The masonry and superstructure work was done under contract by S. B. Mutchler & Co., Phillipsburg, N. J. The improvements are being carried out under the direction of Walter G. Berg, Chief Engineer; F. E. Schall, Bridge Engineer; and E. H. Shipman, Assistant Engineer, Lehigh Valley.

The Railroads of Victoria.

The accompanying map shows the government-owned railroad system of Victoria, Australia, which includes all the railroads of



The Railroads of Victoria.

that colony. In the editorial columns will be found a review of the work of an American railroad officer who has been at the head of the Victorian Railroads for the past three years.

Safety by Legislation.

The letter which follows was written as a personal letter to one of our staff, an old and close friend of the writer; this explains the informality of expression. We have asked permission to print the letter as it was written, retaining the personal quality as, incidentally, it shows how an editor writes when he is unharnessed.—EDITOR.

Swissvale, Pa., Jan. 19, 1907.

My Dear Adams.—I am going to tell you some of the things that I think about block signaling and about the possible good in government interference. Of course, what I think is not important, but in the endeavor to formulate it for you I may clear my own ideas and may perhaps suggest something to you.

I have always been opposed to specific legislation in such matters, and to attempts on the part of government to meddle with details. Any Congress or any state legislature will average far below the railroad officers who have responsibility, in intelligence, in moral character and in knowledge of matters pertaining to railroading. The chances that any legislative body will be able to evolve any legislation that is of any value in controlling railroads in matters of safety are extremely small. Legislation will be suggested and directed by people whose knowledge is superficial, whose interests are transitory, or whose interests are mercenary. I have always believed that enlightened selfishness on the part of the railroad officers would in the long run accomplish a great deal more than efforts at legislation. It is probable that legislation has been useful in the matter of air-brakes, couplers and heating apparatus. It is quite improbable that it would be useful in the matter of block signals, unless it were made very general indeed in its terms. The air-brake and the coupler, and the methods of heating, had been tried out and the standards had been fixed and mechanical conditions simplified before any state or federal control became effective. Block signaling is to-day in a state of rapid evolution, and any attempt at specific legal restrictions or requirements would be based on transitory conditions and often, probably, on mechanical errors. Therefore, if the federal and state governments must legislate in the direction of compulsory block signals, let them make the legislation very general; so as to permit telegraphic block, automatic block, lock and block, train staff, cab signals, or even wireless signaling.

It might be well to increase the pains and terrors of killing and wounding people. It might be well to impose very heavy fines and imprisonment, unless it can be shown that the killing and wounding was unavoidable. But are there not enough laws now to do that if the laws are enforced? Even this very general legislation that I have suggested seems to involve better machinery for investigation than is now at the command of the Interstate Commerce Commission or any of the state commissions. The British Board of Trade inspectors have a dignity, an authority and a range of knowledge much beyond anything that can be brought to bear in this country. A gentleman of much observation and sagacity has just suggested to me that it would be well to provide a board of inspectors made up of men who could command salaries of $25,000 a year. This expressed conveniently the grade of character, attainments and ability necessary in a board charged with the responsibility of investigating accidents and deciding upon the adequacy of material and methods.

At this moment there are many people active in the promotion of nostrums, and the peril is that these people may impose their plausible ideas upon the President, the Interstate Commerce Commission, and members of Congress and of the state legislatures. Within the last few years there has been a great deal of invention in the way of cab signals, train stops and the like. I suppose that I must have turned down an average of about one inventor every two months of that sort for the last two or three years. Within two hours I have had before me the project of an inventor who knows that tens of thousands of lives could be saved every year, and millions of dollars, by the use of a wireless signaling system. Of course, we shall look into his system, but the chances are 100 to 1 that it will not be worth spending an hour's time upon. It is my principle never to turn down an inventor arbitrarily without giving his invention as reasonable consideration as limitations of time and skill will permit. I make myself a great nuisance to our engineers in that way, and have caused them to waste many hours by such examinations.

As for the automatic stop, I am somewhat uncertain what to say. I opposed it in the New York Subway when we were laying out that scheme of signaling. I am now satisfied that I was wrong in that opposition. If I were obliged to say yes or no to-day to any project for using automatic stops on an ordinary steam railroad, I should say no; and yet, I am not certain that I should be right in that decision.

The question of the automatic stop for ordinary railroad use is complex. There are serious objections to putting it overhead or alongside. As you well know, an arrangement by which an automatic stop fixed overhead or alongside shall engage with a brake valve or other contrivance on a moving vehicle, must work within narrow limits. The danger of hitting men on top of the train, or men hanging out one side to give hand signals, or for other purposes of operation, would be considerable. Furthermore, variations in line and surface of track would change the relative positions of the two parts of the apparatus and put them out of adjustment. Consequently, it seems likely that it will be best to attach the trip to the ties so that the relative positions will not be seriously changed by variations in track. But then you come into the difficulties of snow and ice, and your trip is liable not to be operative at the critical instant. Doubtless you have already thought over the complications in signaling and the delays to traffic that the automatic stop will introduce.

Beyond this, and more important than this, to my mind, is the effect on the engineman. He is none too attentive to his duties now, and none too obedient to the rules. If he knows that something along the track is going to stop him if he over-runs a signal, will not the consequence be that he will become still less attentive? But we know that he ought never to relax his vigilance, for reasons other than the mere picking up of signals.

With regard to the automatic stop, then, I should say that it would be a misfortune to have any compulsory action on the part of any branch of the government. I should say, let the thing work itself out. Increase, if necessary, the penalties imposed upon railroad officers and employees for killing folks; but let them work out their own means of avoiding these penalties.

When you analyze collisions, you will find that they are almost without exception cases of defective discipline. At the moment I do not think of any single exception; and here is, beyond all comparison, the greatest cause of the terrible situation on the railroads of the United States. Discipline has sunk to a condition below anything that has existed since I have been watching railroads. Of course, you know how limited are the opportunities that you and I have for judging of this important matter, but I do not believe that I am far wrong in that opinion. This low state of discipline may be attributed more to labor unions than to anything else. It is very little a question of long hours; it is very little a question

of shiftlessness on the part of superintendents and other officers, but it is very greatly a matter of demoralization, due to the growth of the trade union idea. Another element is the tremendous demand for men, in consequence of which a man is no longer very much afraid of losing his job. The men have grown insolent, they have grown indifferent, they have lost respect for authority, they have lost their sense of duty, they have been taught by the newspapers of the country that they are a down-trodden and oppressed body, they have been taught that corporations and their officers are wicked; the whole tone of the press and of the pulpit has been to breed insubordination and a chronic sense of grievance. Take, for example, the instance of the Terra Cotta accident on the Baltimore & Ohio, and apply to it this idea.

Of course I do not mean to say that the railroad corporations and their officers are entirely without fault. In all ranks there are railroad men who have been somewhat demoralized by growing familiarity with the idea that railroads are not transportation machines, but rather opportunities for speculators to make money. That condition has had much to do with the decline of discipline, and, furthermore, the technical men have had in recent times less and less to say in the matter of purchase of apparatus and selection of methods and material. So-called business considerations have more and more controlled. So here again we get a bad result from the predominance of the speculative theory in the conduct of railroad affairs. Some of the great financiers who have taken control of the railroads see this danger clearly and try to build up the power and ability of their technical staff.

By the way, the matter concerning which I wrote to you some time ago, viz., the remorseless demand for speed, has a great deal to do with these collisions; but that is a subject by itself.

H. G. PROUT.
Vice-President and General Manager Union Switch & Signal Co.

Interstate Commerce Commission Tariff Rulings.

The Interstate Commerce Commission has issued two tariff circulars, No. 8-A and No. 9-A, the first containing "regulations governing the construction and filing of freight tariffs and classifications," and the other "regulations governing the construction and filing of passenger tariffs." The regulations are to become effective March 1, 1907. After that date all new tariffs must conform to these rules. Tariffs lawfully on file with the Commission on March 1 will be considered as continuing in force, but the Commission reserves the right to direct the reprinting at any time of any tariff. The regulations cover joint tariffs and joint rates, through tariffs and through rates and also individual rates.

The regulations prescribe the size of the tariff, and forbid reproductions by hectograph or similar process, or typewritten or proof sheets. There shall be shown on the title page the I. C. C. number and cancellations, the kind of tariff, reference to the freight classification as to freight tariffs, when the tariffs are issued and when effective, and the name of the officer issuing. The tariff must contain a table of contents, names of participating carriers, index of commodities, alphabetical arrangement of rates to each destination, index of stations, explanation of reference marks and abbreviations, list of stations, explanatory statements and rules governing the application of rates. No rule or regulation shall be included which in any way authorizes the substitution for any rate named in the tariff of a rate found in any other tariff. The tariffs must also explicitly set forth the rates, together with the names of the places from and to which they apply, all arranged in a simple and systematic manner.

The use of the term "common points" in tariffs is prohibited unless a full list of such points is printed in the tariff or specific reference is given to the I. C. C. number of the issue that contains such list. The same rule applies to such general terms as "grain products," "forest products," "petroleum and its products," and similar terms. Where a commodity or special rate is named, such rate is the only rate that can lawfully be used.

Every amendment to a tariff must specify the cancellations thereby effected and every cancellation notice show specifically where rates will thereafter be found. A change in a tariff shall be known as an amendment, and shall be printed in a supplement to the tariff which it amends. The supplement shall be reprinted each time an amendment is made, and shall always contain all the amendments to the tariff that are in force. There shall at no time be more than one supplement to any tariff, and when the supplement contains 100 amendments in force, the tariff shall be reprinted. When a supplement contains more than 25 amendments, it shall also contain an index to its contents.

Each carrier shall publish and file separate tariffs containing all terminal charges and allowances, together with all other charges and rules which in any way increase or decrease the amount to be paid on any shipment. Every carrier shall publish and file a complete list of the tariffs which it is required to post and which are in effect, and this list shall be reprinted every three months. Commodity tariffs shall be entered alphabetically according to the principal commodity. The concurrence of every carrier participating must be secured and filed with the tariff or amendment by the issuing carrier or its agent.

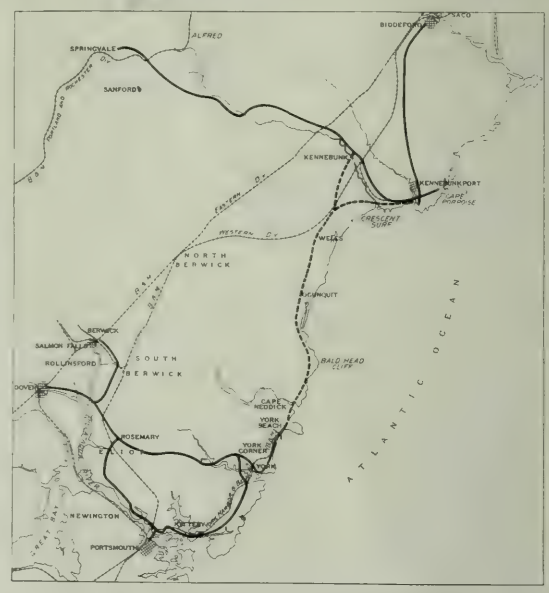
The initial carrier must post all through and joint tariffs; but if in any instance a carrier refuses to participate in through or joint rates to or from its territory and therefore declines to post the through rates, the Commission will give early hearing on complaint against such action and render decision under the provision of the law which confers authority to establish through routes and joint rates.

It will not be the policy of the Commission to permit obstruction to the free movement of traffic by all reasonably available routes, nor to deprive the public in any locality of the advantages of competition among carriers. If it becomes necessary for any carrier to complain of refusal of other carrier to participate in through rate or rates, such complaining carrier may, pending decision by the Commission, use such through rate or rates over the line or lines of the objecting carrier as may have been published and filed, by allowing the objecting carrier or carriers, as their division of the through rate or rates, their local rates between the points on their line or lines where the through rate or rates apply.

The regulations pertaining to passenger tariffs differ somewhat from those for freight tariffs. They contain general rules regarding stop-overs, baggage and excess baggage weights. Special provision is made for the arrangement of points in local and interdivisional tariffs and for statements showing routing.

The Atlantic Shore Line Railroad.

On March 2, 1906, the Atlantic Shore Line Railway, a trolley road operating 35 miles of road from Saco, Me., 15 miles southeast of Portland, to Kennebunkport, and from Kennebunkport east to Springvale, was consolidated with the Portsmouth Dover & York Street Railway, with 42 miles of line running from Kittery, Me., across the Piscataqua river from Portsmouth, N. H., which is



The Atlantic Shore Line, Showing New Connection.

reached by a ferry owned by the company, northeast along the shore to a point beyond York, Me., and reaching by lines running inland, Dover, N. H., and Eliot and South Berwick, Maine. The new company is called the Atlantic Shore Line Railroad, and now has 80 miles of line, which is soon to be increased to nearly 100 miles by a connection 15½ miles long, now being built along the coast between the northern terminus of Portsmouth, Dover & York, and the southern terminus of the old Atlantic Shore Line road, or, in other words, between York Beach and Kennebunk. The accompanying map shows the consolidated system.

The territory reached by this electric road is a flourishing one, particularly in the summer, when the coast towns are filled with summer visitors. Eliot, Kittery, Kittery Point, York Harbor, York Beach, Ogunquit, Wells and Kennebunkport are all summer resorts. The summer local traffic will be large, particularly because the road runs through such an attractive region. On completion of the new

connecting line it will be possible for passengers to ride from Boston to Portland, Me., and beyond to Lewiston or Bath by electric cars. Through traffic, of course, makes up a very small part of a trolley road's business; but the fact that the Atlantic Shore Line forms part of this first through trolley route between the principal city of Massachusetts and of Maine indicates the favorableness of its situation.

Besides the passenger traffic the road does a heavy freight business on its eastern division, that is, between Sanford, Springvale, Kennebunk and Cape Porpoise. The accompanying photograph shows an electric freight locomotive which is used in this service. The side tracks of the Boston & Maine at Springvale, Kennebunk and West Kennebunk have physical connection with the street railway tracks. All the coal and freight to and from the Goodall Worsted Mills is hauled over the eastern division, the steam railroad freight cars being hauled between the mills and the various railroad stations by electric locomotives. A great deal of coal



Electric Locomotive Switching Freight Cars; Atlantic Shore Line.

is also handled between Cape Porpoise and the mills at Sanford, 21 miles. At Cape Porpoise the Atlantic Shore Line owns wharfs, bins and discharging and storing apparatus for coal. The electric locomotives are also used for hauling the railroad freight cars to the different side tracks and points along the line for any purpose, particularly for loading lumber. As the mills at Sanford employ about 4,000 people there is a large amount of freight business done. The Atlantic Shore Line has three locomotives like the one shown and two box car locomotives. An extension of the company's activities is planned which will give the road a through freight traffic. Wharf privileges have been acquired at Boston, Portsmouth and Kittery and extensions to the wharves at Cape Porpoise are planned with the intention of establishing a steamboat line between Boston and Cape Porpoise touching at Portsmouth, N. H. It is expected that a great deal of freight will be handled by this line between Portsmouth, Dover, Rochester and Salmon Falls, N. H., and South Berwick, Eliot, Kittery, York, Kennebunk, Wells, Ogunquit Sanford, Springvale, Kennebunkport and Biddeford, Maine.

The Atlantic Shore Line has $700,000, 4 per cent. preferred, and $2,000,000 common stock, and an authorized issue of $3,000,000, 4 per cent. 20-year refunding bonds. For the 12 months ended October 1, 1906, gross earnings were $297,000, net earnings $132,500, and surplus above fixed charges and taxes, $85,000. This is at the rate of about $3,500 gross earnings a mile.

Railroad Decisions in January.

The following decisions were handed down by Federal and Supreme Courts in January, 1907:

Power to appropriate depot grounds for highway purposes.—The general power conferred on local bodies to establish highways does not empower such a body to condemn for highway purposes land already appropriated under the power of eminent domain for station grounds, when the effect of such second appropriation would be to seriously interfere with their use for this purpose. Chicago, Rock Island & Pacific vs. Williams, 148 Fed. Rep. 442.

Postal clerks as employees.—The Pennsylvania statute providing that postal clerks injured while in the performance of their duties shall have no greater rights than employees suffering injuries does not infringe the power of Congress to establish postoffices and post roads. Neither is it open to objection that it violates the commerce clause of the Federal Constitution, nor does it deny the clerk due process of law or the equal protection of the laws or privileges and immunities enjoyed by citizens of the United States generally. Martin vs. Pittsburg & Lake Erie, 27 Sup. Ct. Rep. 100.

Membership of employees in labor unions.—The Federal act making it a criminal offense for carriers of interstate commerce to withhold employment to railroad men unless they agree not to become members of labor organizations or to blacklist employees on discharge is not in a constitutional sense a regulation of commerce between the states, and being without strict limitation to transactions relating to interstate commerce but equally applicable to commerce not of this character it is unconstitutional and void. United States vs. Scott, 148 Fed. Rep. 431.

Rules for guidance of employees.—A railroad company is charged with the duty to make, promulgate and enforce definite rules and regulations for the guidance and protection of employees, and the employee on his part rests under a like duty of obedience to such rules. Where the rules are mere oral instructions to employees they must be proved by the railroad company where they are relied on as defense to an action for the death or injury of an employee. Seaboard Air Line vs. Shanklin, 148 Fed. Rep. 342.

Reasonableness of commissions' rates.—Federal courts will not review the action of a state railroad commission in fixing a local rate on an article where there is no evidence from which a reasonable deduction can be made as to the cost of transportation, the amount of the article transported or the effect which the rate established by the commissions will have upon the income of the carrier. Seaboard Air Line vs. state of Florida, 27 Sup. Ct. Rep. 108.

Condemnation of stock of minority road.—The Supreme Court of the United States has decided that the improvement of the New Haven & Derby Railroad is a public use entitling its lessee, the New York, New Haven & Hartford, which owns three-fourths of the stock, to condemn the outstanding shares of stock owned by a person who refuses to agree on the terms of purchase of his stock. Such a proceeding is authorized by a Connecticut statute, and when supported by a clear public use as the one in question, which was necessary to develop the property of the parent line, does not violate the due process of law provision of the Federal Constitution. Offield vs. New York, New Haven & Hartford, 27 Sup. Ct. Rep. 72.

Presumption under Ohio railroad employee act.—The provision of the statute making proof of a defect in a railroad appliance causing injury to an employee *prima facie* evidence of negligence is held not to shift the burden of proof of negligence. All that the railroad is required to do to meet this presumption is merely to counterbalance it. It is not required to overcome the presumption. The burden of proof of negligence still rests on the employee. Shankweiler vs. Baltimore & Ohio, 148 Fed. Rep. 195.

Rebates.—The allowance of a rebate to a packing house company is not to be justified on the ground that it was an allowance to the packing company for the use of its own private track in moving the cars to a connection with its own road. The word "rate" in the anti-rebate statute means the net amount the carrier receives and retains and any device by which the amount is reduced below the rate given in the published schedule is a violation of the law. United States vs. Chicago & Alton, 148 Fed. Rep. 646.

Requiring trains to stop at county seats.—An order of a state railroad commission requiring interstate mail trains to stop at county seats already supplied with proper and adequate passenger facilities is an unconstitutional interference with interstate commerce. An injunction against the enforcement of such an order is not open to the objection that it is a suit against a state within the constitutional inhibition, neither is it open to the objection that it violates the statute forbidding the Federal courts to enjoin proceedings in a state court, as a railroad commission is not a court. Mississippi Railroad Commission vs. Illinois Central, 27 Sup. Ct. Rep. 90.

Inspection of rolling stock.—In a case of injuries to an employee caused by the breaking of a brake rod from a hidden defect therein the rule is announced that the company was not liable if the defect was not discoverable by such an inspection as was customarily made by well regulated and prudently conducted railroads, and was of the only kind practicable or which could be made without seriously interfering with the operation of trains. Shankweiler vs. Baltimore & Ohio, 148 Fed. Rep. 195.

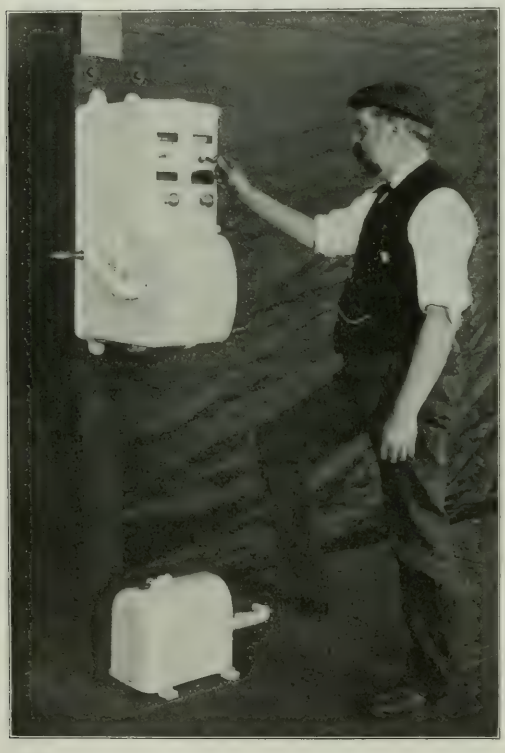
Construction of a foreclosure decree.—The decree and order of confirmation of sale in the foreclosure of a mortgage on the A., T. & S. F. Railroad required the purchasers or their assigns to pay, in addition to the price bid, any indebtedness and liabilities contracted or incurred by the owners in the operation of the road before it was thrown into the hands of the receivers, which were

prior in lien to the general mortgage foreclosed, on the court adjudging them prior in lien thereto. The court reserved jurisdiction for the purpose of adjusting such claims and gave the purchasers or their assigns the right to appear and defend against such claims and appeal from decisions thereon. Under this decree it was held that a claimant against the old company who had not secured payment out of the earnings of the road while in the hands of the receiver as provided in the interlocutory decree appointing the receiver could compel payment only by establishing on principles of equity that his claim was prior in lien to the mortgage as provided by the decree. Atchison, Topeka & Santa Fe vs. Osborn, 148 Fed. Rep. 606.

Foot Power Generator for Controlled Manual Block Station.

The accompanying illustration shows a controlled manual station block instrument in which energy for unlocking purposes is supplied by a foot power generator instead of by the batteries ordinarily employed. A number of advantages are claimed for the generator over the batteries usually employed.

With the batteries and the ordinary form of unlocking key it is possible for an operator to either leave or secure his key in the closed position, thus making it possible for the operator at an adjacent station to secure an unlock without asking for it. With the manually operated generator the operator, in giving an unlock, is required to impart motion to the generator, and this insures his co-operation in the act of giving a signal.



Foot Power Generator for Controlled Manual Block Station.

Where a continuous track circuit is employed between stations the current for the track circuit may be obtained from the same generator that furnishes power for unlocking, even though it may be necessary to employ several cut sections. With this arrangement no batteries have to be employed either in the station or out on the line. If desired, the generator can be wound to deliver alternating current for track circuit purposes, thus eliminating the possible effects of stray currents in holding up the track relays behind a train.

A manual generator by eliminating batteries removes all expense incident to their maintenance. The expense for the maintenance of a generator is practically nothing, and since the first cost of one will not be much in excess of the cost of a battery, plus its maintenance for one year, an abundance of power is obtained with a minimum of cost and trouble. With ordinary exertion a man can develop as much power as can be generated by from 200 to 250 batteries in prime condition. The apparatus is made by the General Railway Signal Company, Buffalo, N. Y.

The Early Use of Balanced Slide Valves.

At the December meeting of the Iowa Railway Club, Mr. W. F. Gould read a paper on balanced slide valves, in which he called attention to the early attempts at valve balancing that had been made on American locomotives. The first of these was a Grant engine built in 1864. This had a valve of the Moss type, and was very similar in construction to the Richardson valve of to-day; in fact, the only difference lay in the manner in which the corner pieces or strips were fitted into the corners of the valve to hold the packing at those points. The long packing strips were the same as in the Richardson valve, except that they were held up by spiral brass springs against the bottom of the steam chest cover, and the face of the valve did not travel over the valve seat as in the case wih these valves of the present day.

In those days there was no relief valve in the steam chest, therefore the engine would not drift at all, not even down a 2 per cent. grade. So these valves soon dropped out of sight and then the Adams valve appeared. This valve was made with a round ring or sleeve hollowed out in the center, and cast solid to the back of the valve. Into this sleeve was fitted a similar one, and it was made steam tight between the sleeves by means of a packing ring upon the periphery of the inside sleeve, while the top of the sleeve or ring was fitted against the bottom of the steam chest cover and was held up in position by means of a three-pronged spring. Each of the above described valves had small holes drilled through into the exhaust cavity, so that whatever steam should leak by either the packing bars or the ring would blow through into the exhaust, in the same manner as that of the Richardson valve of to-day, and still the engines would not drift until relief valves were put in. The area that was enclosed inside the ring on the Adams valve, or within the packing bars on the Moss valve, was all that was balanced on either of them, and there was always enough outside surface of the valve exposed to steam pressure to hold each end of the valve to the seat against port or cylinder pressure when the engine was working at full stroke. Therefore, after the exhaust had taken place, and before the opposite port opened, the actual relief to the valve was very slight, and yet the same conditions exist to-day with the Richardson valve. In those days, when the springs got weak, as they did sometimes, and the engine began to blow, we used to take up the steam chest covers and drive wooden plugs in the holes drilled into the exhaust, and very often it made the engine work better, but the balance features, of course, were lost. Therefore, in time the Adams valve was changed to what is known as the American balanced valve, which change consisted in making a shorter valve seat and changing the form of the packing ring only. So it can be seen the Moss valve was changed to the Richardson merely by shortening the valve seat and changing the form of the packing strips and putting in relief valves in the steam chest, so that the engines would drift, and not improving the balance one iota, for the reason that in no instance is any more pressure taken from the back of the valve than was taken from it when it was the Moss or the Adams of 1864. And it is in that respect just as imperfect now as it was then, and yet nine-tenths of the locomotives of to-day are using the Richardson valve because it is a slide valve and because piston valves for locomotives are a thing of the past. They were tried in 1862-3-4, and were thrown away the same as they are to-day, being supplanted by the slide valve.

Of course there are reasons for this, and one of them is that back pressure when the engine is running at a high rate of speed, is the most prolific cause of trouble with the piston valve.

There is another point to which I desire to call your attention, and I hope that some genius will, in the near future, see a way out of it, and that is the relief valve. I notice some of the recent forms of cylinders are equipped with devices for keeping the steam chest and cylinders hot with live steam, and yet they use the relief valve, a device which admits an unusual amount of cold air into the steam chest and the cylinders while the engine is drifting; therefore it cools off a steam chest or a cylinder or a steam pipe easier and quicker than any other way that I know of, and then many wonder why the steam pipe leaks.

In Prussia and Baden the railroads provide beds for trainmen whose service compels them to sleep away from home part of the time. Until recently the sheets and towels were changed at regular intervals of time, within which the sheets were usually slept on by two or more different men. Now they are changed with the men. Two sheets are issued to each man every two years and two towels every year, one of the sheets being long enough to cover the pillow. The employee cares for the washing and takes the articles with him if his service is changed, and becomes the owner finally.

Locomotive Superheaters.*

BY F. J. COLE.

The use of superheated steam on locomotives has progressed very rapidly in the last eight years, and at the present time about 1,600 engines are so equipped in Europe, and 260 in use or under contract in the United States, about 200 of these being in use on the Canadian Pacific Railway. It is interesting, however, to note that 58 years ago locomotives were built with superheaters.

One of the earliest records on file is of six locomotives built by the firm of John Cockerill, of Seraing, Belgium, in 1848, which are quaintly described as "having boilers 9 ft. long," and in order to obtain great heating surface the space around the smokestack was utilized, which had hitherto not been used.

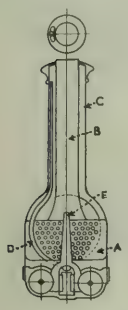


Fig. 1.

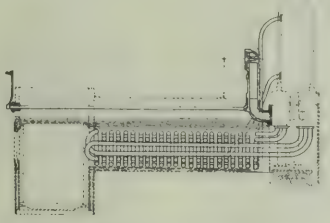


Fig 2.

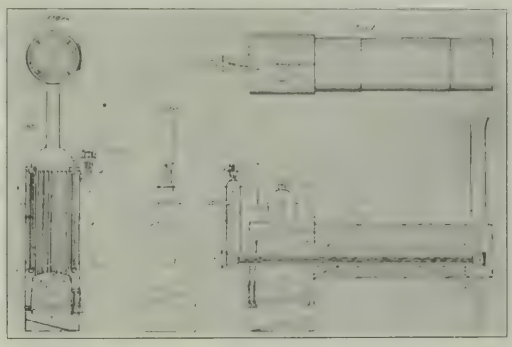


Fig. 3.

This arrangement is shown in Fig. 1, in which A is the smoke chamber, B is the stack, C is the steam dome which surrounds the stack to the upper point, D is the steam pipe which leads from the upper section of the steam dome to the steam chest, which is provided with the usual slide valves; E is the exhaust pipe for both cylinders. To prevent the cooling down of the smokebox, as also the outer side of the stack, there was provided a packing of felt and wood. The smoke chamber, A, is separated from the space F by means of a flat plate or deck extending over the uppermost row of tubes, with space F communicates part of the way with the cylindrical boiler and part of the way with steam dome C. The smoke chamber plate or deck is provided only with two openings, one of which is for the passage of the stack B, and the other for the steam pipe D.

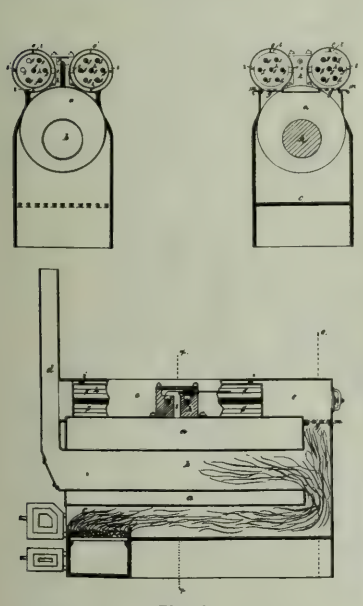


Fig. 4.

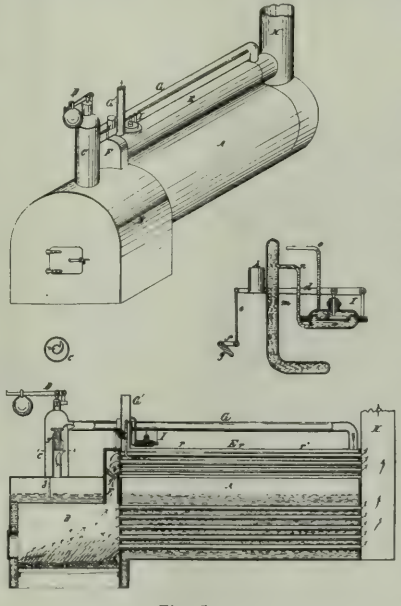


Fig. 5.

The description states that "this arrangement has demonstrated that by the generation of steam, due to the high steam pipe, the steam entered the cylinder entirely dry."

As recorded by Consul Mason, the experiments of Hirn, the Alsatian engineer, in the year 1850 were successful and superheaters were constructed of cast-iron, but the fact that the power of the superheated steam increased with its temperature had not been scientifically proven, and as the parts of the machine coming in contact with the steam were found to suffer when the temperature of 260 deg. C. was passed, no higher temperatures were attained, and it was left for Herr Schmidt, of Wilhelmshohe, to demonstrate that highly superheated steam at 300 deg. and 350 deg. C. materially reduced the amount of steam required, and that it could be used without danger to properly constructed machinery.

A superheater constructed in 1855 by P. J. C. Montety, of Toulon, France, is shown in Fig. 2, which illustrates one of the earliest attempts to apply a scientifically constructed apparatus to locomotives for the superheating of steam. In this the lower part of the boiler is occupied by an internal flue of large diameter, in which the pipes, both for saturated and superheated steam, are run lengthwise and coiled around the outer inside diameter of the large flue, their ends being upwards and terminating in steam boxes in the smoke box. The claims made for this apparatus at the time it was published are:

1st—The general construction and arrangement of apparatus for drying and dilating or superheating steam.

2d—The system or mode of superheating or dilating steam before it enters the cylinders by first drying it in a coil or coils of drying pipes and subsequently superheating or dilating it in a coil or coils of pipes placed in immediate contact with the flames issuing from the furnace.

A patent issued to W. M. Storm in 1857 (Fig. 3), illustrates one of the earlier forms of superheating apparatus applied to locomotive boilers. It consists of an internal flue of comparatively large diameter, with one end terminating in the smoke box and the other end extending entirely through the fire box and protruding outside the back head. A number of superheating pipes are located in this flue and provided with suitable headers for the saturated and superheated steam. The claim for this invention was substantially that of rendering steam to the cylinders without the exposure of the tubes or drying vessel to the direct action of the fire or hot products of combustion. Evidently this was an attempt to make an apparatus which would not rapidly deteriorate by the direct action of the flames, and would have a longer life than superheaters previously constructed which were subject to the direct action of the flame.

A peculiar arrangement patented by O. Newton in 1858 is shown in Fig. 4, in which the superheaters are placed at either side of the top of the boiler. The claim for this device was for producing a more perfect calorification and expansion of the steam after it leaves the prime steam generator and before it enters the cylinders of the steam engine by means of two or more steam chambers constructed,

*A paper read before the Central Railway Club.

as described, separate from the boiler and heated by hot air from the furnace, the steam thus anhydrated passing to the cylinder of the engine from one of these separate chambers while the steam in the other chamber is being prepared for the next stroke of the engine.

An illustration of a superheater by Stillman & Wilcox, patented in 1859, is shown in Fig. 5. It is placed on the top of the boiler with a large flue extending lengthwise and containing a number of small superheating pipes. This is supplied by hot gases directly from the furnace, the flow of which is controlled by an automatic damper in the uptake. The claim made for this device is that it regulated the flow of the products of combustion to the superheater by the differences in pressure between the superheated steam and that of saturated steam.

In 1860 J. Martin invented the device for superheating shown in

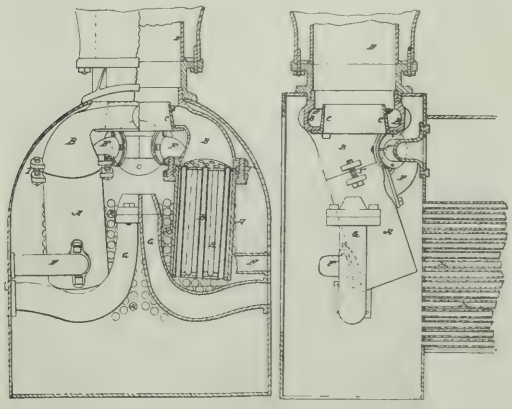


Fig. 6.

Fig. 6. This is located in the smoke box and is described as follows:

The strong draft through the chimney made by the exhaust will cause a vacuum to be formed in the annular chamber S, the filling of which vacuum will cause a strong draft through the flues R, of the chambers A and the pipes B B.

The claims are: First, the combination and arrangement of the flues R with the steam chambers A.

Second, the annular chamber S, in combination with the steam chambers A, flues R, and pipes B.

In 1863 Benjamin Crawford invented the smoke box superheater shown in Fig. 7, which consists of partitioning off the forward part of the boiler for the purpose of superheating steam. The circula-

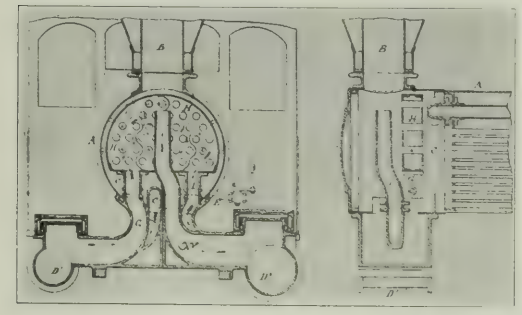


Fig. 8.

tion among the heating pipes is produced by the vertical diaphragm.

Another form of smoke box superheater is shown in Fig. 8. Mr. William S. Hudson, Superintendent of the Rogers Locomotive Works, of Patterson, N. J., patented this device in 1872. He described his invention as follows:

1. The superheating vessel H, in the form of a broadly extended diaphragm, perforated by tubes h and provided with one or more partial partitions h^1.

2. The arrangement, in the smoke box of a locomotive, of a drying and superheating vessel, with connections to the two cylinders, the whole so operated that the live steam shall be received from the boiler into one cylinder and exhausted therefrom into the other cylinder through the said superheater.

3. A locomotive having a secondary live steam pipe E, leading to the second cylinder D^2 and controlling valve e, with means of operating from the footboard, in combination with the main steam pipe C, leading to the other cylinder D^1, and arranged for joint operation relatively to the boiler A and the means for exhausting from the one cylinder into the other and superheating.

Still another form of superheater patented by A. Estrade, in 1882, is shown in Fig. 9. It consists of a U-shaped apparatus placed in the upper part of the fire-box, directly exposed to the direct action of the flames.

An interesting conception is shown in Fig. 10. This was patented by J. B. Bossler and S. D. Stauffer in 1890, but it is safe to assume that no practical application has been made of this device.

About 1898 the Prussian State Railways became active in experiments with locomotive superheaters, using devices of Wilhelm

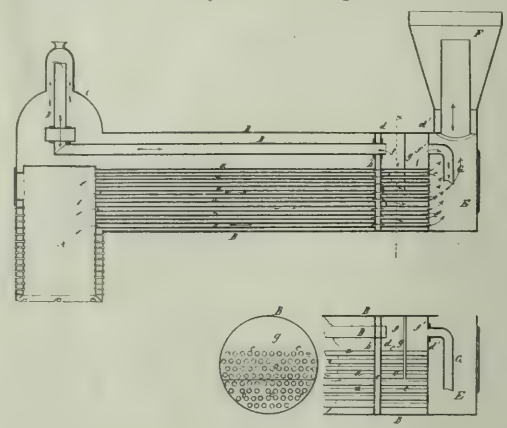


Fig. 7.

Schmidt, of Wilhelmshohe. Herr Schmidt had attained marked success in the use of superheating as applied to stationary practice, and by the assistance of and through the interest of Herr Garbe, of the Prussian State Railways, extensive experimental applications were made upon locomotives in Germany. The first two locomotive superheaters were applied in the year above mentioned upon the Prussian State Railways, and are still running. The first led to an extensive application, from which important experience has been gained. Herr Schmidt became the pioneer of the present development of superheating as applied to locomotives, much credit also being due to Herr Barbe for his bold and courageous indorsement of the principle. The earlier Schmidt superheaters take the form shown in Fig. 11, which shows a longitudinal view of the apparatus.

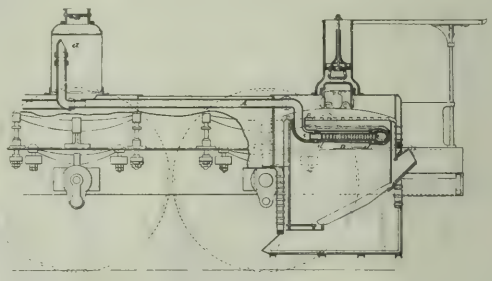


Fig. 9.

This consists of superheating pipes placed in the smoke box in the form of a horseshoe, the bottom part being bent around in semi-circular form to conform to the shape of the longitudinal boiler flue of large diameter which delivers furnace gases of high temperature to the superheating tubes. The gases are forced to circulate around the superheating tubes by means of suitable diaphragm plates. After their temperature is sufficiently lowered they are discharged from the stack.

In 1901 a small Canadian Pacific locomotive was equipped with this apparatus, and its use has resulted in considerable economy in fuel and water. It is still in service.

In Germany there has been considerable competition between the Schmidt superheater just shown and another form, known as the Pielock, which consists of a chamber placed in the barrel of the

boiler between the fire box and the smoke box, through which the boiler flues pass, without break, from the fire box to the smoke box. They are expanded in the end walls of the superheating chamber in order to render them steam and watertight. While this device has some advantages, from a theoretical standpoint, on account of the high temperature of the gases at the superheating chamber, and that the temperature is afterwards reduced while passing through several feet of flues before being discharged into the smoke box, the expanding of the flues at some distance from their ends in the superheating chamber has been adversely criticized in this country and

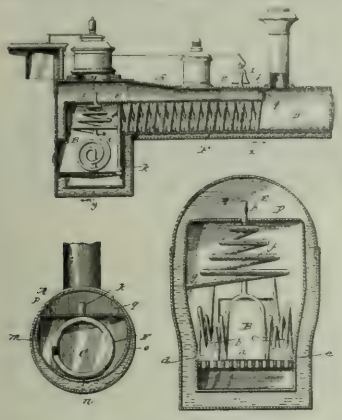


Fig. 10.

considered a serious objection to its use. One of the advantages, on the other hand, is the use of unobstructed flues, which renders them less liable to choke than the ordinary form of flue.

A locomotive built by the Egestorff Works, at Hanover, was equipped with this superheater and exhibited at the St. Louis World's Fair. It was a four-cylinder compound on the Von Borries principle. While the grate bars and draft arrangement were unsuitable for American coal and conditions, which rendered it impossible to obtain high horse-powers, yet the fuel and water economy was the lowest of all the engines tested, and in one instance the very low consumption of 16.6 lbs. of water per H. P. hour was obtained.

The later forms of Schmidt superheaters, as applied in this country, Canada, and to a large extent abroad, are of the fire tube type, as shown in Fig. 12. In this apparatus the usual boiler tubes are replaced in the upper part of the boiler by a number (in this instance 22) of 5-in. (outside diameter), flues. In each of these there are four U-shaped superheating tubes in pairs, extending back within about 3 ft. of the firebox, and connected at the front end to saturated and superheated steam tee headers.

In 1901 a New York Central Atlantic type engine was equipped with the original form of Schenectady superheater shown in Fig. 13. The upper part of the boiler in this apparatus was supplied with 55 3-in. (outside diameter) flues, in which superheating tubes of 1¾ in. outside diameter, and circulating tubes of $1^{1}/_{16}$ in. outside diameter were located. This locomotive is still in service. While considerable economy in water and fuel has been obtained by its use, yet the amount of superheat is not sufficiently high for the best results, and later types of superheaters made by the American Locomotive Company have been of the return bend system with larger

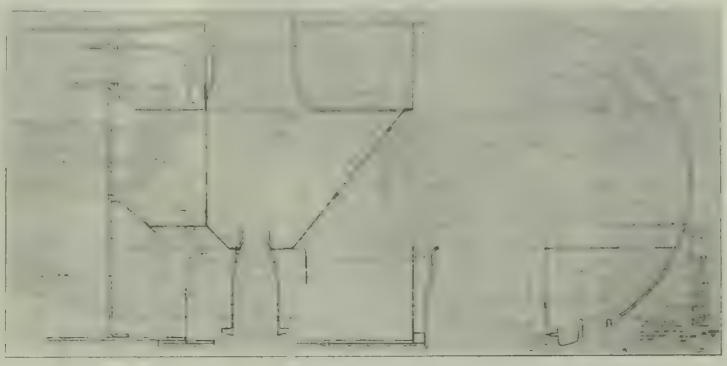


Fig. 12.

fire tubes, allowing a much greater area for the passage of gases and reducing the liability to choke up.

Owing to the restricted space for the passage of gases, the flues are more likely to clog up, and while good results are obtained when the flues are perfectly clear, yet as they gradually clog up, the decrease in superheat obtained is noticeable.

It is interesting to note, however, that with anthracite coal, this type of superheater has been very successful, and a locomotive running on one of the prominent Eastern lines (D., L. & W., No. 955) has been in successful use for over a year and has shown a marked

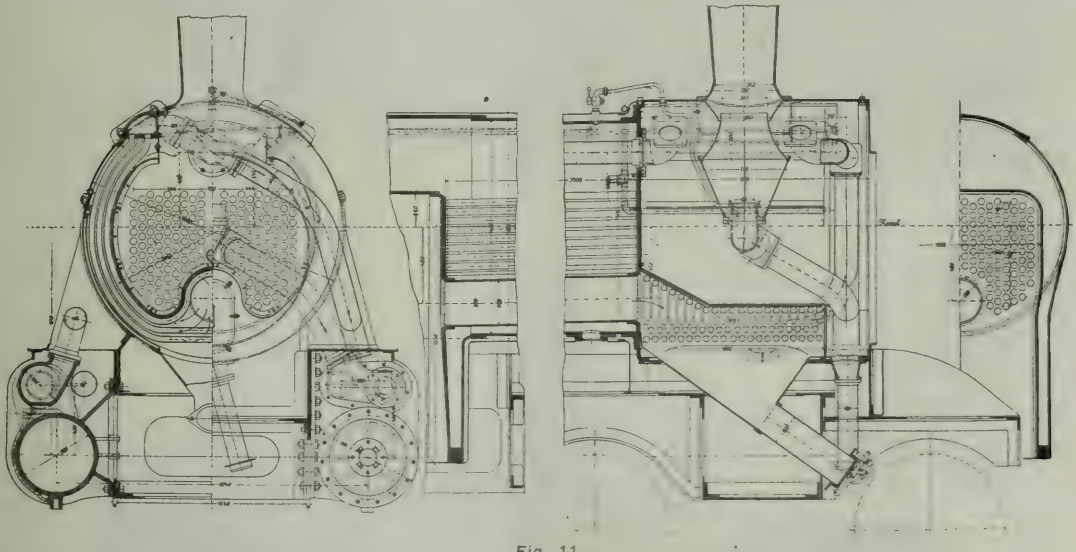


Fig. 11.

degree of fuel economy. This is probably owing to the fact that no choking up or decrease of heating surface by coating over with soot takes place with hard coal. The picture of this anthracite coal engine equipped with superheater is shown in Fig. 14. Fig. 15 shows a later form of the American Locomotive Company's apparatus. The vertical headers are made detachable with independent bolting, so that any one may be removed for repairs without disturbing the rest of the apparatus. The connections to the tee head are made in the usual locomotive manner, viz., cast-iron ball joints, and all parts are designed to be as accessible and durable as possible. It

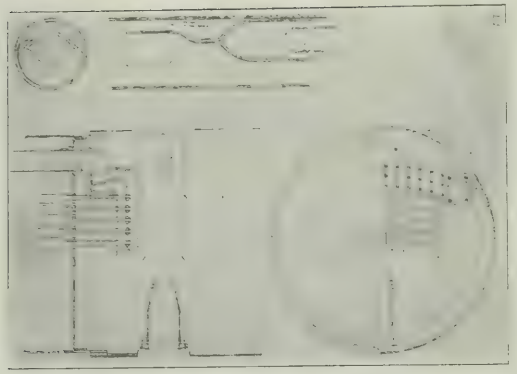


Fig. 13.

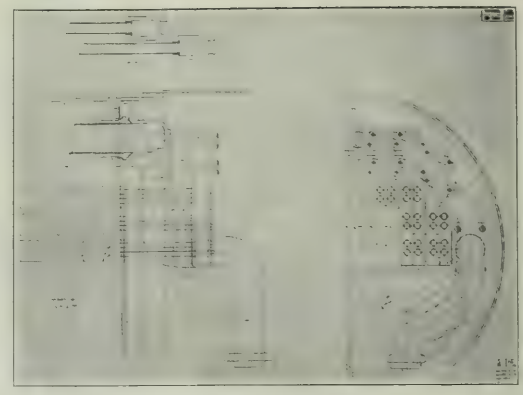


Fig. 15.

will be noticed that the headers are divided into two parts and the superheating tubes are in U-form, the ends being connected to different chambers.

Locomotives equipped with this general type of superheater are:

Northern Pacific.....462 Type, No. 310 (Fig. 16)
C. R. I. & P.....462 Type, No. 847
Boston & Maine.....460 Type, No. 346

A diagram of tests made on the latter engine is shown in Fig. 17, in a run from Greenfield to Boston, involving a 1.1 per cent. grade. The first line from the bottom shows the profile of the road; the second is the speed in miles per hour; the third is the position of the cut-off or reverse lever; the fourth is the position of throttle, either full or partly open; the fifth is the steam chest pressure; the sixth is the boiler pressure; the seventh is the temperature corresponding to the saturated steam at steam chest pressure; the eighth is the actual temperature of the superheated steam at the steam chest; the ninth is the smokebox temperature. The actual amount of superheat obtained at the steam chest is, therefore, given between the lines seven and eight, averaging for the entire run while working steam 114 deg., and reaching in some instances to about 150 deg. The observations were made every mile, so that the diagram gives a very close record of the fluctuations of temperature. The temperature characteristics of the entire run can be very readily observed by means of this diagram in a few moments. It is interesting to note that the excess of temperature between the superheated steam and that at the smokebox is comparatively small, the average probably not exceeding 110 deg. This engine has shown considerable economy in the use of fuel and water.

The superheater applied to the engine on which these tests were made is shown in Fig. 18. The tests of this engine and one of similar type, but using saturated steam, were made by the Boston & Maine Railroad, with the advice of Prof. Gaetano Lanza and several undergraduate students from the Massachusetts Institute of Technology. The water was measured by water meters, and checked by water glasses in each corner of the tank. Four indicators were used in getting cards, and Boyer speed recorder and Crosby revolution counter were used for indicating speed. The steam chest temperatures were taken by means of high-grade glass mercury ther-

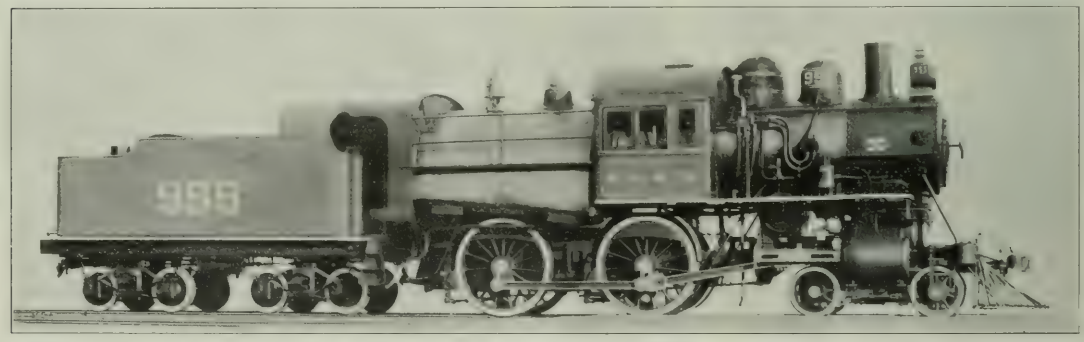


Fig. 14.



Fig. 16.

mometers inserted in the steam chest cavity. The amount of steam used by the air-pump was carefully considered, and the quality of the steam determined by means of a Peabody calorimeter. The amount of coal was determined by weighing some two or three tons placed on the tender, and the remainder contained in bags weighing 100 lbs. each. The tabulated summary of the tests is given in the accompanying table. It will be seen that the economy in coal, on the basis of ton miles, was 15.15 per cent.

SUMMARY OF TESTS ON B. & M. ENGINES, 1123 AND 1126, AUGUST 16, 17, 24 AND 25, 1906. BY AMERICAN LOCOMOTIVE COMPANY, ROGERS WORKS. October 29, 1906.

Line.	Item.	Superheated steam (Eng. 1126) — Run				Summary			Saturated steam (Eng. 1123) — Run				Summary			Gain, 1126.
		1. West	2. East	3. West	4. East	Max.	Min	Mean	5. West	6. East	7. West	8. East	Max.	Min.	Mean.	Pr ct.
1.	Direction of run															
2.	Number of cars	8	6	8	9	9	6	7.75	9	8	7	9	9	7	8.25	
3.	Tons behind tender	300	271.3	315.2	329.6	329.6	271.3	331.3	360.2	342.2	374	375	375	274	337.8	
4.	Ton-miles per run (105.6 miles)	32,630	28,649	33,285	45,365	45,365	28,649	34,985	38,037	36,130	28,931	39,610	39,610	28,931	35,672	
5.	Coal burned, lbs.	7,480	6,820	5,762	7,043	7,480	5,762	6,779	7,353	8,035	7,700	8,600	8,600	7,353	7,922	
6.	Water evap. (from and at 212 °), lbs.	60,962	54,300	52,960	59,150	60,962	52,960	56,845	64,780	60,065	65,140	66,220	66,220	60,065	64,201	
7.	Water evap., per lb. of coal, lbs.	8.15	7.95	9.19	8.40	9.19	7.95	8.42	8.81	7.55	8.46	7.7	8.81	7.55	8.13	3.6
8.	Ton-miles, per lb. of coal	4.36	4.19	5.77	6.44	6.44	4.19	5.19	5.17	4.50	3.75	4.61	5.17	3.75	4.507	15.15
9.	Ton-miles per lb. water (from and at 212 °)	.535	.528	.628	.767	.767	.528	.615	.587	596	.444	598	598	.444	.556	10.49
10.	Smokebox temperature, average, deg. Fahr.	584	595	576	588	595	576	586	594	589	600	597	600	589	595	
11.	Superheat average while working, deg. F.	80	114	99	101	114	80	98.6								
12.	Cutoff, per cent. of stroke, average	24	25	24	27	27	24	25	27	24	23	22	27	22	24	
13.	Throttle opening, per cent. of full opening	88	85	76	76	88	76	81.25	62	54	72	76	76	54	66	
14.	Per cent. of run with throttle open	69.7	81.8	76.2	74.5	81.8	69.7	77.55	78.6	78.1	85	82.8	85	78.1	81.1	

Another form of superheater which has been applied to a number of Canadian Pacific locomotives is a development by Messrs. Vaughan and Horsey, shown in Fig. 19. The reports from this apparatus are very satisfactory and high temperatures have been obtained. At the present time about 150 locomotives have been equipped, and in addition fifty are under contract for next year's delivery. This apparatus consists, as in the Schmidt and American Locomotive Company forms, of a number of large 5-in. tubes located in the upper part of the boiler, in which U-form superheating tubes connected to headers in the smoke box are arranged. The characteristics of this superheater, briefly, are, the use of two comb-like headers, with fingers cast integral, one located in the upper part of the smoke box for the saturated steam with the fingers extending downward, and the other just below the center of the smoke box for the superheated steam with the fingers extending upward, arranged in alternate rows for connection to the superheating tubes. The superheating tubes are connected by means of a cross to the front of the fingers and arranged in groups of four, each opening service four superheating tubes. A Canadian Pacific ten-wheel locomotive equipped with superheater is shown in Fig. 20.

The attitude of the Canadian Pacific Railway, and especially that of Mr. H. H. Vaughan, assistant to the vice-president of that road, toward the application of superheaters to locomotives has been praiseworthy, in that from the small beginning of one locomotive to which a superheater was applied by Mr. Roger Atkinson in 1901, this railway now has more locomotives equipped with superheaters than any other line on this continent. By this large scale

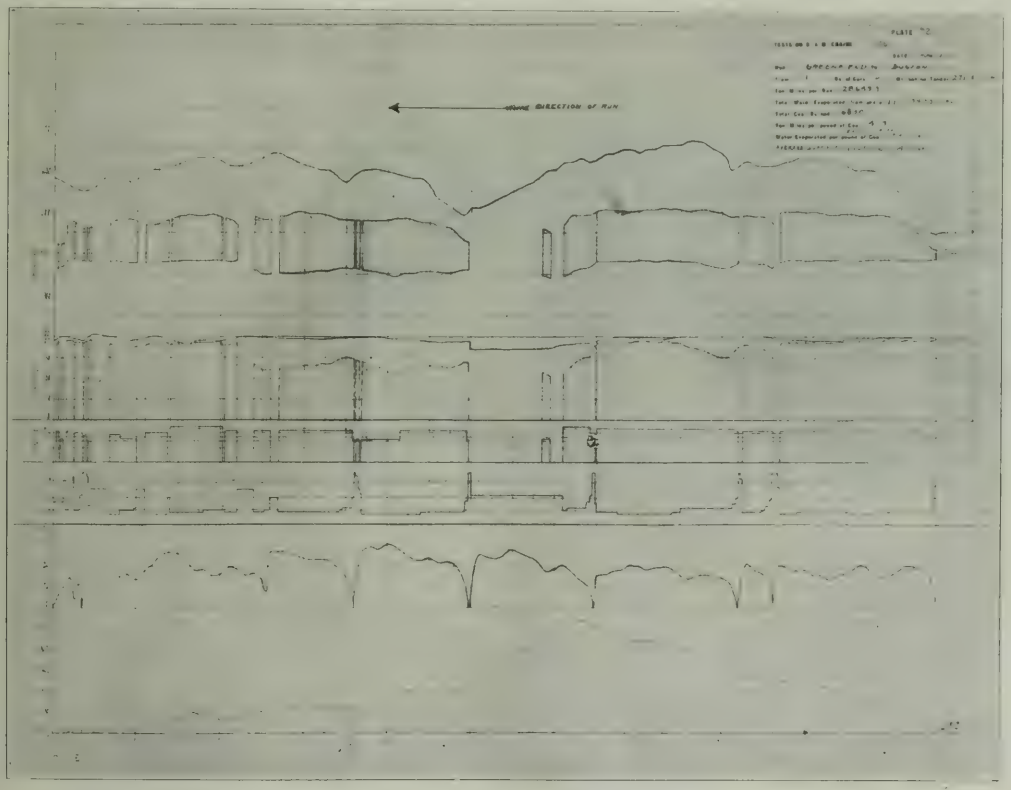


Fig. 17.

application, the natural nursing which a small number of locomotives equipped with a special device would ordinarily receive has been entirely overcome and the question of superheating has been placed directly upon its merits, the number of applications being so great as to prevent specially careful treatment of individual locomotives. This attitude required considerable courage, but the results appear to fully demonstrate the wisdom of the course pursued. With over 200 locomotives now equipped with different forms of superheaters, an opinion has been formed which is of great value in establishing the superheater as a fixture in locomotive practice.

It is not to be expected that so important a principle as super-

heating, which has undergone a development in this country in so short a period as five years, would be perfect, but it may certainly be said from facts of experience that superheating, as a principle, has demonstrated its value and established itself as a subject for the best thought and most careful consideration of locomotive designers.

The superheater presents the possibility of economy in fuel, increased capacity for steam-making of any given boiler and an increased cylinder capacity, because of the absence of moisture in the steam. Among the other advantages offered by superheating is an important one in connection with the question of boiler pressure. Not only many locomotives with rather small boilers be considerably improved in steam-making ability, but pressures may actually be reduced in connection with superheating, to a limited extent, without noticeable loss of power. In operation it has been noticed that the boiler pressure of a locomotive using superheated steam may vary within wide limits during a run without such decrease of speed as would follow the same fluctuations in pressure in a locomotive using saturated steam. This becomes rather important from an operating standpoint.

Viewed as a question of economy, the superheater renders it possible to continue the use of old locomotives, which, without the application of superheaters, would be considered out of date, and when applied to the largest and most modern of passenger locomotives, the economy in fuel and steam appears in connection with the capacity of the fireman to produce the necessary horse-power.

In his papers upon this subject Mr. Vaughan has covered the theory of superheating so thoroughly as to render it unnecessary for it to be covered again. This discussion is intended to review the chief steps in the progress of superheating and to illustrate the most important of the more recent improvements.

The application of superheating to locomotives has not been free from difficulties, but sufficient experience has been gained to warrant the opinion that, as a principle, superheating has now established itself upon a permanent basis.

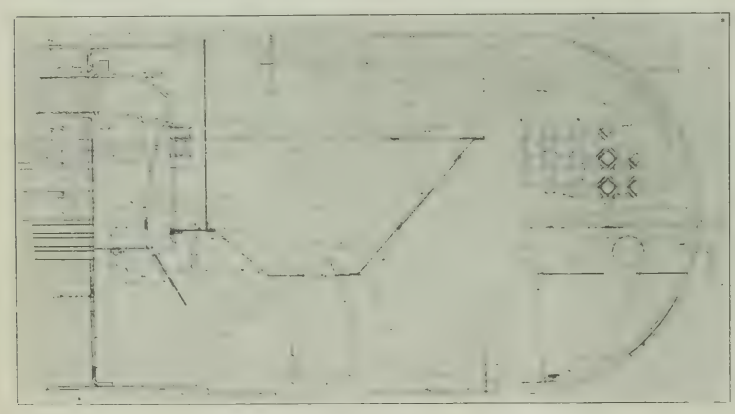


Fig. 19.

National Characteristics in Locomotive Building.

II.

[The critical reader of these extracts from Maurice Demoulin's interesting comparisons should bear in mind that his book was written probably as long as two years ago. In several casual statements, such as: "Great Britain has almost entirely rebuilt its motive power equipment within the last four or five years," the writer has been misinformed; but, taken as a whole, his comparisons are interesting and valuable.]

Great Britain.—Higher powered locomotives have been built in England during the last few years, but the designers have gone

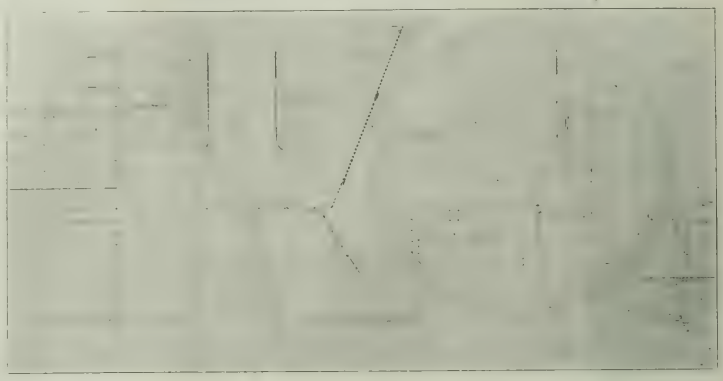


Fig. 18.

slowly; they departed with regret from established forms, and that only when confronted with absolute necessity and assured of certain results. This attitude of mind is in striking contrast with that of the Germans, who are always ready to test new theories on a large scale. England is not, in railroad matters, a country of investigation and test. Ingenuity and the spirit of research have been voluntarily limited to actual necessity. Furthermore, the density and regularity of traffic, the importance of the receipts per mile, the general methods of operation, the division and specialization of trains, the exceptional quality of the fuel, the high axle loads permitted, and the independence of the companies have removed many difficulties which are to be found in other countries where the problems are more complex.

The English companies have been successful in getting all the work out of their machines that was possible by using the best fuel. It was only when with the highest rate of consumption they could not generate enough power that the locomotive builders decided, inch by inch, to lengthen their grates. Their idea has not been that of the United States, to make as large an engine as possible, but to build as small and as light a machine as could do the work. So for the past 20 years light locomotives have remained in the front rank in England a little longer than was possible in other countries. The change has come, however, and Great Britain has almost entirely rebuilt its motive power equipment within the last four or five years. The intermediate types, built from about 1896

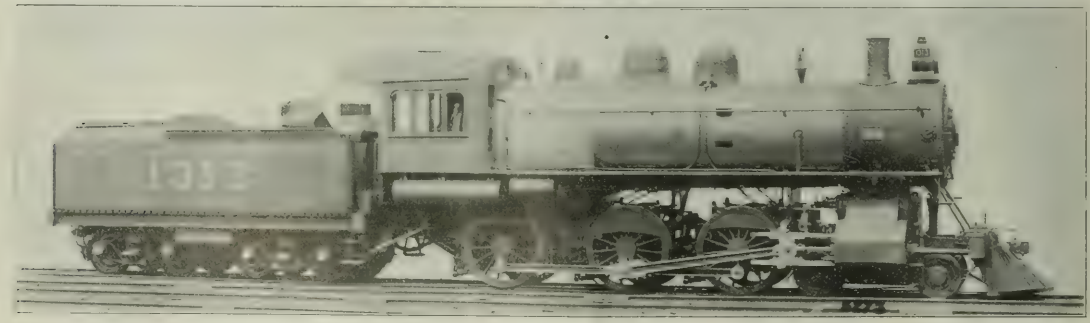


Fig. 20.

to 1900, were steps in the transition from the then established forms to the present machines, which, breaking away from traditions believed to be immutable, have enough tractive power to haul most of the heavy trains, especially on the lines in the north and west. Many of the new types of locomotives are as powerful as the prevailing types recently built on the continent, judging from their heating surface and grate area. Taking into account the superior quality of fuel, the rate of combustion which they normally attain, and their tractive adhesion, we find that they are even more powerful than the continental engines. There are some points which should not be lost sight of in considering these English machines and comparing them with those of other countries. They may be classed a little apart and justify the generally used ratio of greater heating surface and weight to grate area.

Irish locomotives have the same general arrangements as those of Great Britain, although they are less powerful, in spite of the broad gage of the track. In the British colonies we also find the same types, but they usually have more axles because of the lower axle load allowed; the diameter of the wheels, also, is less. Excepting in India, American influence is generally in evidence; Consolidation and Prairie types are frequently met with, especially on narrow gage lines.

The railroads in the north of England no longer have a monopoly in speed. The French lines to-day rival and even exceed them on certain runs. Nevertheless, England will for a long time continue to be a country of many and frequent express trains of all classes. The density of population, the number of great industrial centers and the national character explain a situation not found in any other country. The speeds attained in regular service are as high as 60 miles per hour, and at least one regular run is made at the rate of 62 miles per hour; this is on the Great Central from Aylesbury Road to Sheffield, about 125 miles. There are at least 52 runs where the schedule speed is more than 54 miles per hour over distances varying from 30 to 250 miles.

Probably the most remarkable service in England is on the line from London to Plymouth, 240 miles. On that portion from Newton-Abbot to Plymouth, 32 miles, there are grades of from 1½ to 2 per cent., and there is another part, 50 miles long, with grades of from 0.8 to 1.2 per cent. The whole run is made without stop in 4 hours 22 minutes, while the distance from London to Newton-Abbot, 208 miles, is covered in 3 hours and 42 minutes, or at an average speed of over 56 miles per hour. The average train load is 200 tons.

Perhaps because of an unfortunate early experience, England has for the past 10 or 12 years stood out most obstinately against compounding, although the idea was largely formed and developed in her marine engines. It may be said that even to-day there is not a single compound locomotive in England which is not a trial machine. This condition is due to circumstances which it would take too long to discuss in this place; most English motive power men seem to fear the complication of the four-cylinder compound engines and are not yet quite convinced that they really pay for themselves in the economy or increase of power which is credited to them. The three-cylinder engines of the London & North Western, a defective type, have long since been broken up or relegated to passenger service, and are now only used on express trains or as pilots. The Worsdell engines of the Great Eastern and of the North-Eastern have been changed to single-expansion machines.

It is proper to state here that the introduction of the compound in England has not been accompanied by so radical a transformation of the locomotive as it has in France. Certain characteristics of the French compound locomotives belong, in a way, to the English type, but have not, in the latter case, been so much improved. However that may be, the remarkable results obtained with French compound locomotives have attracted the attention of the English companies and the time is not far distant when the four-cylinder type, more or less modified, will be extensively used in England. The London & North Western has a few engines of the Webb four-cylinder type dating from 1900. Since 1903 the Great Western has put in service three Atlantic type, four-cylinder compounds, built at Belfort; one is of the type used on the Nord of France and the other two are like those on the Paris-Orleans, somewhat modified in their external appearance. The Great Northern has just built two interesting four-cylinder compounds. It would appear for the moment that the future of the system in England depends on the results obtained with these five machines in comparison with simple locomotives on the same lines. In any case the question is still open and the English, like the Americans, seem rather disposed to look to the superheater for a solution.

The English machines, without losing their characteristic symmetry and simplicity, have, nevertheless, of late years, undergone important modifications because of the large increase in the power of the boilers and the introduction of American and continental details, often modified to fit local ideas and tendencies. Thus we have seen the gradual introduction of the Belpaire firebox, which is used more or less generally in new engines on such important lines as the Great Western, the Midland, the Great Central and the Great Eastern, though it seems, on the whole, to be actually going out; smokeboxes which are quite long, though not really of the extended type; outside cylinders and even, though this is exceptional, four cylinders, of which two are inside. Finally, attention must be called to the appearance, on some recent engines, of the Walschaert valve gear.

English locomotives are somewhat massive and their weight compared with grate area, is usually greater than that of continental engines. Nevertheless the power produced per square foot of grate area being higher than that obtained elsewhere and the fuel being almost entirely lump coal of a superior quality, the weight per horsepower is certainly no greater. On the other hand, the limit of weight per axle is generally placed at about 20 tons, so the English builders have not been forced to pay the same attention to the reduction of weight as the continental builders.

The English fireboxes are of the Belpaire or Crampton types. The first of these, after having enjoyed a somewhat extensive popularity, seems likely, as noted above, to be less generally used, if not entirely abandoned, in the future. Fireboxes are always placed above the axle, and are shallower than on the continental engines, while certain Atlantic type engines, notably on the Lancashire & Yorkshire and the North-Eastern, have a large grate area whereby combustion can be made complete. The Great Western has within recent years adopted a boiler without a dome but with a wagon top firebox. The tubes are always smooth and are of steel or brass. Grates are cast-iron without a drop.

The smokeboxes are parallelopipedons, which are successful in stopping sparks and are still extensively used, being found in machines of the most recent construction. The stacks are quite short on account of the height of the engines and the clearance on many of the lines, which limits the height above the rail to from 13 ft. to 13 ft. 6 in. They are usually surmounted by a brass or red copper cap.

The safety valves are always loaded direct, and twin valves, the Webb or Ramsbottom, are being less and less used. They are never placed on the dome but always on the roof sheet over the firebox. Boilers are only fastened to the frame at the smokebox and with supports and expansion plates at the firebox. We know of no English locomotive which has any intermediate support to the boiler. The height of the center of the shell of boilers recently built varies from 8 ft. 6 in. to 9 ft.

The smokebox doors are round, and there is often more than one central opening; many recent engines have several bolted doors placed around the circumference. The exhaust is always fixed and the pipe is set at the height of the center of the boiler. Outside frames have been abandoned, although the Great Western has a number of comparatively recent machines of this type. The frames are strongly braced. Cast-steel is generally used for all accessory pieces and exclusively for wheel centers.

Relying on the excellence of their roadbed, English builders seldom fit their locomotives with equalizing bars, so that the engines, especially the types where no truck is used, and even those of the Atlantic type, which are heavily loaded at the center, have a tendency, when running at high speed, to gallop. Axles are forged and are frequently built-up. The Adams bogie is less used than formerly, and we now find on many of the latest engines the swing link type by which the weight is returned to the central position by gravity. The wheel base of the bogies has been made rather short and rarely exceeds 6 ft. 6 in.

Inside cylinders are still extensively used, even where the diameter is as much as 21 in. for simple expansion engines. The valves are ordinarily placed above the cylinders, but sometimes, when the cylinders are outside, the valves are below. When the valve motion is between the frames the valves are above the cylinders and are operated by an intermediate rocking shaft. Recently they began to use the Walschaert valve gear; only, however, on four-cylinder simple or compound engines. Piston valves are used mostly, but we find also a number of balanced valves and even some with the exhaust through the back.

Interchangeability is still an end always sought for in the motive power departments, and new types are often worked out with the idea of using the mechanism of previous types. Running boards are straight and rather low. The cabs have been changed somewhat within the past few years because of the great height of the engine, which now fill about all of the clearance allowed, so that even the upper corners have to be rounded. Care is taken to get that symmetry and regularity that is of such prime importance to the English. The painting is carefully done and maintained, especially on express locomotives.

All tenders are of the six-wheeled bogie type; yet, because of the number of water tanks and Ramsbottom scoops their water capacity is not proportioned to the length of the runs, which are sometimes as much as 200 miles without a stop.

Belgium.—The motive power on Belgian roads has gone through greater changes during the past 20 years than in any other country. The first decade of this period saw the general use of outside frames and the wide firebox in a Belpaire boiler, which

gave grate area of about 54 sq. ft.; this allowed the burning of fine coal. Starting from this date, a complete reaction set in, leading to the introduction of the pure Scotch types, with inside frames and cylinders and a narrow and deep firebox; these engines were widely used elsewhere and gave excellent service. They were designed to burn briquettes. Later the necessities of the service led to the production of new types with four and six wheels coupled and to the introduction of the superheater; among these engines were Atlantic type locomotives, some of which were shown at the Liege Exposition. All of them had comparatively shallow fireboxes with inclined grates, fitted with a short brick arch and adapted to either a mixture of fine coal and briquettes or briquettes only. The deep firebox, however, is still applied to high-speed express locomotives.

It is hard to be sure of the end toward which even well marked characteristics in design are tending. They may be either experimental or the results of long development. The recent exposition at Liege, however, where some new and interesting models were shown, enables us to review the principal types of Belgian locomotives. These engines showed careful workmanship and presented a fine appearance, though a trifle massive; they were compact and powerful. An examination shows that the Belpaire firebox and outside frames, that were for so long characteristic features of the Belgian locomotives, have now been abandoned. All the recent boilers are of the Crampton type with the crown stayed with vertical stays; the shell is set high to get enough depth for the firebox, which, however, is always above at least one of the coupled axles; they are of the narrow type dropping down between the frames. The smokeboxes extend to the front in the English manner; the tubes are smooth; the safety valves take the load direct and are immediately above the firebox. The stacks are very short on account of the great height of the shell, which rises to 9 ft. 2 in. above the rail in some recent engines; the stack is usually surmounted with a polished brass cap. The cylinders are usually on the inside, but there are some on the outside on the four-cylinder trial machines. The mechanism is heavy and massive and the cranks are hollow. The six-coupled types with wheel of moderate diameter are becoming more and more predominant, for passenger service; a perfectly rational development in a small country with a dense population, where trains are run at frequent intervals and on lines where it is rarely possible to maintain high speed for long distances. As a matter of fact, the longest express run in Belgium is only 75 miles.

United States.—The necessity for rapid production to meet the increasing demands of the enormous railroad systems of the country has left American locomotive builders no leisure for the study of the minutiae of certain details of construction, which might be useful in reducing weight and improving the operation of their engines. The locomotives in use in the United States present a most interesting subject for study, especially in their increasing power, which is becoming more and more characteristic of them. American builders recognize to-day that they can well borrow certain details from European practice. No one denies American engineers credit for the initiative they have taken in introducing the high-speed four-coupled engine with the bogie in front, known as the Atlantic type, and making general the use of trucks with two or four wheels under most types of engines. They were the first to break away from the fictitious limitations set on locomotive development by raising the boiler higher than would have been thought possible in Europe; a simple measure that allowed the machine to grow to proportions unforeseen 20 years ago.

The American high-speed locomotive, as it is now built, has a grate area of from 48 sq. ft. to 64 sq. ft., and a heating surface of from 2,700 to 3,800 sq. ft.; it weighs, in working order, from 75 to 105 gross tons, of which from 46 to 75 tons are upon the driving wheels, and it can haul over an undulating track of ordinary easy grades a train weighing 200 gross tons at a speed of 50 miles an hour. Recent freight engines have from 43 sq. ft. to 60 sq. ft. of grate area and weigh from 90 to 110 gross tons. For roads whose tracks can carry the weight they have built engines weighing 125 gross tons, with a heating surface of 4,800 sq. ft., while an exceptionally heavy Mallet articulated locomotive built for the Baltimore & Ohio has 5,600 sq. ft. of heating surface. This remarkable increase in the grate areas cannot be attributed directly to the use of inferior fuel, for locomotives burning a good quality of bituminous coal frequently have a grate area of from 48 to 54 sq. ft. Freight locomotives of the later types haul as heavy loads over steep grades as the mogul locomotives in use a dozen years ago could haul on a level.

The usual axle load allowed varies from 22 to 23 gross tons, while in some cases it is put at 26 tons. The axis of the boiler of a high-speed engine is often 9 ft. 6 in. above the rail on engines having drivers from 70 in. to 80 in. in diameter, while the diameter of the shell itself on engines of recent design is rarely less than 70 in., and is often as much as 80 in.

The practice which has dominated the whole transformation of American locomotive design during the past ten years, and which was the initial cause of the development, is the application of a firebox allowing grates of more than 35 sq. ft. area, and which, being almost cubical, seems not to suffer as much from variable expansion as the narrow fireboxes that are deep and long. To use this form of firebox it is necessary to raise the axis of the boiler so that the foundation ring may be placed above the rear wheels. When the coupled wheels do not have a diameter of more than 63 in., the firebox can be placed above them and still be deep enough, without raising the axis of the boiler to more than 9 ft. 6 in. above the rail. When the wheels have greater diameters, this cannot be done and the firebox is set behind the coupled wheels and is carried direct by trailing wheels that are usually about 48 in. in diameter. This arrangement obtains in the recently developed Atlantic type.

General Conclusions.—The evident tendencies which have become more and more firmly established in European practice may be summed up as follows:

1. The increasing and possible general use of a wide firebox with from 38 sq. ft. to 48 sq. ft. area, having wide water legs, being either of the Belpaire or corrugated flue type and widened as much as possible, in combination with a wagon-top boiler, which seems to be an interesting, if not indispensable, complement.

2. The return to smooth tubes for long shells. The adoption of heating surfaces proportioned to the grate area ranging from 3,000 sq. ft. up.

3. The gradual increase of the adhesive weight, either by increasing that allowed on each axle, when possible, or by increasing the number of coupled wheels. Engines for fast trains with six wheels coupled will probably come more extensively into use, at least until it is possible to use Atlantic type locomotives with an adhesive weight of at least 40 tons.

4. The conditions prevailing in Europe in the matter of fast trains involves the use of the Pacific or the prairie types by which the use of six-coupled wheels is reconciled to that of the wide firebox. The Atlantic type, if it is still built a few years hence, will necessarily need the wide firebox, for the possibility of the use of the latter constitutes the principal advantage of this type of machine. The consolidation locomotive seems to have filled for some time to the requirements of freight service, but it is quite possible that the application of the wide, or at least a widened firebox, with a corresponding elevation of the shell, may become more frequent on this type of machine. For suburban service, the six-coupled type with the driving wheels set between two Bissel or four-wheeled bogies seems to be becoming popular. We can also see, in the six-coupled type, with a two-wheeled pony truck in front and a four or six-wheeled bogie behind, one of the types of the future. If the diameter of the driving wheels is kept at 63 in., it is quite easy to use a wide firebox on this type of engine, although it is less necessary than on the other types.

5. It is also quite possible to foretell the extended use of engines with four cylinders, driving four cranks placed either on the same or on different axles, the wheels on which are coupled. It is to be expected that such machines will usually be compounds, in spite of the tendency on the part of some builders to use the four cylinders on simple expansion engines. The use of this latter type can only be extended by applying superheaters, and it is on the recognition of this fact in practice that some of the promoters of the type depend. We see a general increase in the ratio between the high and low-pressure cylinders of compound locomotives. Finally, powerful and perfect as the locomotive of to-day may be, it can only be considered as marking a stage in the evolution of the machine, the end of which it is easy to foresee.

Foreign Railroad Notes.

The Krupp works have some cars with two eight-wheeled trucks for carrying heavy guns which are able to carry a load of 198,000 lbs. each. The railroads haul these cars only to four fortified forts on the North sea and the Baltic and to the Krupp proving grounds, the great car being between two or more empties, if in a regular freight train.

In its fiscal year ending with March, 1905, 198 miles were added to the Japanese railroad system, making the total 4,694 miles, which had cost on the average $41,913 per mile. The train movement for the year had been at the rate of 10 trains each way daily, the passenger car movement to 59 and the freight car movement to 95 freight cars each way daily, and the average number of cars per train was 15.4. The movement of passengers was equivalent to 777 each way daily; of freight, to 617 tons each way daily—a very considerable business. The average passenger journey was 21 miles; the average freight haul, 95 miles. The average receipt was 0.7 cent per passenger-mile and 0.8 cent per ton-mile. The earnings averaged $6,440 gross and $3,530 net per mile. The average earnings per train-mile were 86 cents gross and 47 net, and the net earnings were 8.3 per cent. on the cost of the railroads. The number of employees was 14.2 per mile of road. The railroad from Tokio to Yokohama, 404 miles, earned $24,477 gross and $7,992 net per mile, the latter being 18 per cent. on its cost.

GENERAL NEWS SECTION

NOTES.

The Atchison is reported to have re-established a $2 charge for reconsigning grain in Chicago.

It is announced that the Pennsylvania Railroad has raised the age limit at which it will employ men in any capacity from 35 to 45 years.

It is reported that the New Haven road will commence operation of its all-water service between New York and Boston late this spring.

It is said that the Trunk Lines have agreed on an advance of 10 per cent. on bituminous coal and other heavy commodities, effective April 1.

On February 1 the Boston & Maine made a reduction of from 15 to 25 per cent. in its passenger fares. On the Fitchburg division the new rate is 2 cents a mile.

Fourteen clerks of the Pennsylvania Railroad, employed at the Broad Street Station, have been dismissed because they borrowed money at usurious rates of interest.

The Indiana Senate passed the Bland Bill January 31, which provides for two-cent railroad fares in Indiana, with no excess charge for failure to purchase tickets.

In testimony before Interstate Commerce Commissioner Lane, at Seattle, Wash., January 24, the Northern Pacific stated that it had reached the limit of its carrying capacity as a single track line.

It is reported that the pay car has been abolished on the St. Louis, Iron Mountain & Southern, and that in the future all employees of the Iron Mountain will receive their pay through special pay agents.

The steamer "Empress of China," which reached Victoria, B. C., February 3, broke the record held by the "Empress of Japan," making the fastest trip between Yokohama and Victoria, 10 days, 3 hours, 30 minutes.

The Bureau of Corporations has submitted a series of questions to navigation companies engaged in coastwise, lake and river transportation, to ascertain their relations with the railroads and their traffic arrangements.

The Missouri House passed a bill, February 4, making 2 cents the maximum rate that may be charged for carrying passengers on any railroad in the State, except branch lines less than 40 miles long and under independent ownership. These short lines are allowed to charge 3 cents a mile.

It is reported from St. Paul that the temperature has been below zero almost continuously for three weeks. McHenry, N. Dak., the terminus of a Northern Pacific branch, reported 48 degrees below, February 5, and said that there had been no freight trains there since December 18, and that all fuel, including gasolene, was gone.

The Minneapolis, St. Paul & Sault Ste. Marie is said to be facing the worst snow blockade in its history. It is said that over a stretch of 300 miles, from Kenmare to the international boundary line, not a car has been moved since the day after Christmas, and should the present conditions continue, officials fear business will be hampered until spring.

Senator Heyburn presented a resolution in the Senate February 5 providing for a special committee of five Senators to "investigate the reorganization of the Northern Pacific property, to ascertain what title and estates are owned by the corporation, which was created by act of Congress of July 2, 1864, and if said Federal corporation has no title or estates in any property, then what reason there is why said charter act should not be fully repealed by Congress."

At a hearing in the Harriman merger case, at San Francisco, January 30, before Interstate Commerce Commissioner Lane, W. A. Bissell, assistant traffic manager of the Santa Fe system and director in the Western Pacific Railroad, testified that the Santa Fe and the Southern Pacific managements are observing an unwritten agreement, whereby they share about equally the citrus fruit traffic of southern California, each scrupulously avoiding any intrusion into the other's territory after the fruit has been packed.

Immigration officials at Winnipeg announce that 59,000 laborers will be required this season for work on new railroads in the Canadian Northwest. This estimate is based on returns from the leading contractors as to their requirements for the large undertakings now in hand, including the Grand Trunk Pacific and extensions of the Canadian Pacific and Canadian Northern. Contractors are depending on new immigrants to a larger extent than in any previous season, and some anxiety is felt for fear a shortage in the volume of immigration may cause delays in railroad construction.

A bill has been introduced in the lower house of the North Carolina General Assembly to prohibit railroads or other public service corporations from paying stockholders more than 6 per cent. on actual value of the corporation's property and requiring the company to retain in its treasury an amount equal to 10 per cent. on the property value. At the end of the year all net earnings over the 6 per cent. dividend and the 10 per cent. rese ve is required to be paid into the state treasury. The bill also gives the corporation commission power to fix salaries of officers and investigate and regulate in detail the management of the public service corporations.

Under the adjustment reached February 5, all conductors, trainmen and yardmen of the Southern Railway are to receive an increase in wages, the total amount involved being between $350,000 and $400,000 a year. No flat percentage of increase in wages is given to any class of employees, the increase in every case being dependent on conditions. The increase amounts, however, from 6 per cent. as the minimum to 25 per cent. as the maximum. Through freight conductors are to be paid on a basis of $3.18 a hundred miles; local freight conductors, $3.80 a hundred miles; local freight brakemen, $2.15 a hundred miles, and through freight brakemen, $1.75 a hundred miles.

Employers' Liability Law Before the Supreme Court.

In the United States Supreme Court, on application of Attorney General Bonaparte, the case of Damselle Howard, Administratrix, Plaintiff in Error v. The Illinois Central Railroad Company *et al.* has been set down for argument April 8. This case is most important, as it involves the constitutionality of the national "Employers' Liability Act."

Damselle Howard brought suit against the Illinois Central in the United States Circuit Court for the Western District of Tennessee to recover damages for the death of Will Howard, her son, a locomotive fireman, due to the negligence of the railroad company, basing her claim for damages upon the Act of Congress approved June 11, 1906, commonly known as the "Employers' Liability Act." Judge McCall, following a similar decision by Judge Evans of the Western District of Kentucky, held the Act invalid because unconstitutional. This decision was made January 1, 1907. Attorney General Bonaparte, deeming the Act of Congress thus held invalid by the court to be of great public importance, resolved to attempt to have the decision reversed. Only once before has similar action been taken by the Department of Justice. In the case of Johnson v. Southern Pacific Company the decision of the lower court nullified the application of the Federal Safety Appliance Act. Intervention was asked by the Attorney General and granted by the Supreme Court. The decision by Chief Justice Fuller in that case reversed the action of the court below and sustained the validity of the statute in all important parts. The plaintiff in this case is a poor colored woman. All the resources of the Department of Justice will be used to sustain the constitutionality of this Act of Congress.

Theodore P. Shonts.

A typical business man of the West, outspoken and hearty of manner, powerful of build; an indefatigable worker, a fighter, and a "good fellow" whenever good fellowship does not interfere with business—that is the sort of traction chief New York is to have. As President of the Interborough-Metropolitan Company, he is commissioned to transform into a harmonious system the now unbalanced network of urban railroads intersecting the city's most densely peopled districts overhead, underground and on the surface. For this work he has had no special preparation. His assets are general fitness, proved ability as an organizer, and experience as a builder and officer of steam railroads.

In 1882, when he was 26, Mr. Shonts became a railroad contractor. After building two lines in Iowa he helped to build the Indiana, Illinois & Iowa, of which he was General Superintendent from 1882 to 1886, General Manager until 1902, and President from 1898 to 1902. It was in 1898 that Mr. Shonts and Paul Morton got control of the road's stock, and they kept it until the Vanderbilts bought them out, giving each a profit of nearly $1,000,000. The two partners then became interested in the Toledo, St. Louis & Western, of which Mr. Shonts was elected President in January, 1904.

President Roosevelt first heard of Mr. Shonts through Paul Morton, then Secretary of the Navy. He listened to Morton's praise and invited the westerner to visit him at the White House. From the

first he liked Shonts. Especially did he like the visitor's demand: "I'll not touch the job, Mr. President, unless I can have absolute authority."

Of his own accomplishments on the Isthmus, Mr. Shonts has spoken as follows: "If we have not, as our critics complain, made the 'dirt fly,' we have made the filth fly, and we have made yellow fever, that supreme terror of the tropics, fly so far from the Isthmus that it will never, let us hope, find its way back again."

Among the things Mr. Shonts did as chairman were these: He launched the building of complete water and sewage systems, the paving of Panama and Colon, and the cleansing of both cities, and the organization of a sanitary force now entirely equipped for maintaining the healthful conditions of the country. He caused the building of quarters for the army of workers, opened the commissary stores, and arranged for transporting food supplies to the Isthmus with regularity and celerity, though the base of supplies was 2,000 miles away.—*New York Evening Post.*

M. M. and M. C. B. 1907 Conventions.

A circular is being distributed by J. W. Taylor, 390 Old Colony Building, Chicago, Secretary of the American Railway Master Mechanics' Association, and the Master Car Builders' Association. The 1907 conventions will be held at Atlantic City, N. J.; the M. M. convention on June 12, 13 and 14, and the M. C. B. convention on June 17, 18 and 19. Meetings will be held in the sun parlor on the steel pier, and the headquarters of both conventions will be at the Marlborough-Blenheim hotel. The circular gives the rates agreed on by the various hotels.

Panama Construction Company Incorporated.

The certificate of incorporation of the Panama Construction Company was filed at Albany, N. Y., Feb. 4. The company plans to build the Panama Canal if the government awards the contract to W. J. Oliver and associates. The officers are as follows: President, John B. McDonald; First Vice-President and General Manager, W. J. Oliver; Chairman of the Board, R. A. C. Smith; Secretary and Assistant Treasurer, D. V. Reynolds; Treasurer, R. A. Chester. Executive Commitee: John B. McDonald, W. J. Oliver, John Peirce, R. A. C. Smith, R. A. Chester. Board of Directors: John B. McDonald, John Peirce, Charles H. Ackert, Robert A. C. Smith, Robert A. Chester, George Peirce, Patrick T. Walsh, William H. Sayre, Patrick J. Brennan, George F. Harriman, Robert Russell. Mr. McDonald will have his offices in New York and Mr. Oliver will spend his time at Panama. A syndicate of surety companies will furnish the $2,000,000 bond required by the government. The authorized capital of the company is $5,000,000, and the sum of $1,500,000 is announced as paid up. The principal offices will be in New York city.

Western Pacific Terminals at Oakland, California.

The United States Circuit Court of Appeals has reversed the decision of the Circuit Court which was in favor of the Southern Pacific in its claim to title of the filled-in land north of the retaining wall at the mouth of the estuary at Oakland, Cal. The latest decision is that the grant of land by the town of Oakland to parties who afterward sold it to the Southern Pacific only applied and gave title to land extending to the low tide line of 1852, and that therefore the Southern Pacific now has no claim to the long strip of filled-in land extending out into the harbor. It is on this land that the Western Pacific plans to build its terminal. A year ago it laid tracks there and held possession by force until an injunction was granted restraining it from further building. The above decision holds that the made land is the property of the state.

Car Loading and Detention.

The following figures were prepared by E. D. Sewall, assistant to the President of the Chicago, Milwaukee & St. Paul: St. Paul's average freight equipment last year was 42,658 cars, of which about 3 per cent. always were on repair tracks. Average daily loading was 10.4 per cent. of cars in service. Daily loading varied 1,634 cars. This variation represents 13,572 cars, or an investment of $10,800,000, based on average value of all the equipment in freight service. In other words, there is idle during the dull season 30 per cent. of the entire equipment, even in an active year.

During the rush seasons the road is often 20 per cent. behind its orders for equipment, on which basis it would require 8,532 cars additional, at a cost, including the motive power, of $8,300,000. Interest on this additional capital at 5 per cent. plus maintenance would be $1,395,000. Detention of cars exceeds the time in transit.

Baldwin Locomotive Works Fire.

On Tuesday night, January 29, fire destroyed one of the Baldwin Locomotive Works buildings, which included the erecting shop, paint shop and drawing room for electric locomotives. The building burned was four stories, fronting 230 ft. on Spring Garden street, and 208 ft. on Fifteenth street. The loss is estimated to be within $500,000; insured for $309,000. But, as Mr. A. B. Johnson says: "The principal loss, and one which it will be exceedingly difficult to replace, is that of all our drawings for electric locomotives and trucks, which were destroyed."

The situation was met by a fine example of picturesque energy. The fire started at 5.40 in the evening, while Mr. S. M. Vauclain, the General Superintendent, was on the steamer from Cape Charles, arriving at Fortress Monroe at 6.40. The news reached him by telephone; he caught the return boat at 7.10, and at 5 o'clock next morning he was in the burned shop and had matured plans of procedure when the workmen came at 7 o'clock. The upper floors were burned, but by 1 o'clock the two lower floors were cleared and in working order, with new belting, line shafts, repaired machinery, etc. Working full force through the day and all night, by 7 o'clock Thursday morning the debris was cleared and the damaged walls were taken down. The builders soon began replacing as much of the structure as will be used for the former purposes. Part of the space, 120 ft. x 50 ft., will be occupied by an extension of the present office building. During the fire week the firm shipped 54 locomotives.

Pass Contract Not Affected by Rate Law.

Judge Walter Evans, in the Federal Court at Louisville, Ky., Feb. 2, overruled the demurrer of the Louisville & Nashville to the equity petition filed by Erasmus L. and Annie M. Motley, in which the latter sought to enforce a contract by which the railroad company agreed to issue annual passes to each of the plaintiffs during their lifetime. The court says that the act of June 29, 1906, known as the Railroad Rate bill, under which the railroad company declined to issue the passes as agreed in January, 1907, should be construed precisely as if, in its general language, there was an express exception excluding from its operation the complainants' contract. In no other way can the vested contract rights of the complainants be preserved. The court says further that the passes issued to the Motleys, while called "free passes," were not so any more than a ticket bought and paid for.

Mail Payments.

The House Committee on Post Offices and Post Roads reached an agreement, Jan. 31, on the matter of compensation of railroads for carrying the mails.

The committee as first agreed to recommend a reduction of 5 per cent. in the price paid for carrying 48,000 lbs. or less per day and 10 per cent. reduction from the present price for carrying 48,000 to 80,000 lbs. per day, with a flat rate on all over this amount of $18 per ton per mile per annum, a reduction from $21.37½ per ton. The roads at first agreed to accept the 5 and 10 per cent. reductions if the flat tonnage rate were fixed at $20 per ton.

The committee refused to accede to this and an agreement was finally reached that the price should be $19 per ton per mile per annum.

The committee also voted to reduce the rent of postal cars about $1,000,000 annually and also to deduct from the tonnage the weight of the mail bags. The department was unable to estimate what amount would be saved by the elimination of the bags.

Delayed Grain Movement in the Northwest.

Fifty million dollars is a low estimate of the amount of money tied up by the action of the railroads in not handling the grain crop early. Circumstances occurred later—like the great snow storms—which tied up the roads and made it impossible to take care of the traffic, and the railroads also have lost heavily. The policy of holding back shipments so that earnings may be equalized the year round, month by month, has been an expensive one, and it is likely to produce a revolution in railroading. The roads must be prepared to take care of the traffic quickly and clean it up. The effect will be to do away with agreements to hold back until lake navigation is over, that the roads may enjoy a longer haul of freight, and this lesson will teach the farmer the value of having storage facilities for his grain independent of the railroads, and then if he is forced to pay a high rate of freight during the winter months he can wait till summer and ship via the lake route. At the same time he will be able to raise money on his stored grain in case of necessity. In fine, the situation this winter has taught the railroads, the grain grower, and the fuel dealer a lesson that they should never forget.—*New York Evening Post.*

Iowa Demurrage Bill.

A reciprocal demurrage bill was introduced in the Iowa General Assembly, Feb. 1, providing that it shall be the duty of every railroad company upon the verbal or written application of any shipper to its agent for a car or cars to be loaded with other than perishable matter to state the character of the freight and its destination, to furnish said cars within three days from 7 o'clock a. m. of the day following the application, unless prevented by some unavoidable cause. For failure to comply with this request it is provided the company must pay $2 a day a car, together with all damages the applicant may sustain.

After delivery of cars is made the applicant under the measure is allowed 48 hours to load. After they are loaded it is provided the

company must carry them forward at a rate of not less than 80 miles a day for 24 hours, and in failure of this provision makes the company liable to the shipper $2 a car a day. It is further provided the railroad company shall give notice to the consignee of arrival of cars 24 hours after their arrival. In failure of this provision makes them liable of $2 a car a day.

On the other hand, shippers are to have 48 hours for loading cars of a capacity of less than 80,000 lbs., computing from 7 o'clock a. m of the day after such car is placed, and the shipper must pay to the company $2 a day a car for every day's delay, unless such is unavoidable. It is further provided that the railroad company shall not be compelled to deliver cars for shipments to persons in default of payment of fine. This provision, it is believed, will give to the railroad companies ample protection against indiscriminate demand for cars and neglect upon the part of shippers to load when such cars are delivered. It is further provided that where goods are shipped in less than carload lots the company may charge for more than 48 hours' storage one cent per 100 lbs. In carload lots not more than 10 cents a ton a day or fraction thereof. Under the provision of this bill it is permissible for two or more shippers to begin joint actions against a company in suits for collection.

Manufacturing and Business.

Charles S. Henry, Manager of the Chicago office of the New York Air-Brake Co., died at his home in Evanston, Ill., on January 27.

John E. Zimmermann, formerly Secretary of the American Pulley Co., Philadelphia, has become a partner in the firm of Dodge & Day, Engineers, Philadelphia.

Robert W. Hunt & Co., Chicago, have been appointed Consulting Engineers to the Receivers of the Union Traction Company, Chicago, and placed in direct charge of the lowering of the car tunnels under the Chicago river.

Dodge & Day, Engineers, Philadelphia, are building the new shops for the Jones & Lamson Machine Co. at Springfield, Vt. The work is being pushed as rapidly as possible and the order for the steel has already been placed.

A fire occurred on the night of January 31st in the machine shop at the works of the Federal Railway Signal Company at Troy, N. Y., which was destroyed. The officers of the company say they have already made arrangements to go on with their production and hope to be in full swing again in 30 to 45 days.

According to press despatches from Sharon, Pa., plans have been completed by the Standard Steel Car Company for an addition to its plant at New Castle. The extension will occupy ten acres of ground, and the main building will be 1,100 ft. long. It will be devoted to building motor trucks and car frames.

Among orders recently received by the Power Specialty Co., 111 Broadway, New York, for Foster superheaters are the following: Northern Colorado Power Co., Denver Gas & Electric Co., Norwich & Westerly Electric Railroad, Haverhill Electric Co., Electric Company of America, Allis-Chalmers Co., Westinghouse, Church, Kerr & Co.; Westinghouse Electric & Mfg. Co., Ingersoll-Rand Co. Each order is for upwards of 5,000 h.p.

The Revolute Machine Company has received an order for two Everett-McAdam blue printing machines for the Baldwin Locomotive Works. This order was given on the morning after the fire in which the blue printing plant of the locomotive works was destroyed. One of the machines had been in the plant for a year, and a second had been ordered. It was requested that the latter be shipped immediately, making in all three new machines.

The General Railway Signal Co. is arranging to change its place of manufacture from Buffalo to Rochester, N. Y. When the company was organized, in 1904, and acquired the property and business of the Taylor Signal Co. and the Pneumatic Signal Co., it owned well-appointed works in Rochester as well as in Buffalo, but all work was concentrated at the Buffalo plant. It is now reported that the Buffalo real estate is to be sold to the Continental Telephone Co.

Henry Clark Sergeant, of the Ingersoll-Sergeant Drill Company, part of the Ingersoll-Rand Company, died at his home in Westfield, N. J., on January 30 at the age of 72. Mr. Sergeant had a notable inventive faculty which early asserted itself. His first United States patent, issued when he was 19, was for a boiler feed. A list of other patents granted to him in his early life suggests the range of his inventive genius. A governor for marine engines to prevent their racing when the wheels were out of water, patented by him in December, 1858, was adopted by the United States government for the navy. Other patents granted to him were for gas regulators, steam pumps, four for steam boilers, five for brick machines, six for water meters and one for a fluting machine. In the early seventies, when Mr. Sergeant was at the head of a machine shop of his own in New York City, he came to know Simon Ingersoll, who was developing the first Ingersoll rock drill, then an untried device. The two men formed the Ingersoll Drill Company. Mr. Sergeant worked particularly on adapting compressed air to the drills for mine and tunnel work. In 1886 he formed the Sergeant Drill Company independently, but two years later again joined Mr. Ingersoll, when the Ingersoll-Sergeant Drill Company was formed with Mr. Sergeant as its first president. As an evidence of his active mind and wide diversity of interests he was in his earlier years a public lecturer and a champion skater; later in life when a director of the Third Avenue Elevated Railroad, he designed the ticket canceling box, now used on the elevated and subway lines of New York City, which so mutilates the ticket as to make it impossible to defraud the company by using it again. He was quick to see the best way to do the thing which came in his way to do.

Iron and Steel.

Recent orders for rails have been only for small lots for electric lines.

The Council City & Solomon River, which is extending its line in Alaska, is reported to be in the market for 10,000 tons of rails.

The Pennsylvania Company has ordered from the Carnegie Steel Company rails and 4,000 tons of tubular steel for the Pennsylvania Railroad tunnels and terminals at New York.

The Norfolk & Western has ordered 3,000 tons of steel for bridges; the Chicago, Milwaukee & St. Paul 2,360 tons, and the Pennsylvania 1,360 tons. The Delaware & Hudson has given an order for 1,300 tons of steel for bridges to the American Bridge Company. It is reported from Pittsburg that 20,000 tons of steel plates have recently been sold.

OBITUARY NOTICES.

Capt. George J. Grammer, Vice-President in charge of freight traffic of the New York Central Lines, died on February 4 at Chicago after an illness of several weeks. His death was directly due to a relapse following an operation. Capt. Grammer was born in 1845 in Ohio. After several years' experience on western river steamship lines, he began railroad work, in 1881, as General Freight and Passenger Agent of the Evansville & Terre Haute. He was made Traffic Manager of that road and of the Evansville & Indianapolis two years later, and in 1886 was made General Traffic Manager of the two roads. Later his authority was extended over the Peoria, Decatur & Evansville, the Louisville, Evansville & St. Louis, and the Chicago & Eastern Illinois. In 1892 he was elected President of the Evansville & Terre Haute, the Evansville & Indianapolis and the Evansville & Richmond. In 1894 he went to the Chesapeake, Ohio & Southwestern as General Manager, and, a few months later, was made General Freight Agent of the Lake Shore & Michigan Southern. He was appointed General Traffic Manager of the last named road in 1896, and in 1905 was elected Vice-President in charge of the New York Central Lines west of Buffalo. In the latter part of 1906 he was elected Vice-President in charge of freight traffic of all the New York Central Lines.



G. J. Grammer.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Purdue University.

At a meeting of the Engineering Assembly of Purdue University on January 28, an address was delivered by Harrington Emerson, an expert production engineer, on Railroad Operating Records. An article by Mr. Harrington on Finished Repair Parts for Locomotives was published in the *Railroad Gazette*, Nov. 23, 1906.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Atchison, Topeka & Santa Fe.—See Denver, Enid & Gulf.

Atlanta & West Point.—W. H. Smith, Acting Auditor, has been appointed Auditor.

Chicago, Rock Island & Pacific.—J. H. Mather, claim agent at Des Moines, Iowa, has been appointed General Claim Agent, with office at Chicago, Ill.

Denver, Enid & Gulf.—E. P. Ripley, President of the Atchison, Topeka & Santa Fe, has been elected also President of the Denver, Enid & Gulf.

Detroit & Toledo Shore Line.—G. W. Alexander has been appointed Secretary and Treasurer, with office at Detroit, Mich., succeeding J. H. Muir, deceased.

Detroit, Toledo & Ironton.—W. L. Greenhalgh, Assistant Treasurer, has resigned.

Elmina & Eastern Transportation Company.—W. B. Clint, Vice-President and Auditor, has been appointed General Manager and Auditor, with office at Elmina, Tex. P. M. Shannon succeeds Mr. Clint as Vice-President, with office at Pittsburg, Pa.

Galveston, Beaumont & Northeastern.—The officers of this company are as follows: President, A. W. Miller; Vice-President, C. S. Vidor, both with office at Galveston, Tex.; Auditor, W. H. Brooks; Traffic Manager, E. H. Green, Jr., and General Superintendent, W. E. Halliday, all with office at Beaumont, Tex.

Kalamazoo, Lake Shore & Chicago.—The officers of this company are as follows: President, S. J. Dunkley; Vice-President, G. E. Bardeen; Secretary and General Manager, James Grant; Traffic Manager, H. D. Swayze, and Acting Auditor, A. L. Waldo, all with office at Kalamazoo, Mich.

Licking River.—W. H. Allington, Treasurer, has been elected also President, with office at Salt Lick, Ky., succeeding R. H. Lanyon.

Norfolk & Southern.—E. R. Baird, Jr., has been appointed General Solicitor, with office at Norfolk, Va.

Northwestern Pacific.—The officers of this company, which is a consolidation of Southern Pacific and Santa Fe lines in northern California, are as follows: President, E. E. Calvin, of the Southern Pacific; Vice-President, A. H. Payson, of the Santa Fe; Secretary, J. L. Willcutt, and Treasurer, N. T. Smith, both of the California Northeastern; Comptroller, Thomas Mellersh, of the California North-Western.

Oregon Railroad & Navigation.—See Union Pacific.

Philadelphia, Baltimore & Washington.—James McCrea, President of the Pennsylvania, has been elected also President of the P., B. & W., succeeding A. J. Cassatt, deceased.

Quincy, Omaha & Kansas City.—W. S. Thompson, chief clerk of accounts, has been appointed to the new office of Auditor, with office at Kansas City, Mo.

Savannah & Statesboro.—W. B. Moore has been appointed Auditor, with office at Statesboro, Ga., succeeding D. Van Wagenen, resigned.

South & Western.—The general offices of this company have been removed from Bristol, Va., to Johnson City, Tenn. The office of A. A. Pflegar, Vice-President, has been removed from Christiansburg, Va., to Bristol.

Tacoma Eastern.—Samuel Wilson has been appointed Auditor and General Freight and Passenger Agent, with office at Tacoma, Wash., succeeding J. G. Dickson, resigned.

Tremont & Gulf.—R. H. Jenks, President, has been appointed Secretary and Traffic Manager. W. T. Joyce succeeds Mr. Jenks. L. J. Carpenter has been appointed Treasurer and General Manager.

Union Pacific.—H. J. Stirling, Auditor of the Oregon Railroad & Navigation, has been appointed also to the new office of Auditor of the Union Pacific, with office at Omaha, Neb.

Traffic Officers.

Erie.—E. H. Barto has been reappointed Suburban Passenger Agent, with office at New York.

Seaboard Air Line.—B. M. Waldron has been appointed Freight Claim Agent, with office at Portsmouth, Va., succeeding O. B. Bidwell, Jr., resigned to go to another company.

Trinity & Brazos Valley.—D. C. MacWatters, formerly General Passenger Agent of the Colorado Springs & Cripple Creek District, has been appointed General Passenger Agent of the Trinity & Brazos Valley, with office at Fort Worth, Tex.

Operating Officers.

Alabama Great Southern.—See Cincinnati, New Orleans & Texas Pacific.

Algoma Central & Hudson Bay.—J. S. Wynn, General Auditor, has been appointed Acting Manager, succeeding to the duties of W. N. Sawyer, General Manager, resigned.

Chicago & Alton.—See Chicago, Indiana & Southern.

Chicago Great Western.—Otto Cornelison, Superintendent of the Clarion division, has been appointed Superintendent of Transportation, with office at St. Paul, Minn. L. M. Shipley, Superintendent of Terminals at Oelwein, Iowa, succeeds Mr. Cornelison. Maurice Daily, Master Mechanic of the Des Moines division, succeeds Mr. Shipley.

Chicago, Indiana & Southern.—E. Ryder, Superintendent of the Chicago & Alton at Bloomington, Ill., has been appointed to the new office of General Superintendent of the C., I. & S., with office at Chicago, Ill., effective February 15.

Chicago, Rock Island & Pacific.—John McGie, Master Mechanic at Little Rock, Ark., has been appointed Superintendent of the Panhandle division, with office at Geary, Okla. T. W. Rudd has been appointed Superintendent of the Indian Territory division, with office at Haileyville, Ind. T.

Chicago, St. Paul, Minneapolis & Omaha.—Edward Digle has been appointed Superintendent of Terminals at East St. Paul, Minn., with authority over the St. Paul and Minneapolis yards.

J. R. Welsh has been appointed Assistant Superintendent of the Wisconsin division, with office at Spooner, Wis.

Cincinnati, New Orleans & Texas Pacific.—W. T. Caldwell, Superintendent of Terminals of the Missouri Pacific at Little Rock, Ark., has been appointed to the new office of Inspector of Transportation of the Cincinnati, New Orleans & Texas Pacific and of the Alabama Great Southern.

W. S. Andrews has been appointed to the new office of Assistant to the General Manager, with jurisdiction over the transportation department.

Flint River & Northeastern.—W. A. Olliff has been appointed Superintendent of Transportation and Car Accountant of this road and of the Georgia Northern.

Georgia Northern.—See Flint River & Northeastern.

Grand Trunk.—D. Crombie has been appointed Master of Transportation, with office at London, Ont., succeeding S. Ennes, transferred.

L. H. Nolan has been appointed to the new office of Superintendent of Terminals at Detroit, Mich., with office at Milwaukee Junction, Mich.

Illinois Central.—C. L. Ewing, Superintendent at Carbondale, Ill., has been appointed General Superintendent of Northern and Western lines, succeeding F. B. Harriman, promoted. C. R. Wescott, Trainmaster at East St. Louis, Ill., has been appointed Superintendent of the Springfield division, with office at Clinton, Ill., succeeding Charles Dougherty, resigned to go to the Cincinnati, New Orleans & Texas Pacific.

Licking River.—J. B. Shaw, Trainmaster, has been appointed Superintendent, with office at Yale, Ky.

Loring & Western.—B. M. Musser has been appointed General Superintendent, with office at Loring, La., succeeding J. T. Burlingame, resigned.

Mexican Railway.—H. A. McCulloch, Marine Superintendent, has resigned and the office has been abolished. See Pan-American.

Missouri, Kansas & Texas of Texas.—W. W. Hoffman has been appointed Trainmaster of the Waco, Houston, Austin and San Antonio divisions and the Belton branch, with office at Smithville, Tex., succeeding H. G. Evans, resigned.

Missouri Pacific.—C. H. Bevington has been appointed Superintendent of the Omaha division, with office at Omaha, Neb., succeeding J. Russell, resigned.

See Cincinnati, New Orleans & Texas Pacific.

Oregon Short Line.—See Union Pacific.

Pan-American.—H. A. McCulloch, Marine Superintendent of the Mexican Railway, has been appointed Assistant General Manager of the Pan-American, succeeding C. B. Cox, resigned.

Pittsburg & Lake Erie.—F. S. Weigel, Assistant Trainmaster, has been appointed to the new office of Assistant Superintendent, with office at Pittsburg, Pa.

Rio Grande Junction.—J. Q. Matthews has been appointed Acting Superintendent, with office at Grand Junction, Colo., succeeding W. A. Whitney, Superintendent, promoted.

Southern.—B. G. Fallis, formerly Superintendent of the Missouri Pacific at Chester, Ill., has been appointed Superintendent of the Charlotte division of the Southern, with office at Charlotte, N. C., succeeding P. L. McManus, promoted.

Union Pacific.—E. M. Botsford has been appointed Acting Assistant Superintendent of the Wyoming district of the Union Pacific lines west of Green river, and of the Utah division of the Oregon Short Line, succeeding H. J. Roth, resigned.

Vera Cruz & Pacific.—W. A. Hill has been appointed Superintendent, with office at Tierra Blanca, Mexico.

Wisconsin Central.—See Wisconsin Central under Purchasing Agents.

Engineering and Rolling Stock Officers.

Atchison, Topeka & Santa Fe Coast Lines.—A. B. Todd, Master Mechanic of the Los Angeles division, has been appointed Master Mechanic of the Valley division, with office at Richmond, Cal., succeeding E. H. Harlow, transferred to the First district of the Albuquerque division, with office at Albuquerque, N. Mex. I. C. Hicks, whom Mr. Harlow succeeds, is transferred to the Los Angeles division, with office at San Bernardino, Cal., succeeding Mr. Todd.

Baltimore & Ohio.—J. Kirkpatrick, Master Mechanic at Cumberland, Md., has been appointed Master Mechanic at Newark, Ohio, succeeding G. J. DeVilbiss, resigned to go to the Hocking Valley. A. H. Hodges, general foreman at Brunswick, Md., succeeds Mr. Kirkpatrick. See Hocking Valley.

Chicago Great Western.—See Chicago Great Western under Operating Officers.

Chicago, Rock Island & Gulf.—C. M. Case has been appointed Chief Engineer, with office at Fort Worth, Tex., succeeding J. S. Peter, resigned.

Chicago, Rock Island & Pacific.—H. M. Stone has been appointed Engineer of the Northern district, with office at Cedar Rapids, Iowa, succeeding Garrett Davis, transferred. J. G. Bloom, Engineer of Maintenance at Topeka, Kan., has been appointed Engineer of the Southwestern district, with office at Topeka. See Chicago, Rock Island & Pacific under Operating Officers.

Cincinnati & Muskingum Valley.—R. R. Metheany, Jr., Assistant Engineer of the Southwest System of the Pennsylvania Lines West at Louisville, Ky., has been appointed Assistant Engineer of the Cincinnati & Muskingum Valley, with office at Zanesville, Ohio, succeeding H. W. Brown, transferred.

Erie.—T. Rumney, Assistant Mechanical Superintendent, has been appointed Mechanical Superintendent, succeeding George W. Wildin, resigned to go to the Lehigh Valley. E. A. Wescott, general foreman of car repairs at Kent, Ohio, succeeds Mr. Rumney. William Schlafge, Master Car Builder, has been appointed to the new position of General Master Mechanic. The offices of all are at Meadville, Pa.

Fort Worth & Denver City.—A. M. Mullinix has been appointed Superintendent of Bridges, Buildings and Water Service, with office at Fort Worth, Tex., succeeding O. J. Travis.

Halifax & Southwestern.—L. H. Wheaton, who for the last two years has been Chief Engineer in charge of the construction of this recently completed road, has been appointed Engineer of Maintenance of Way, with office at Bridgewater, N. S.

Hocking Valley.—S. S. Stiffey, Superintendent of Motive Power of this company, of the Toledo & Ohio Central, of the Kanawha & Michigan, and of the Zanesville & Western, has been appointed to the new office of General Superintendent of Motive Power of these companies. G. J. De Vilbiss, Master Mechanic of the Baltimore & Ohio at Newark, Ohio, succeeds Mr. Stiffey, with office at Columbus, Ohio.

Illinois Central.—F. L. Thompson, formerly roadmaster of the Louisville division, has been appointed Assistant Engineer of Bridges, in charge of track elevation.

Kanawha & Michigan.—See Hocking Valley.

Oregon Short Line.—See Union Pacific.

Pennsylvania Lines West.—See Cincinnati & Muskingum Valley.

Portland & Rumford Falls.—A. R. Manderson has been appointed Master Mechanic, with office at Rumford Falls, Me., succeeding M. R. Davis, resigned.

Santa Fe Central.—T. J. Tonge has been appointed Superintendent of Motive Power, Rolling Stock, Bridges, Buildings and Water Service, with office at Estancia, N. Mex.

Southern Pacific.—R. M. Drake, resident engineer of the Western division, has been appointed Engineer of Maintenance of Way of the Northern district, with office at San Francisco, Cal., succeeding W. C. Edes, resigned to go to another company.
See Union Pacific.

Toledo & Ohio Central.—See Hocking Valley.

Tremont & Gulf.—J. H. Scott has been appointed Superintendent and Chief Engineer. N. Greener, Master Mechanic, has been appointed Superintendent of Motive Power.

Union Pacific.—F. W. Newcombe has been appointed Signal Engineer of this company's lines east of Green river, of the Oregon Short Line, and of the Southern Pacific lines east of Sparks, with office at Ogden, Utah.

Vera Cruz & Pacific.—P. C. Morales has been appointed Acting Master Mechanic, with office at Tierra Blanca, Mex.

Zanesville & Western.—See Hocking Valley.

Purchasing Agents.

Norfolk & Southern.—H. W. Davies has been appointed Purchasing Agent, succeeding W. R. Burrows, resigned. Mr. Davies is 36 years old, and has been in the accounting department of the Southern for the last four years. During the 12 years previous he was in the local freight department of the same road.

Wisconsin Central.—C. W. Booth, Assistant General Superintendent, has been appointed Purchasing Agent, with office at Milwaukee, Wis., succeeding J. A. Whaling, and the office of Assistant General Superintendent has been abolished.

LOCOMOTIVE BUILDING.

The Northern Pacific has ordered 25 switching locomotives from the American Locomotive Co.

The St. Louis & San Francisco has ordered 45 locomotives from the Baldwin Locomotive Works.

Fox Brothers & Co. are about to place a contract for locomotives for a Porto Rico plantation railroad.

The Brinson Railway has ordered some locomotives from the Baldwin Locomotive Works. G. M. Brinson, Savannah, Ga., is President.

The Middletown & Cecilton, now under construction, will soon ask bids on locomotives. W. R. Polk, Middletown, Del., is General Manager.

The Williamsville, Greenville & St. Louis has ordered one ten-wheel 54-ton locomotive from the East St. Louis Locomotive & Machine Shop Co. for February delivery.

The Great Northern has ordered 10 switch engines from the Baldwin Locomotive Works instead of 15, as reported in our issue of January 25. This, together with the 100 Prairie, 25 Mallet and 15 Pacific type already ordered, makes a total of 150 locomotives for 1907 delivery. The switch engines will be six wheel and the general dimensions follow:

Type of locomotive	Switching
Total weight, engine and tender	215,000 lbs.
Weight on drivers	135,000 "
Diameter of drivers	43 in.
Cylinders	19 in. x 26 in.
Boiler, type	Belpaire
" working steam pressure	200 lbs.
" diameter	66 in.
" number of tubes	291
" diameter of tubes	2 in.
" length of tubes	11 ft. 3 "
Total heating surface	1,873.50 sq. ft.
Grate area	27.22 "
Tank capacity	8,000 gals.

The Atlantic Coast Line, as reported in our issue of January 18, has ordered from the Baldwin Locomotive Works 20 simple six-wheel switch engines, 68 ten-wheel freight locomotives and 12 ten-wheel passenger locomotives. The specifications are as follows:

General Dimensions.

	Switching.	Ten wheel.
Type of locomotive	Switching.	Ten wheel.
Weight on drivers	110,000 lbs.	115,000 lbs.
Weight, total	110,000 lbs.	135,000 lbs.
Diameter of cylinders	19 in.	20 in.
Stroke of pistons	24 "	26 "
Diameter of drivers	50 "	68 in. passenger; 63 in. freight.
Type of boiler	Straight top, narrow firebox.	Straight top, wide firebox.
Working steam pressure	180 lbs.	185 lbs.
Heating surface, total	1,669 sq. ft.	2,660 sq. ft.
Tubes, number	215	334
" material	Knobbled charcoal iron.	
" outside diameter	2 in.	2 in.
" length	14 ft.	14 ft. 5 in.
Firebox, length	71⅝ in.	96⅛ in.
" width	34¼ in.	66 in.
" material	Steel according to Baldwin Loco. Works specifications.	
Grate area	17.03 sq. ft.	44.1 sq. ft.
Tank capacity	2,500 gals.	6,000 gals.
Coal capacity	8 tons.	10 tons.

Special Equipment.

Air-brakes	Westinghouse
Boiler lagging	Johns-Manville
Brake-beams	Diamond special
Brake-shoes	Perfecto
Couplers	Tower
Headlights	Dressel
Injector	Monitor, for Switching
Injector	Hancock for Ten-wheel
Journal bearing	Damascus bronze
Piston rod packing	U. S. Metallic
Valve rod packing	U. S. Metallic
Safety valve	Star
Sanding devices	Watters
Sight-feed lubricators	Nathan Bull's-eye
Springs	A. C. L. standard
Steam gages	Star brass
Other specialties	Lewis grease separator on driving wheels and engine truck journal boxes

The Colorado, Texas & Mexico, now under construction, will ask

bids on locomotives about May 1. George D. Locke, Missouri Trust Building, St. Louis, Mo., is Purchasing Agent.

CAR BUILDING.

The South & Western will shortly be in the market for 2,000 freight cars.

The Missouri Pacific is asking bids on 750 wooden stock cars of 60,000 lbs. capacity.

The Wabash has ordered 1,000 box cars from the American Car & Foundry Company.

The Cleveland, Cincinnati, Chicago & St. Louis is reported in the market for express cars.

The Detroit United has ordered 50 city and 10 interurban cars from the Cincinnati Car Co.

The Boston & Maine is reported to have ordered 1,000 box cars from the Western Steel Car Co.

The Peoria Railway has ordered 15 double truck city cars from the American Car & Foundry Co.

The Missouri & North Arkansas has ordered 100 box cars from the American Car & Foundry Company.

Fox Brothers & Co. are about to place a contract for several cars for a Porto Rico plantation railroad.

The Chicago & Illinois Western is in the market for 300 gondola cars of from 80,000 to 100,000 lbs. capacity.

The Hudson Companies, it is reported, have ordered 250 all-steel passenger cars from the Pressed Steel Car Co.

The Delaware, Lackawanna & Western has ordered a Ganz motor inspection car from the Railway Auto Car Co.

The Guerrero (Mexico) Lumber Milling & Manufacturing Co. will shortly be in the market for logging cars.

The Chicago, Lake Shore & South Bend, now under construction, will order electric cars within a few days.

The Great Northern, as reported in our issue of January 18, has ordered 114 passenger cars from Barney & Smith.

The Brinson Railway has ordered some cars from the Waycross Car Works. G. M. Brinson, Savannah, Ga., is President.

The Great Western Oil Refining & Pipe Line Company, Chicago, is asking bids on 25 tank cars of 8,000 gallons capacity.

The Colorado & Southern, as reported in our issue of January 25, has ordered 33 passenger cars from the Pullman Co.

The Milwaukee Refrigerator Transit Company, Milwaukee, is in the market for 136-ft. refrigerator cars of 60,000 lbs. capacity.

The Middletown & Cecilton, now under construction, will soon ask bids on cars. W. R. Polk, Middletown, Del., is General Manager.

Dolese & Shepard, Chicago, are asking prices on 50 gondolas of 60,000 lbs. capacity, 50 gondolas of 80,000 lbs. capacity, and 50 gondolas of 100,000 lbs. capacity.

The Colorado, Texas & Mexico, now under construction, will ask bids on cars about May 1. George D. Locke, Missouri Trust Building, St. Louis, Mo., is Purchasing Agent.

The Mobile & Ohio is in the market for 1,000 box cars of 60,000 lbs. capacity, 500 steel underframe drop bottom gondola cars of 100,000 lbs. capacity, and 500 drop end gondola cars.

The Colorado & Southern, as reported in our issue of January 4, has ordered 350 stock cars, 350 ore cars instead of 600 ore cars, as reported in our issue of January 30; 175 flat cars, 50 gondola cars and 14 cabooses from the American Car & Foundry Co.

The St. Louis & San Francisco, as reported in our issue of January 25, has ordered 3,000 steel underframe box cars of 80,000 lbs. capacity, 1,000 steel underframe gondolas of 100,000 lbs. capacity, and 500 stock cars of 80,000 lbs. capacity from the American Car & Foundry Co., and 88 passenger coaches from the Pullman Co.

The Mineral Range has ordered 50 hopper bottom rock or coal cars of 80,000 lbs. capacity from the American Car & Foundry Co., for June delivery. These cars will weigh 32,000 lbs., and will measure 30 ft. long, 9 ft. 8 in. wide and 8 ft. 6 in. high, over all. The special equipment is as follows:

Brakes	Westinghouse
Brasses	Camel
Couplers	R. E. Janney
Draft rigging	Gould
Dust guards	Harrison
Journal boxes	Symington
Springs	Railway Steel-Spring Co.
Trucks	Diamond arch-bar
Wheels	American Car & Foundry Co.

The Norfolk & Western, as reported in our issue of February 1, is building at its Roanoke shops 1,000 drop bottom gondola cars of 100,000 lbs. capacity for May to December delivery. These cars will weigh 38,100 lbs. and will measure 38 ft. 2½ in. long, 8 ft. 11½ in. wide and 4 ft. high, inside measurements, and 40 ft. long, 9 ft. 11 in. wide and 7 ft. 11½ in. high, over all. Bodies will be of wood and underframes of metal. The special equipment includes:

Bolsters	Sectional, of plates and angles
Brake-beams	N. & W. standard deck beams
Brakes	Westinghouse
Brasses	Ajax Plastic Bronze
Draft rigging	Butler
Dust guards	Wooden
Springs	Union Spring & Mfg. Co., and Pittsburg Steel & Spring Company.

The Seaboard Air Line, as reported in our issue of February 1, has ordered 1,500 ventilated box cars of 60,000 lbs. capacity, and 1,000 gondola cars of 80,000 lbs. capacity. The box cars will weigh 38,000 lbs., and will measure 36 ft. long, 8 ft. 6 in. wide and 7 ft. 6 in. high, inside measurements, and 37 ft. 9¾ in. long, 9 ft. 6¾ in wide and 13 ft. 5⅝ in. high, over all. The gondola cars will weigh 37,400 lbs., and will measure 40 ft. 6 in. long, 8 ft. 7 in. wide and 3 ft. 3⅛ in. high, inside measurements, and 42 ft. 3½ in. long, 9 ft. 9¾ in. wide, and 7 ft. 3⅛ in. high, over all. The bodies of all cars will be of wood, and the underframes of metal. The special equipment for all cars is as follows:

Bolsters, body	Structural or pressed steel
Bolsters, truck	I-beam
Brake-beams	S. A. L. standard
Brakes	Westinghouse
Brasses	S. A. L. standard
Couplers	Tower
Door fastenings	Dayton
Draft rigging	S. A. L. standard
Dust guards	Wooden
Journal boxes	Symington
Paint	S. A. L. standard
Roofs	Chicago or Murphy
Springs	S. A. L. standard
Trucks	S. A. L. standard

RAILROAD STRUCTURES.

Austin, Tex.—The State Railroad Commission has issued an order requiring the Santa Fe, the Southern Pacific, the Galveston, Houston & Henderson and the Missouri, Kansas & Texas to jointly build a concrete causeway 140 ft. wide and two miles long over Galveston bay at a cost of about $4,000,000.

Chicago, Ill.—The car barns of the Union Traction Company were recently damaged by fire; loss about $200,000.

Kansas City, Mo.—The new viaduct between Kansas City, Mo., and Kansas City, Kan., was formally opened November 29. It is 1.6 miles long, has a level roadway from 40 to 60 ft. wide, and is connected with inclines and elevators for vehicles. The superstructure is of heavy steel on concrete pedestals laid on creosoted and concrete piles. The Kaw river is spanned by a bridge with two sections weighing 1,800 tons, supported by three piers containing 6,415 cu. yds. of concrete.

Bids are wanted February 25, by the Board of Park Commissioners, Kansas City, Mo., for building a reinforced concrete bridge 68 ft. wide and 75 ft. long over Brush Creek at Forty-seventh street and Lydia avenue, to cost about $12,000. Frank P. Gossadd is Chairman of the Board.

The United States Senate has passed a bill authorizing the Interstate Bridge & Terminal Company to build a bridge over the Missouri river at Kansas City.

Lawrence Junction, Pa.—It is reported that the Pennsylvania will spend $175,000 for new shops and make other improvements during the coming spring.

Minneapolis, Minn.—About 160 acres of land have recently been bought in St. Anthony Park, a suburb, it is said as a site for freight transfer yards of the Great Northern and Northern Pacific.

Port Arthur, Ont.—The Grand Trunk Pacific has let contracts to Barnett & McQueen for building a large grain elevator to have a capacity of 10,000,000 bushels at the mouth of the Mission river. Four trains will be able to discharge grain into it simultaneously. It is to be built of concrete, steel and tile. Work will be begun early this spring.

St. Louis, Mo.—A bill has been introduced in both houses of Congress to authorize the St. Louis Electric Bridge Company, which is a representative of the Illinois Traction Company, otherwise known as the McKinley syndicate, to build a combined highway and railroad bridge over the Mississippi river at St. Louis.

Talladega, Ala.—A bill has been passed by the United States Senate authorizing the Atlanta, Birmingham & Atlantic to build a bridge over the Coosa river.

Toronto, Ont.—The Canadian Northern has bought 110 acres

of land on the Don Flats as a site on which to build roundhouses, car shops, repair sheds, cold storage plants, etc.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALABAMA WESTERN.—See Illinois Central.

ALTOONA & LOGAN VALLEY (ELECTRIC).—A certificate has been filed by this company at Altoona, Pa., to build an electric line from Hollidaysburg, Pa., to Frankstown. The company also plans to build a number of extensions in Altoona.

ATCHISON, TOPEKA & SANTA FE.—See Southern Pacific.

ATHABASCA RAILROAD.—This company, which has a charter for a line from Edmonton, Alb., to Fort McMurray, is applying to the Dominion Parliament for permission to also build a line from Fort McMurray to Fort Smith, a total of 490 miles.

ATLANTA & ST. ANDREW'S BAY.—This company has extended its road from Cottondale, Fla., to Domer, five miles.

ATLANTIC & NORTH CAROLINA.—See Norfolk & Southern.

BOSTON & MAINE.—The directors of the Fitchburg have voted to issue $800,000 of bonds to pay for double-tracking the road from Troy, N. Y., northeast to Johnsonville, 16 miles, and eliminating grade crossings.

CANADIAN NORTHERN.—The Oakland, Man., extension is to be built north between the present main line and Lake Manitoba, work to be begun early this spring.

CANADIAN PACIFIC.—It is reported that this company will begin work on a line between Prince Albert and Regina, Sask., 260 miles, early this spring.

CENTRAL & SOUTHEASTERN.—This company, which has projected a line from Chanute, Kan., to Memphis, Tenn., 425 miles, and from the smelters at Chanute to zinc mines in southwest Missouri, has surveys made from Chanute to the Missouri-Arkansas state line. Rights of way have also been secured in Kansas. Ten miles of grading has been done, and a number of bridges put up. A. N. Hoxie, President, Joplin, Mo.; F. S. Hoxie, Secretary, 273 Fifth avenue, New York.

CHESTER, PERRYVILLE & STE. GENEVIEVE.—The Saline Valley has been opened for business from West Chester, Mo., southwest to Minith, 23 miles.

DULUTH, RAINY LAKE & WINNIPEG.—Financial arrangements have been made for building from the southern terminus at Virginia, Minn., on the Mesaba range, to Duluth, 70 miles.

This company has extended its road from Gheen, Minn., to Pelican, seven miles.

HALIFAX & SOUTHWESTERN.—The Barrington section of this road has been opened for business from Barrington Passage, N. S., east to Liverpool, 86 miles.

ILLINOIS CENTRAL.—This company, which is building from Corinth, Miss., southeast to Haleyville, Ala., 80 miles, as part of its Birmingham extension, is building the part of the line in Mississippi under the name of the Mississippi & Alabama, 42 miles, and the remainder in Alabama under the name of the Alabama Western, 38 miles. Contracts for grading, track laying and masonry on the Mississippi & Alabama have been let to Smith & Scott, of Corinth. About 85 per cent. of the grading is completed and track laid for a little over three miles. On the Alabama Western, contracts have been let to the Tallay-Bates Construction Company, Memphis, Tenn.; L. E. Myers Company, Chicago, Ill., and to Smith & Scott, of Corinth, Miss.; also to the Strobel Steel Construction Company, of Chicago, Ill., for the Brush Creek viaduct. Grading is 44 per cent. completed, and track laid for almost two miles.

INTERCOLONIAL.—Contracts have been given to Willard Kitchen, of Fredericton, N. B., for building the Colton Factory Branch from Richmond, N. S., to Kempt Road, Halifax, a little over two miles. Grading is to be started during April.

The company proposes to double track its road between St. John and Hampton, 22 miles, and between Moncton and Painsee Junction, seven miles.

MISSISSIPPI & ALABAMA.—See Illinois Central.

MONCTON, N. B.—The Intercolonial will rebuild six bridges and replace a number of short spans along the line of its road during the present year. A new passenger station is to be built at Amherst, N. S., new machine shops at Riviere du Loup, and a number of other buildings put up.

NORFOLK & SOUTHERN.—Contracts let to H. H. George, Richmond, Va., for building from Raleigh to Zebulon, 25 miles, and to J. G. White & Co., of Wilson, N. C., and New York, from Zebulon to New Bern, 105 miles; other construction includes branch from Farmville on this line south to Snow Hill, 10 miles, an extension from Bayboro south to Oriental, 10 miles, and from Chocowinity to Neuse Junction (near New Bern), 30 miles. The Virginia & Carolina Coast is building from Mackay's Ferry to Columbia, 22 miles, and from Bayboro to Oriental, 10 miles, and the Atlantic & North Carolina, from Morehead City to Beaufort. In addition the Norfolk & Southern is building a cut-off from Bishop Cross west to Pinetown, 10 miles, for which contract has been let to J. L. Wilkinson. Grading completed from Chocowinity to Neuse Junction, 30 miles, and track laid from Pamlico Junction to Zebulon, 23 miles; Bragaw to Neuse Junction, 22 miles; Mackay's Ferry to Cresswell, 13½ miles, and Morehead City to Beaufort about three miles, all the completed work was done last year except 13 miles east of Pamlico Sound, which was built this year. A bridge over the Pamlico River at Washington is now nearing completion. Additional contracts for work from Mackay's Ferry to Edenton, 10 miles, are to be let this spring. It is expected that all these lines will be built during the first half of this year. Charles O. Haines, Raleigh, N. C., Vice-President.

NORTHWESTERN PACIFIC.—See Southern Pacific.

ORFORD MOUNTAIN.—This company is planning to build an extension from Mansonville, Que., to North Troy, Vt., four miles, and from Windsor Mills, Que., to Bromptonville, eight miles.

PENNSYLVANIA.—Considerable heavy construction work is under way on the Pittsburg division, most of which is between Beatty and Southwest Junction, and calls for the excavation of 640,000 yds. and the placing of 18,500 yds. of masonry, which has just been finished. Near Donohue about five miles the work involves 1,600,000 yds. of excavation, of which 861,000 yds. are in one cut at Donohue Summit. The cut is 3,000 ft. long and 100 ft. deep. About 200,000 yds. at Donohue Summit must be cut through solid rock. It is expected that the entire excavation will be completed this spring. All the masonry for this section has been completed, except the bridge over the Alexandria branch. This new section of line shortens the present distance by about 1,000 ft. and eliminates 210 degrees of curvature besides very bad features in the present construction between Donohue and Beatty. The old line went through a tunnel.

RALEIGH & PAMLICO SOUND.—See Norfolk & Southern.

RIO GRANDE, SIERRA MADRE & PACIFIC.—Col. C. W. Greene and associates, who have been granted a concession by the Federal Government to build a line from Nueva Casas Grandes, state of Chihuahua, Mexico, to La Dura, in the state of Sonora, about 400 miles, have organized the Sierra Madre & Pacific to carry out this work. The line is to be built as an extension of the Rio Grande, Sierra Madre & Pacific owned by the same interests. The new line will connect with the Cananea, Yaqui River & Pacific at La Dura. Surveys made and contracts for the work will soon be let.

ST. LOUIS, ROCKY MOUNTAIN & PACIFIC.—Regular train service nas been begun on 41 miles of the main line between Clifton House, N. Mex., and Cimarron, and on 11 miles of branches to Koehler and to Raton. Grading has been completed for 96 miles from Des Moines west towards Ute Park, and track laid for 82 miles on the main line, leaving 24 of the 106 miles on the contract. The whole road is to be ready for operation by April 1. Eighty-lb. rails have been laid on the main line and 70-lb. rails on the branches. A large yard is being built near Koehler Junction.

SASKATCHEWAN VALLEY & HUDSON'S BAY.—This company is applying for incorporation to build a line from Edmonton, Alb., to Fort Churchill, on Hudson's Bay, via Prince Albert, approximately 1,500 miles. G. E. McCraney, Ottawa, is interested.

SEABOARD AIR LINE.—A 20-mile extension has been authorized from Jacksonville Ala., to Anniston, Ala., where the Woodstock furnaces, pipe works, etc., are located, as well as several short lines to mines in Calhoun and other counties.

SHERBROOKE & QUEBEC.—Application has been made by F. N. McCrea and E. W. Tobin, Sherbrooke, Quebec, to incorporate this company to build a line from Sherbrooke, Que., to the Quebec bridge, 110 miles.

SIERRA MADRE & PACIFIC.—See Rio Grande, Sierra Madre & Pacific.

SONORA RAILWAY.—See Southern Pacific.

SOUTHERN PACIFIC.—This company now has at work about 5,000 men on the extension of the Sonora Railway, south along the Pacific coast from Guaymas, state of Sonora, to Mazatlan and Guadalajara, state of Jalisco, 775 miles. The road will soon be in operation for about 300 miles from Guaymas southeast. The most difficult part of the work is from Guadalajara across the Sierra Madres to Mazatlan. (Sept. 14, p. 69.)

An agreement has been made between this company and the Atchison, Topeka & Santa Fe to build the Northwestern Pacific to connect the California North-Western of the Southern Pacific at Wil-

lits, Cal., with the San Francisco & Northwestern, a lumber road in the north owned by the Santa Fe. This will make a through line from Eureka to Willits to San Francisco, 290 miles. The joint line is to be controlled in alternate years by the Southern Pacific and the Santa Fe. (Sept. 21, p. 76.)

Vandalia.—This company is now extending second track from a point two miles west of the Union station at Indianapolis, Ind., to the top of the grade at Ben Davis, 4¼ miles, the work to be completed by June of this year. Second track is being laid by Jones Bros., of Columbus, Ohio, from Knightsville to the East Yard, Terre Haute, Ind., about 14 miles. This work includes building a new line between Brazil and Seelyville, eight miles, to secure better alinement and grades. This work is to be finished about July 1. From Terre Haute a short stretch of second track from the west end of the Wabash river bridge to Macksville, one mile, is being laid.

Virginia & Carolina Coast.—See Norfolk & Southern.

Winnipeg & Lakes (Electric).—An extension of time for one year has been granted this company, which plans to begin work this summer on lines to Lake Manitoba, Lake Winnipeg and Portage la Prairie, all in Manitoba. T. G. Haig, Winnipeg, is the promoter.

Winnipeg & Northwestern.—This company is applying for authority to build a line from Winnipeg, Man., to the Lobstick River in Saskatchewan, with a number of branches. A. T. Drummond, Toronto, is solicitor.

RAILROAD CORPORATION NEWS.

Buffalo & Susquehanna.—This company has completed its line to a connection with the Lake Shore & Michigan Southern and the South Buffalo at Blasdell, N. Y., six miles south of Buffalo, and has arranged with the Erie for trackage rights into Buffalo from a connection with the latter road a few miles south of Blasdell. Through passenger service has begun and freight service will soon be started under this arrangement. It is supposed that the B. & S. will ultimately enter Buffalo over the Lake Shore & Michigan Southern tracks, and will build its own freight terminals in that city.

Gross earnings for the six months ended December 31, 1906, were $896,301, an increase of $115,912; net earnings $323,815, an increase of $32,671.

Chesapeake & Ohio.—Gross earnings for the six months ended December 31, 1906, were $12,583,400, an increase of $719,244; net earnings, $4,729,553, an increase of $4,180.

Chicago, Rock Island & Pacific.—This company has sold to Speyer & Co., New York, $6,500,000 4½ per cent. equipment notes dated February 1, 1907, and maturing in 20 semi-annual installments beginning August 1, 1907. They are secured on equipment costing over $7,400,000.

See Mobile, Jackson & Kansas City.

Chicago, South Bend & Northern Indiana (Electric).—This company, which has acquired the Northern Indiana, has made a mortgage to the Central Trust Company, New York, to secure an issue of $5,000,000, 30-year, 5 per cent. bonds. The authorized capital stock is $7,500,000. (Feb. 1, p. 163.)

Colorado & Southern.—Gross earnings for the six months ended December 31, 1906, were $6,776,265, an increase of $761,813; net earnings $2,058,310, an increase of $125,815.

Cincinnati, New Orleans & Texas Pacific.—Gross earnings for the six months ended December 31, 1906, were $4,319,431, an increase of $286,925; net earnings, $831,386, a decrease of $120,445.

Detroit United (Electric).—Kean, Van Cortlandt & Co., New York, and William Salomon & Co., New York, are offering at 95½ and accrued interest, to net 6⅝ per cent., $2,000,000 three-year, 5 per cent. collateral trust coupon notes due February 15, 1910. These notes are secured by the deposit of $3,624,000 par value of securities, and the notes are a direct obligation of the company.

Erie.—The New York Stock Exchange has listed $12,000,000 4 per cent. convertible 50-year, series B coupon bonds of 1953; of this amount $2,000,000 were issued in 1905 to pay for locomotives, and the remaining $9,015,000 par value in bonds were sold for $8,715,000; of this sum, $5,278,205 was spent for construction, and $1,672,812 for equipment, up to November 30, 1906. The remaining $1,763,982 cash is held in the treasury, as are also $985,000 unsold bonds, which will be issued from time to time as occasion requires.

It is understood that this company will spend $12,000,000 for the electrification of 225 miles of line, mostly suburban roads, but it is stated that because of the condition of the money market this amount will not be borrowed at present.

Gross earnings for the six months ended December 31, 1906, were $27,025,203, an increase of $1,165,213; net earnings, $8,005,168, an increase of $146,479.

See Buffalo & Susquehanna.

Gulf & Ship Island.—Gross earnings for the six months ended December 31, 1906, were $1,182,417, an increase of $187,830. It is interesting to notice that the tendency toward greatly increased operating expenses, so evident on the larger lines, also shows in the earnings of this road, where the cost of operation increased 37 per cent., leaving net earnings of $267,493, a decrease of $57,525.

Louisville & Nashville.—Gross earnings for the six months ended December 31, 1906, were $23,930,446, an increase of $2,847,768; net earnings, $6,635,890, an increase of $401,504.

Minneapolis, St. Paul & Sault Ste. Marie.—Gross earnings for the month of December, 1906, were $920,498, an increase of $5,809. The operating ratio increased from 51 per cent. to 62 per cent., making the net earnings $350,329, a decrease of $94,260. Gross earnings for the six months ended December 31, 1906, were $6,800,537, an increase of $667,869; net earnings, $3,374,903, a decrease of $76,846. The operating ratio during this period rose from 44 per cent. to 50 per cent.

Mobile & Ohio.—Gross earnings for the six months ended December 31, 1906, were $5,102,540, an increase of $588,276; net earnings, $1,629,050, an increase of $139,439.

Mobile, Jackson & Kansas City.—The management of this road has turned over a majority of the capital stock of this company to a voting trust consisting of J. E. Borne, President of the Colonial Trust Company; Alexander McDonald and B. F. Yoakum, Chairman of the Executive Committee of the Chicago, Rock Island & Pacific. It is said that Mr. Yoakum will supervise the operation of the road.

Nashville, Chattanooga & St. Louis.—Gross earnings for the six months ended December 31, 1906, were $5,688,911, an increase of $425,956; net earnings, $1,205,509, a decrease of $43,832.

National of Mexico.—A semi-annual dividend of 1 per cent. on the $32,000,000 4 per cent. first preferred stock has been declared, payable February 11. When the first dividend, 1 per cent., was declared on this stock last July, it was somewhat doubtful as to whether payments would be continued. Gross earnings for the six months ended December 31 were $3,698,330, an increase of $375,642; net earnings, $1,349,918, an increase of $108,398.

New York, Ontario & Western.—Gross earnings for the six months ended December 31, 1906, were $4,292,447, an increase of $268,668; net earnings $1,485,137, an increase of $259,987.

Norfolk & Western.—Gross earnings for the six months ended December 31, 1906, were $15,085,680, an increase of $1,198,803; net earnings, $5,617,371, an increase of $33,044.

Northern Central.—Gross earnings for the year ended December 31, 1906, were $11,632,700, an increase of $1,100,700; net earnings, $2,654,300, an increase of $592,900.

Pennsylvania.—Gross earnings of the Lines East for the year ended December 31, 1906, were $148,239,900, an increase of $14,317,900; net earnings, $46,434,300 an increase of $5,902,700. Gross earnings of the Lines West were $80,493,300, an increase of $8,479,800; net earnings, $21,753,400, an increase of $2,298,000.

Philadelphia, Baltimore & Washington.—Gross earnings for the year ended December 31, 1906, were $15,941,200, an increase of $1,265,000; net earnings, $4,341,300, an increase of $468,000.

Seaboard Air Line.—This company offered, up to February 1, at 90 and accrued interest, to the stockholders and the holders of voting trust certificates about $7,300,000 5 per cent. general mortgage and collateral trust 30-year bonds, being part of a recently authorized issue of $18,000,000, to the extent of 12 per cent. of their respective holdings; of the remainder of this issue, something over $5,000,000 is for refunding purposes. (Jan. 25, p. 130.)

Southern.—Gross earnings for the six months ended December 31, 1906, were $28,316,306, an increase of $1,711,862; net earnings, $7,104,563, a decrease of $912,118.

Southern Pacific.—Gross earnings for the six months ended December 31, 1906, were $61,570,913, an increase of $7,967,734; net earnings, $23,996,446, an increase of $4,883,984.

Union Pacific.—Gross earnings for the six months ended December 31, 1906, were $39,026,250, an increase of $3,209,165; net earnings $18,809,196, an increase of $1,613,352.

West Jersey & Seashore.—Gross earnings for the year ended December 31, 1906, were $5,206,300, an increase of $553,900; net earnings, $1,249,400, a decrease of $14,300.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Closing the Salton Sea Break 197
- Growth of Schools of Engineering 197
- Mr. Morse's Offer to the New Haven 197
- A Phase of Surprise Checking 197
- Economical Weight and Speed of Freight Trains 198
- A Railroad Commission Example 198
- A New German Passenger Tariff 199
- New Publications 200

ILLUSTRATED:
- New Cars from Middletown Car Works .. 206
- Snow-Test of N. Y. Cen. Motor Car Trains 211
- The Canal System of Canada 214
- Closing the Latest Break of the Colorado River to Salton Sea 217
- N. Y., N. H. & H. Overhead Construction 220

CONTRIBUTIONS:
- The Profitable Weight and Speed of Freight Trains. 200
- The Supply Department. 203

MISCELLANEOUS:
- Railroad Legislation 204
- Safeguards on Steam Railroads 205
- Experience with Electric Traction in London 207
- Collisions Prevented by Block Signals ... 208
- Capt. George J. Grammer 208
- Government Accident Bulletin No. 21 209
- The Lackawanna Fast Freight Service ... 212
- The Territory of the Alaska Central R.R 213
- Education of Apprentices on the Mo. Pac. 216
- Benzoelectric Rail Motor Cars in Hungary 220
- Shantung Railroad (Note) 207
- Rail Motor Cars in New Zealand (Note) 217

GENERAL NEWS SECTION:
- Notes 221
- Trade Catalogues 223
- Obituary 223
- Meetings and Announcements 223
- Elections and Appointments 224
- Locomotive Building 224
- Car Building 225
- Railroad Structures 226
- Railroad Construction 226
- Railroad Corporation News 228

VOL. XLII., No. 7. FRIDAY, FEBRUARY 15, 1907.

We are advised that the latest break in the bank of the Colorado river was closed at 6 p. m., February 11. The total time consumed from dumping the first rock was 15 days 2 hours. The material used aggregated 77,000 yds., mostly rock. The depth of water at the beginning of this last—and apparently successful—attempt was 34 ft. and the speed of the current was 4½ miles per hour. Further comment on this tremendous task will be found in another column.

Never before in this country have there been so many students enrolled in its schools of engineering. A recent canvass has shown that five institutions, viz., Cornell University, the Massachusetts Institute of Technology, Purdue University, the University of Illinois and the University of Michigan, each have 1,200 or more students in their engineering departments, and together they enroll in engineering more than 6,500 students. The institutions named are the leaders in the matter of attendance, ranking in the order named. While it is reported that certain institutions, especially those of the East, as for example, Princeton, Yale and Columbia, have enrolled fewer students in engineering courses than in previous years, others have largely increased their enroiment. This is especially true of the institutions of the middle and western states. The number of engineering students in one institution of high rank has doubled in five years; that of two others, in approximately seven years; that of others in ten years. Moreover, it appears that this increase is due to no sudden impulse but is the logical outgrowth of the prosperity and of the intellectual development of the country. The prospect is that the rate of increase which has occurred in the recent past will be maintained for many years to come. The report of the Bureau of Education for 1904, which is the latest available source of information concerning all of the institutions, gives the number of students in engineering courses for the whole country as 20,545. The end of the first quarter of the present century is likely to find 75,000 students in the engineering courses of American colleges. Of the number in attendance, not less than 15 per cent. will graduate each year or, approximately, 11,000 candidates for the engineering profession. Great as this number appears to be, it is not likely to drug the market. At the present time the supply is far short of the demand. The industrial world seems to have no difficulty in absorbing all who graduate, and considering the growth in the country's industries, and the constantly changing methods of manufacture, it is probable that the prospective growth of the schools of engineering will do no more than keep pace with the development of the country's industries.

The offer of $20,000,000 by C. W. Morse for President Mellen's Sound boat properties capitalized in stock and debt at much less than half that amount, and for which only $5,000,000 were offered three years ago, undoubtedly was a tribute to Mr. Mellen's judgment as organizer and operator, just as an earlier offer of the same sum for a trolley system which had cost $10,000,000 in 3½ per cent. bonds is a test of his judgment as an investor. But rejection of both offers was predestined, and it seems strange that the Sound boat proposition should have been seriously entertained. The vast investment of Mr. Mellen in electric roads is still new and tentative while very promising. But it has yet to stand the shock and strain of a reversed wave of industrial conditions. Not so what may be called the New Haven corporation's navy. It is old, tested by competition as well as by industrial stress, each of the greater lines of boats a logical outlet of the original railroad system which it joined, and the whole now greater than its original parts by virtue of centralized operation and control. For Mr. Mellen's corporation to part now either with its trolley or boat system would be as if the head of an army were to barter away his artillery and a protective fleet. There is a sense, too, in which any breaking up of what may justly be entitled the Mellen system would be a loss to economic science. There are a number of other bigger railroad combinations. But no other system so peculiarly and picturesquely blends monopoly over an intense industrial region with marine interests and with electric projects and potentialities. The final outworking of the collective whole will be a distinct contribution to the science of transportation which many of us will live to see. Meanwhile possibilities of naval warfare of Admiral Mellen versus Admiral Morse give a halo of future interest to the situation for those who recall the dramatics of the "dollar lines" of the later seventies between New York and Boston.

Surprise checking of enginemen, to be of the highest value, must show how well and faithfully they watch out for dangers and guard against them. To test the men's obedience to a rule where disobedience very likely will *not* result in damage, as is reported to

have been done on the Lake Shore last week, is what might be called discipline in the second degree. It is useful in its place, but it is not the most important thing, as regards the men, while as regards the public (when reported in the newspapers), it is distinctly harmful, for it leads people to think that the discipline is worse than it is. This same criticism applied in the case of the Chicago & North-Western surprise checking at Mayfair, some months ago, which was heralded abroad by the Chicago reporters. On most roads an extinguished light is not specifically defined in the rules as a condition requiring a full stop, and in case the engineman is able by moonlight or his headlight to see the blade and to know that it is in the "proceed" position he has an excuse for not stopping; and, under some rules, a fair defense. We are not trying to excuse enginemen for disregard of any rule, howsoever slight may be the danger involved, but merely to show that there are different kinds of misconduct as regards observance of signals, and that if a superintendent is going to make shining examples of disobedient enginemen he had better take cases concerning which there can be no well-founded differences of opinion. It is more useful, as an example, to show up one man in a million, who disregards a stop signal, than to expose a hundred who merely take a questionable way of reporting an irregularity in which no vital issue can be made clear. It does indeed take much more time, care and expense to find the one in a million; but, on the other hand, the certificate of merit thus given to the 999,999 who did not fail is correspondingly more valuable. If a superintendent is really forced to make much noise in administering "second degree" discipline he ought to find some way to elude the reporters. The most rational way to avoid unpleasant publicity in this matter is to make surprise checking of all kinds so common that the reporters will not look upon it as a sensation to be heralded. Moreover, this must appeal to the wise superintendent as the real need in the case, regardless of the newspapers. How is it that at any time on any road, a score, or a dozen or a half dozen, men commit the same error at the same place on the same day? Such a condition would seem to indicate a marked need of surprising somebody out of a rut, whatever the nature of the rule violated, whether of the first, second or third degree of importance.

The interesting paper by Mr. M. B. Wild, Statistician of the Baltimore & Ohio, in our issue of February 8, discussing the economical weight and speed of freight trains, is supplemented this week by equally interesting documents from Mr. B. A. Worthington, First Vice-President and General Manager of the Wheeling & Lake Erie and Wabash-Pittsburg Terminal, Mr. George R. Henderson, Consulting Mechanical Engineer, and Mr. J. M. Daly, Car Accountant of the Illinois Central. Mr. Wild took the standpoint that although it is open to question whether much actual delay has occurred in yards from holding cars for big trainloads, there is reason for discussion whether the big trainload is proving as profitable as its obvious economies in motive power cost lead one to suppose. Mr. Wild argued that the delays incident to securing the maximum trainload and moving it might not only offset the saving, but go so far beyond that the highest net revenue derived from a given period of service would be obtained from a 24-car train running 25 miles an hour, rather than from a 40-car train running 10 miles an hour. As against this, all three of our contributors believe that freight speeds as high as those named by Mr. Wild are not practicable. Mr. Worthington contends that the extravagant part of freight train movement under present conditions lies, not in the work on the road, but in the delays to cars at railroad terminals and on industry spurs; that the average daily mileage of car equipment is but a relatively small factor to be considered, and that in actual practice it will cost a good deal more to haul low-class freight in small and fast trains than it will in larger trains which move slower.

There is no doubt that in any such calculation a sharp division should be made between conditions on a road which characteristically handles low-grade traffic and one which has its main interest in manufactured articles and merchandise, which must of necessity move rapidly, in comparatively small trainloads. It is also doubtless true, as Mr. Worthington points out, that trains are not apt to approach the calculated speed line very closely on freight runs, so that a large margin must be left for actual variations, and any division superintendent could cite many cases where excessive and unscientific trainloading has proved a costly expedient. An engine that cannot properly handle its load delays not only its own train but an indefinite number of other trains, especially in single-track working, and in times of general traffic congestion, when the prime necessity is to keep freight moving. Indirectly, the advantage to a railroad of having a community friendly rather than hostile must certainly be taken into consideration, and we are inclined to believe, perhaps wrongly, that much of the oppressive state legislation in the Northwest could have been avoided by the single expedient of habitually running trains close to their schedule time, even at some sacrifice in operating cost.

We agree with Mr. Worthington's belief that the lost time before the car starts is a matter demanding more urgent attention than the lost time after it is under way. The old grievance of railroad managers, that their cars are locally used for warehouses by shippers, has never been more sharply accentuated than it has this winter, and amid all the discussion on the subject and all the blame which has been heaped upon the railroads for conditions that they were not, in the main, responsible for, no remedy for this evil has been brought out. Increased terminal facilities at crowded points, decentralization of through freight to avoid such points whenever it is possible, as recently suggested by Mr. Hill, and constant, unremitting watchfulness of every industry and every shipper holding back cars, are the resources which the railroad manager has to enable him to move freight on time and keep his cars on the line. Along with these things, it is surely worth while to consider most carefully whether the savings of a maximum trainloading balance cost of retarded train movement, keeping in mind that on single-track roads, constituting the bulk of our mileage, it has not been found practicable to secure an average movement substantially in excess of 15 miles per hour in the direction of "right of track" movement and 14 miles in the reverse direction, independent of the train loading. It is also true that such studies will not be likely to have a very broad application; from the very nature of the business, each road and each locality has its own conditions and its own peculiar set of problems.

A RAILROAD COMMISSION EXAMPLE.

The acute but much belated agitation in Connecticut against stock watering of electric railways has been recognized by Governor Woodruff, of that state, in a special message which is a form of document not often put forth in that commonwealth where the powers of the executive are somewhat exceptionally limited. The message is, in substance, a plea for additional powers for the state railroad commission, especially in the matter of regulating new capitalization and restricting it to actual values of the railway properties capitalized. It is, in effect, a proposition that the Massachusetts plan of capitalization should be adopted by Connecticut. If the message stopped there it would be commendable. But, unfortunately, it goes further and, on the theory of absence of powers, exculpates, at least by strong implication, the state railroad commission from responsibility for the unfortunate plight in which Connecticut finds herself. One can understand, perhaps, the position of a Governor who, seeking by new and general legislation to rectify for the future an old evil, does not wish to arouse personal antagonism in a state commission in which two members out of three are politicians and leaders of the dominant party. But such a motive hardly justifies failure to press home the real responsibility.

The situation in Connecticut, where the railroad commission itself has been urging its own lack of power over street railway capitalization, can be best illustrated by limiting the argument to a single case and a few sections of the state's railroad law. In the Connecticut statutes, Section 3,872 requires street railway companies to make annual returns sworn to by the President and Treasurer of the corporation. The form shall "substantially follow the form required by the interstate commerce commission for steam railroads . . . with such additional matters as shall render the return as complete, as to the business property and affairs of the companies, as the return required from steam railroad companies." Section 3,873 penalizes at $25 a day neglect on refusal to make such return and orders report of the penalty to the State Treasurer. The commission (Section 3,898) is given power to summon and examine under oath such witnesses as they think proper in relation to the affairs of any railroad or street railway company and recreant witnesses can be subjected to heavy penalty. Other citations of the Connecticut statutes could be made but the above are sufficient. They show clearly enough that while constructive powers of the Connecticut commission over street railway capitalization may not have been large their *preventive* power has been immense. All that was needed on the part of the commission was disposition and ini-

tiative. It is hardly too much to say, metaphorically, that if a single member of the commission had raised a finger of warning it would have blocked in the state untold millions of trolley stock watering.

The immediate target of the Connecticut movement and of the Governor's message has been the capitalization of the Connecticut Railway & Lighting Company, whose great volume of watered stock has recently become a security paying good dividends by its lease to the Consolidated Railway Company, the great holding corporation of the New York, New Haven & Hartford Railroad Company. The figures setting forth the hydraulics of the Railway & Lighting Company have been printed in these columns heretofore and need not be repeated now. It may suffice to say that out of capitalization of some $30,000,000 in stock and bonds about two-thirds represents watering of securities with construction and equipment account raised in the balance sheet to meet it. For six years —1901 to 1906 inclusive—and beginning with the year (1901) of the first return the Railroad Commission of Connecticut has accepted the company's statement without criticism or even comment upon its inflated character; and one searches the annual reports of the commission in vain for criticism of, much less .protest or action against, the trolley stock watering in the state rife through many years. The statement may also be repeated here that the Connecticut Railroad Commission consists of three members, all of one political party, one of them an engineer more than 70 years old, and the two others active politicians and formerly chairmen of their party's state committee, neither of them with railroad training previous to taking office.

These are the plain statements of fact which neither the people of Connecticut, her legislature nor her Governor should blink. But the case ranges farther than Connecticut and has more than local meanings. The commission, inefficient and nerveless as it has been, simply illustrates the nature of the "political" state commissions everywhere—commissions which charged as trustees with holding the even scales of justice between the public service corporations and the people have been true to the real interests of neither. But the Connecticut case strikes still deeper in another direction. It proves not only the absurdity of the familiar plea—likely to be more familiar hereafter—of "lack of power," but the vital importance of improving the *personnel* of the state commissions. The state may invest those commissions with unlimited powers and may hedge them about with statutes that are sternly mandatory. But if ability or character are not there legislatures and corporations alike strive in vain. Indeed the weaker the commission in nerve and mental and moral calibre the more dangerous it becomes when new statutory responsibilities are heaped upon it.

A NEW GERMAN PASSENGER TARIFF.

The negotiations among the several states of the German Empire for a uniform passenger tariff, which have been pending some two years, have resulted in an agreement, and the reformed tariff will probably go into effect May 1, 1907. The basis of the new tariff is as follows:

	Class 1.	Class 2.	Class 3.	Class 4.
Pfennige, per kilometer	7.0	4.5	3.0	2.0
Equals, cents per mile	2.68	1.72	1.15	0.767

The chief obstacle to a uniform tariff was the objection of the South German states to the introduction of the fourth class, and this has not been wholly overcome; for in Bavaria and Baden no fourth class cars are contemplated; but on local trains only the fourth class rate will be charged for third class cars, the rate being known as class 3b.

With these rates there will be no reduction for round-trip tickets, and no free baggage. The above rates are for ordinary passenger trains. For express trains there will be an addition, but not as heretofore, an addition of so much per kilometer, but a fixed sum for three zones, namely:

	Kilometers.		
	1 to 75.	76 to 150.	More than 150.
Classes 1 and 2	0.50 pf.	1.00 mk.	2 mk.
Class 3	0.25 "	0.50 pf.	1 "

That is, for distances less than 47 miles, the ticket will cost 6 cents more in the third class and 12 cents more in the higher classes; 47 to 93 miles, 12 cents third and 24 cents first and second; all greater distances, 24 cents third and 48 cents in higher classes. This, it will be seen, is a substantial addition to the fare for short distances; thus, New York to Stamford second class, 54 kilometers, the fare would be 2.33 marks by passenger train and 2.83 by express; to New Rochelle, half as far, the fare is 1.16 marks by passenger train and 1.66 by express; in the first case 21 per cent., in the other 41 per cent. more for the fast train. But for great distances the charge for speed is inconsiderable: 24 cents to Philadelphia and only 48 cents for the longest distance for which tickets are issued. The purpose of this, doubtless, is to keep local travel off from long-distance express trains; but it would seem to be disadvantageous for the longer distance suburban trains, such as New York-Morristown, New York-Tarrytown, or New York-Stamford; where a whole train can be filled at either terminus, to the advantage both of carrier and passenger.

What we would call coupon tickets over two or more different lines by the new tariff will cost 0.115 cent more per mile for the first and second class and 0.077 cent more for third class than the tickets over one line; but they have the important advantage that they are good both on passenger and express trains. As comparatively few journeys as long as 300 miles can be made without such tickets, the one mark and two mark additions for express trains for all distances above 93 miles have very much fewer applications than they would have in a country like this. Suburban and holiday tickets, school and workmen's tickets are excepted from the uniform tariff, but most other commutations, such as mileage and book tickets, are prohibited.

There has been heretofore on some (perhaps all) the roads affected an allowance of 25 kilograms (55 lbs.) free baggage. By the reformed tariff all baggage taken in baggage cars will be charged at the following rates for every 25 kilograms:

Zone	Marks.	Zone	Marks.
1 to 25 km	0.20	351 to 400 km	2.00
26 " 50 "	0.25	401 " 450 "	2.25
51 " 100 "	0.50	451 " 500 "	2.50
101 " 150 "	0.75	501 " 600 "	3.00
151 " 200 "	1.00	601 " 700 "	3.50
201 " 250 "	1.25	701 " 800 "	4.00
251 " 300 "	1.50	More than 800 km	5.00
301 " 350 "	1.75		

That is, for less than 16 miles, 4.8 cents for 55 lbs. or less; anything more than 55 lbs. up to 110 doubles the charge; 16 to 31 miles, 6 cents; then an addition of 4.8 cents for every 31 miles up to 310 miles; 12 cents for every 62 miles up to 500 miles, and for all distances greater than 500 miles $1.19 per 55 lbs. This makes New York to Philadelphia 18 cents for 55 lbs., 36 cents for 56 to 110 lbs., and 54 cents for the 150 lbs. free baggage allowed on American railroads. New York to Washington or Boston our allowance of free baggage would cost $1.43; Chicago to Buffalo, $3.57; but no more from Chicago to New York. These rates are likely to make the passenger think twice before he packs his trunk; which is doubtless desirable. In one country where the matter was investigated, it was found that not one passenger in seven had any baggage for the baggage car, and it is questioned whether the six should be taxed for the benefit of the one who does have baggage; that is, whether they should pay as much as though they had baggage.

In comparing with conditions here, it should be remembered that the free baggage allowance in Germany heretofore has been but 55 lbs. (where there was any), and that the German cars enable the passenger to carry into the car with him probably more than three times the amount of baggage that he could dispose of conveniently in one of our cars. At the above rates baggage may be taken up to the weight of 440 lbs. on one ticket. For weights in excess of this the rates are doubled. Applying these rates to the journey from New York to Chicago, with the allowance of 150 lbs. of baggage (165 lbs. would cost no more), we have:

	Class 3.	Class 2.	Class 1.
Fare	$10.71	$16.07	$24.99
Speed	.24	.48	.48
Baggage	3.57	3.57	3.57
Total	$14.52	$20.12	$29.04

The German second class cars are as good as our first class on most long routes. The first class can hardly be said to be better, but there is usually plenty of room in them. If we take a passenger without baggage, the charge is reduced to $10.95, $16.55 and $25.47 respectively.

Journeys of that length, however, are extremely rare in Germany; and even those of half that length are not common. From New York to Buffalo the German charges would be:

	Class 3.	Class 2.	Class 1.
Fare	$5.05	$7.58	$11.79
Speed	.24	.48	.48
Baggage	2.85	2.85	2.85
Total	$8.14	$10.91	$15.12

This is an unfavorable specimen on account of the baggage; if the distance were only five miles less the charges would be 36

cents less. New York to Boston or Washington (say 370 kilometers) we have:

	Class 3.	Class 2.	Class 1.
Fare	$2.64	$3.96	$6.16
Express	.24	.48	.48
	$2.88	$4.44	$6.64
Baggage	1.43	1.43	1.43
Total	$4.31	$5.87	$8.07

No figures are given for fourth class fares, because fourth class cars are not run on express, nor for long distances. In considering these comparisons it should be remembered that the German fares are to be good on all state railroads in the German Empire, and our figures are chiefly for the routes of heaviest travel and lowest fares in this country. Comparisons with routes in the Far West and the South would be much more unfavorable for the American lines. There is nowhere in Germany districts where population is so thin and travel so light as in many parts of this country. Further, it should be remembered that an overwhelmingly large part of the German travel is third class. Again, there is now a tax on tickets, which adds to the traveler's expense, though not to the railroad's income.

NEW PUBLICATIONS.

Railway Signal Association: Proceedings for the Year 1906. C. C. Rosenberg, Secretary, 12 Linden St., Bethlehem, Pa.

The present report makes a volume nearly an inch thick, the report itself, excluding the advertisements, filling 342 pages. The transactions here recorded were reported in the *Railroad Gazette* as they occurred. The annual meeting, which was held at Washington in October, fills over 200 pages. Among the subjects dealt with in the reports here printed are Electric locking at interlocking plants; How to remedy the effects of foreign current in track circuits; Specifications for mechanical and electric interlocking, for rubber covered wire, for illuminating oil, for signal posts and concrete foundations, and for storage batteries. The "Comprehensive Plan for a Complete System of Signaling" and the discussion thereon fill about 30 pages.

Ten-Wheel Type Locomotives.—Two pamphlets, published by the American Locomotive Co., New York. 6 x 9 in.; 24 and 33 pages; 54 and 72 illustrations.

The last two pamphlets published by the American Locomotive Company are the fifth and sixth of their series describing modern locomotives built by them. These pamphlets, which are uniform with their predecessors, are devoted respectively to ten-wheel type locomotives weighing less than 150,000 lbs. and those weighing more than 150,000 lbs. In the introduction it is stated that the ten-wheel type has been displaced by the Atlantic type for passenger traffic, which requires the tractive effort of six-coupled driving wheels and a boiler capacity that cannot be provided for on ten wheels. The ten-wheel type is also limited in the diameter of its drivers, because when this is over 73 in. a deep firebox cannot be readily used unless it is placed between the drivers. The ten-wheel type, however, has a large field in passenger service where the steam requirements are not too great; it has a greater motive power capacity in proportion to total weight than the Atlantic type. It is also most satisfactory for freight service where the trains are of moderate weight and high speed is desired. The pamphlets contain the usual photographs and full specifications of many different engines.

CONTRIBUTIONS

The Profitable Weight and Speed of Freight Trains.

Pittsburg, Pa., Feb. 8, 1907.

To the Editor of the Railroad Gazette:

Regarding Mr. Wild's contribution on the above topic in your issue of Feb. 8, it is evident from the article that Mr. Wild has the notion that the delay to freight trains in transit is responsible for a large share of the extreme car shortage that has existed during the past year on the railroads throughout the country. Let us analyze the question and see if this is a fact, and if Mr. Wild's suggestion seems practicable (which I do not admit for reasons which I will hereinafter state) let us see what effect the carrying out of the plan suggested would have toward relieving the car shortage.

I have before me the annual reports of all the principal railroads in the country, including the Baltimore & Ohio, the Buffalo, Rochester & Pittsburg, the Chesapeake & Ohio, the different companies forming the Vanderbilt Lines, the Harriman Lines and the Pennsylvania Lines East and West of Pittsburg, the Pittsburg & Lake Erie, the Toledo & Ohio Central, the Bessemer & Lake Erie, the Missouri Pacific, the Denver & Rio Grande, Great Northern and the Wabash Lines East and West of Toledo; these reports showing that the railroads mentioned are obtaining at the present time an average daily mileage from their equipment, of from about 12 miles on single track railroads hauling a preponderance of low class traffic, to as high as 38 miles per day on roads having from one to four tracks and handling a preponderance of high class traffic.

What does this mean? Does it not demonstrate to a certainty that the railroads of the country are obtaining from one to three hours service out of their car equipment during each 24 hours? Let us suppose, for example, that Mr. Wild's theory can be worked out and we can increase this mileage 50 per cent. (which I do not admit is practicable) we would still have left from 75 to 80 per cent. of the 24 hours during which the railroads were getting no use of their equipment. Would this not suggest that instead of sacrificing the additional expenditure involved in moving tonnage at higher speeds and in smaller train units in order to improve the movement during the less than 20 per cent. of the time out of each 24 hours that our cars are earning revenue and at the same time rendering service to the shippers of the country, that we should get busy on the *80 per cent.* of the time, and exert ourselves to lessen the time that loaded and empty cars are allowed to stand at railroad terminals, and the delay in "spotting" and "pulling" cars from industry spurs, at the same time making an energetic effort to induce shippers to load and unload cars more promptly.

It will be seen that the average daily mileage of car equipment is but a small factor in the consideration, and the great delay occasioned to car equipment in the 80 per cent. of the time unaccounted for would seem to suggest that the best way to relieve the car shortage is to bring about the fullest co-operation between the shippers and railroads, because there is not a road in the country that is not daily checking up its equipment, gathering up its loads as soon as they are ready and pulling out empties as soon as they can get hold of them, to put them into other traffic.

If Mr. Wild's table, showing the reduction in cars per train at varying speeds of from 10 to 35 miles per hour, may be considered as tonnage, he makes the following reductions in train-load:

	Per cent.
Between a speed of 10 and 15 miles per hour	12½
" " " 10 " 20 " "	30
" " " 10 " 25 " "	40
" " " 10 " 30 " "	50
" " " 10 " 35 " "	62

If Mr. Wild will take any of the modern resistance curves that have been made by the use of dynamometer cars to arrive at the resistance to moving loads, for example, the resistance curve of the *Engineering News* and the Schenectady Locomotive Works (which has been adopted by the Master Mechanics' Association), or the resistance curve of the Baldwin Locomotive Works, or for that matter, the curve made from dynamometer tests made by the late Arthur M. Wellington in 1878, which shows a slightly higher resistance between speeds of from 10 to 35 miles per hour than the others, he will find that the tonnage that can be drawn with each unit of available traction (traction that comes within the coefficient of adhesion) say on a four-tenths of 1 per cent. grade (which is about as favorable as we encounter on most low-grade lines) his reduction in tonnage would be:

Between	10	and	15	miles	per hour	18	per cent.,	instead	of	12½	per cent.
"	10	"	20	"	"	35	"	"	"	30	"
"	10	"	25	"	"	52	"	"	"	40	"
"	10	"	30	"	"	63	"	"	"	50	"
"	10	"	35	"	"	75	"	"	"	62	"

Please understand, however, that a table calculated on these lines would not be practicable for two reasons:

First.—During my experience in inaugurating and checking for a period of four years a tonnage rating system on a road having approximately 9,000 miles of railroad, with 12 superintendent's divisions, with marked variations in physical characteristics, the only trains that ever approached the calculated speed line on freight runs within 12 to 15 per cent., were the test trains on which I rode and which were given special movement and were handled under the most favorable conditions.

Second.—Before such a sliding scale could be used, it would be necessary to calculate one to meet the physical characteristics of each freight division, because the factor of gradient resistance is invariable regardless of weather conditions or rolling friction, while the other elements of resistance, atmosphere, curvature and wheel friction, fluctuate according to the physical characteristics. For example, the resistance to a moving load on a four-tenths of 1 per cent. grade, according to established formula, would call for a decrease in the load of 75 per cent. as between 10 and 35 miles per hour, while on a 1 per cent. grade the decrease would be 61 per cent., under same conditions of speed, and on a 2 per cent. grade would be 64 per cent., simply because the factor of grade resistance is the same at all speeds and does not fluctuate from 20 times the per cent. of grade per ton, from which it will be clear that no uniform table could be made to apply to all the divisions of a given railroad, to say nothing of applying such a table to the different railroads of the country.

On a four-tenths of 1 per cent. grade, however, a reduction of 10 per cent. in a given load per unit of engine traction would give an increase in speed from 10 to 13 miles per hour, instead of an

increase of 50 per cent., as stated by Mr. Wild, and a reduction in load of 30 per cent. would give an increase in speed from 10 miles per hour to between 17 and 18 miles per hour, instead of doubling it, bearing in mind all the time that these are theoretical figures, and that the engines in actual practice, in daily work, will not work up closer than within 12 to 15 per cent. below the calculated performance under the very best practice.

After all, the test of our theories is to work them out in practice, and Mr. Wild's table likens itself to a rating sheet which I made nearly 20 years ago, based entirely on theoretical calculations, there being very little difference in the premises which I used and those that are to-day accepted by railroad statisticians in making such figures. While I was able to prove the accuracy of every figure which I had made, the trouble with the rating sheet was that the locomotives could not begin to pull the tonnage, and after I had made a careful study of the situation, I found that there were very many practical obstacles which I had not considered.

A few years ago we had 12 divisions of a certain large railroad make a series of tests under speed conditions varying as two to one and train-loads as one to one and three-tenths, covering a total of nearly 15,000 train miles, and the concensus of opinion was, when we had got entirely through with these tests, that it was really impracticable to load even slow trains for a speed of 10 miles per hour, as the engines could haul at a speed of from 12 to 15 miles per hour any load that they could start on a low grade line, and our tests finally developed that for divisions with low-grade physical characteristics, a speed of 12 to 15 miles per hour was the most economical load for the engine, and for heavier gradient lines from eight to ten miles per hour. As we had both high and low class traffic, our engine rating was made on the basis of both time and load.

As it has been my fortune to operate railroads handling a preponderance of high class freight moving at fast speeds and earning approximately one cent per ton per mile, and for the past two years a railroad with a preponderance of low class tonnage, the average earnings for the last fiscal year being 4.79 mills per ton per mile (or less than one-half as much as was earned on the road first mentioned) my experience teaches me that it would be suicidal for a railroad handling low class freight (quite a considerable share of it on the lines under my jurisdiction moving at two mills per ton per mile, which is barely sufficient to cover operating expenses, but the business must be handled) to cut down its train-load for the purpose of increasing the speed of trains between stations, a check of which shows that the trains are actually running 15 miles per hour while in motion (the delayed time incident to the density of traffic and because of an average of over 12 meeting points per hour during each of the 24, consuming 40 per cent. of the total time between terminals) for the reason that to move the tonnage in smaller units would mean an increase in the number of trains to be met and passed, and the slight gain that would be made through increasing the speed while in motion would be more than offset by the additional delay at meeting points, and the cost of service would be so largely increased that the business would no longer be profitable, as the margin of profit at the present time is extremely small.

From the annual reports which I have before me I have selected for practical illustration the figures for two roads for the last year for which we have the figures, but for obvious reasons (as I do not wish to make any invidious comparisons) we will call one of the roads the "Low-class Traffic Line" and the other the "High-class Traffic Line." I have selected these two roads because it so happens that there is only one mile difference in their total mileage, and the operating conditions and physical characteristics of the two roads are very much the same, running through the same country.

On the Low-class Line 70 per cent. of the tonnage comes under the heading of "Products of Mines," including anthracite and bituminous coal, coke, ore, stone, sand, etc., 20 per cent. coming under the heading of "Manufactures," including petroleum and other oils, sugar, naval stores, iron, pig and bloom, iron and steel rails, castings, machinery, cement, brick, lime, wagons, carriages, etc., etc., the remaining 10 per cent. coming under the head of products of agriculture, products of animals and products of forest, the average earnings per ton on the low-class line being slightly less than 66 cents, while on the high-class line 22 per cent. of the tonnage comes from products of agriculture, 12 per cent. from products of animals, 29 per cent. from products of manufacture, and 6½ per cent. from products of forest, with only 24 per cent. from products of mines, one-fourth of its tonnage being low-class, while practically three-fourths of the tonnage of the other line is low-class. The road moving the high-class tonnage has a large number of fast beef and perishable freight trains eastbound and an equal number of fast merchandise freight trains westbound, moving on schedules of 20 to 25 miles per hour. The density of traffic per mile of road is somewhat heavier on the low-class line.

Please understand that I am not criticizing the operations on the high-class line, because I realize that the class of tonnage being handled on the road in question justifies the higher cost of transportation, but for the purpose of this article comparative figures showing the cost of operation and freight statistics for the two roads in question are enclosed herewith.

Comparative Results of Operation—Low Class vs. High Class Traffic Line.
(Figures taken from latest annual reports.)

	Account.	Traffic line. Low class.	Traffic line. High class.	Per cent. + the + and − the −
1.	Gross earnings	$7,787,091	$9,108,730	+ 16.97
2.	Operating expenses:			
	Conducting transportation	2,612,126	4,328,013	+ 65.70
	Maint. of way and structures	923,804	822,272	− 10.99
	Maint. of equipment	1,033,658	1,197,263	+ 15.83
	General expenses	224,091	135,162	− 39.55
	Total	$4,793,979	$6,193,010	+ 35.23
3.	Per cent. of operating:			
	Expenses to earnings	61.56%	71.17%	+ 9.61
4.	Net earnings	$2,993,111	$2,625,720	− 12.27
	Freight Statistics.			
5.	Gross freight earnings	$6,507,188	$7,437,711	+ 14.29
6.	Revenue ton-miles	1,223,271,342	1,151,118,925	− 18.64
7.	Company ton-miles	34,420,388	33,002,570	− 39.36
8.	Revenue tons carried	9,879,558	5,800,484	− 41.29
9.	Average distance haul one ton	123.8	250.2	+ 102.10
10.	Freight train miles	2,604,122	4,510,552	+ 115.40
11.	Mileage of loaded freight cars	41,046,682	90,338,692	+ 116.92
12.	Mileage of empty freight cars	20,806,638	41,949,611	+ 101.61
13.	Average tons per train mile	470	329	− 46.07
14.	" tons per loaded car	30.68	16.42	− 46.48
15.	" empty cars per train	9.93	9.30	− 6.34
16.	" revenue per ton, cts.	65.87	128.22	+ 94.66
17.	" revenue per ton mile, cts.	.532	.646	+ 21.57
18.	" cost per ton-mile, cts.	.327	.365	+ 11.62
19.	" net ergs per ton mil., cts.	.205	.148	− 27.80

Analysis of these figures shows that the gross earnings on the high-class traffic line were slightly less than 17 per cent. greater, while the operating expenses were 35 per cent. more. It will be noted that the expenses of conducting transportation, however, were over 65 per cent. more, incident to the high-speed trains moving the tonnage in smaller units.

While the high-class traffic line earned 17 per cent. more gross money, it earned over 12 per cent. less net money than the low-class traffic line, and it handled 41 per cent. less tons carried.

It will also be noted that the high-class traffic line was required to haul each ton over double the distance of the low-class traffic line, which produced the effect of requiring the high-class road to haul its tonnage at about 3½ per cent. lower average revenue per ton-mile than the low-class road, although the high-class traffic line received over $1.28 for each ton carried, while the low-class traffic line received slightly less than 66 cents per ton carried.

It will be noted also that the revenue train-load on the low-class traffic line was 610 tons as against 329 tons on the high-class traffic line, or 46 per cent. less train-load, and might be said to represent the two extremes of operating conditions, both of which are fully justified by the character of traffic handled.

The same ratio of decrease is noticeable in the average tons per loaded car as in the train-load, being 16.42 tons on the high-class traffic line as against 30.68 tons on the low-class traffic line, incident to the fact that it is moving merchandise more or less bulky and light weight, and refrigerator cars taking comparatively light loads, while the low-class traffic line is hauling mostly ore, stone and coal.

The ratio of operating expenses to earnings seems to favor the low-class traffic line, yet the more expensive high-speed service required on the high-class traffic line very likely justifies the higher operating ratio, as the tonnage in question is strongly competitive with four to five other through lines, and must be handled at high speed in low train units.

On the whole, notwithstanding that the two extremes of traffic and operating conditions are encountered in a comparison between these two roads, an analysis of the results on the mileage basis (which is slightly in excess of 500 miles on each road, with net earnings of over $5,000 per mile of road operated) proves conclusively to any railroad man that both of these roads are efficiently handled, and my judgment is that no uniform sliding scale providing for the reduction of engine ratings on the various roads indiscriminately, regardless of the classification of the tonnage which they are required to handle and on which the average earnings varies over 100 per cent., with operating conditions radically different (some having single-track with poor yard and terminal facilities and short passing tracks, and others having second, third and fourth tracks and ample terminal facilities, yet operating through the same country) would be at all practicable, and for the reasons herein given my judgment is that we are trying to cure an evil, which if it exists at all is only in special cases, with a remedy which, if adopted, would have but very slight effect upon the general situation of car shortage.

B. A. WORTHINGTON,
First Vice-President and General Manager W. & L. E.

New York, Feb. 11, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have been very much interested in the communication of Mr. M. B. Wild published in your issue of February 8, on the profitable weight and speed of freight trains. This is a subject that cannot be given too much thought and attention, particularly at the present time of car shortage and the likelihood of legislation regarding

hours of train men. The old theory of the heavy train being the most economical one is very largely adhered to in spite of considerable evidence that both economy of operation and quantity of transportation call for a lighter load and a greater speed.

The heavy train cannot be discussed however intelligently without also considering the heavy locomotive, that is to say, there is a vast difference in results between a heavy train with a medium heavy locomotive and a heavy train with a *proportionately* heavy locomotive: in the first case the locomotive will be overloaded, but in the second case it will not be so necessarily, and if a heavy train and a heavy locomotive have the same relative proportions one to the other as a light train and a light locomotive, the result of speed of operation will not be different, but naturally the heavy train will be run with the greatest amount of economy.

The assumptions stated by Mr. Wild in his paragraphs labeled A and B do not seem to me to conform exactly to actual facts. To make this clear I give below the tractive force of a locomotive for different speeds in miles per hour, and below that the resistance per ton of train on a level, on a one per cent. and on a two per cent. grade. The figures for tractive force are what we could expect from a locomotive of ordinary proportions which had a tractive effort in full gear of 40,000 lbs., and the reduction corresponding to the increased speed follows the curve prepared several years ago by a committee of the Master Mechanics' Association:

Running speed, miles per hr...	10	15	20	25	30	35
Tractive force, 1,000 lbs.....	40	33	25	20	18	15
Level resistance, per ton.....	5	6	7	9	10	11
1 per cent. grade	25	26	27	29	30	31
2 per cent. grade	45	46	47	49	50	51

It will be seen from these that the available tractive force of the locomotive decreases somewhat more rapidly at increased speeds than the allowance given in line C of Mr. Wild's table. On high grades the increase of resistance due to speed bears a much smaller proportion to the total resistance than it does on low grades; so that when we consider both together we are quite prepared for the assertion that on a one per cent. grade the same locomotive which we have above considered would take 1,430 tons at 10 miles an hour back of tender, whereas at twenty miles an hour it could only take 800 tons, and at thirty miles an hour only 400 tons back of tender, this reduction being considerably more rapid than appears in Mr. Wild's table. On a level, of course, the difference would be still more marked. But without knowing the actual conditions of grade, curvature, etc., and the size of locomotive on which he bases information, it is impossible to do more than call attention to this fact.

On line E we notice that Mr. Wild takes his train mile revenue at 10 cents per loaded car mile, and as on many roads the weight of car and lading, day in and day out, averages 33 tons, we should have a revenue of .3 cent per ton mile back of tender.

The cost of train operation per mile as given in line H does not seem to vary in exactly the same ratio that we have found by some studies which were made of various profiles, and in order to obtain some figures which would compare with those presented by Mr. Wild, I have taken the cost of operating a train over a division assumed to be 150 miles long with a summit in the middle, the grade being one per cent. up on one side, and one per cent. down on the other. The down hill portion being run uniformly at 30 miles per hour, and the up hill portion at varying speeds.

I have prepared a table which can be compared with Mr. Wild's, but using the actual expenses as estimated by considering the fuel, train crew, repairs and various charges that would actually occur on the different trips, and making the allowances for diminution of train weight with increase of speed as referred to above. The data used for this table can be found in page 180 of my recent book on Cost of Locomotive Operation:

Speed up hill, miles.....	5	10	15	20	25	30
Av. speed bet. terminals	7.2	12.5	16.7	20.0	22.7	25.0
Cost, per 1,000 ton-miles....	$0.51	$0.53	$0.56	$0.64	$0.78	$0.98
Net rev., per 1,000 ton-miles	$2.49	$2.47	$2.44	$2.36	$2.22	$2.02
Thousand ton-miles pr month	6,000	9,050	8,500	6,890	5,200	3,920
Net revenue pr engine month.	$14,940	$22,323	$20,740	$16,250	$11,544	$7,918

From this it would appear that the greatest net revenue earned per engine per month is at an average speed between terminals of 12½ miles per hour, and even at an average speed of 16.7 miles per hour the revenue is at least one-third greater than at 7.2 miles per hour. As we increase the speed the necessary reduction in train load causes a greater drop in the revenue. The method of obtaining the figure of net revenue is as follows:

From the table on page 180 of the book referred to, the cost of operation for 1,000 ton miles is given, which is the third line in the table here inserted, and this deducted from $3, the above assumed figure for revenue, gives us the net revenue found in the fourth line. The fifth line, giving the thousands of ton miles per month that one engine is capable of handling under the assumed conditions, allowing proper time for lay-overs, at terminals, etc., can be multiplied by the fourth line, so that the sixth line, being the product of the two, will represent the net revenue earned per engine month.

In Mr. Wild's article he has figured in his line P the net revenue in 5,000 hours; whereas our figures are for one month, or 720 hours. And while his maximum revenue is obtained at an average speed of 25 miles per hour, our table shows a maximum at 12½ miles per hour.

There is no intention, in producing these figures, of saying that Mr. Wild's data are incorrect, because without knowing the exact conditions existing on the line which we are studying, with the size and power of its equipment, and its physical properties and environments, it is impossible to draw any definite conclusions. Yet it is also evident that if such conditions are different, the final results will also be different, as illustrated by the table above given. There is little doubt, however, but that economy of operation and movement of traffic both require a speed greater than usually obtaining in freight service in this country. But just what combinations of speed and load will produce the best result can only be stated by working out the proper data for the conditions as they actually exist on the territory under investigation.

GEORGE R. HENDERSON.

Chicago, Feb. 10, 1907.

To the Editor of the Railroad Gazette:

With reference to the article on "The Profitable Weight and Speed of Freight Trains" appearing in the *Railroad Gazette* February 8 over the signature of Mr. M. B. Wild, I wish to take friendly issue with him on the accuracy of his basis of computation. Allow that the figures shown by Mr. Wild are correct as regards speed or reduction earnings and expenses per train-mile, and instead of basing our conclusions on theoretical computations of 5,000 hours of service—50,000 train-miles and 2,000,000 loaded car-miles—let us take actual train service conditions as we find them on 95 per cent. of the divisions of railroads throughout the country, both on single and double track. In Mr. Wild's article no reference is made to the return of the power in the direction of light traffic or light grades where the tonnage hauled on trains is not a factor, hence his conclusions if based only on the tons hauled in direction of heavy traffic must necessarily be in error, as the same expense per train-mile is incurred in both directions.

Take for example a practical, every-day condition. Suppose we have 140 loads to move from Baltimore to Philadelphia, a distance of 100 miles, that being the direction of heavy traffic, the coal and refrigerator cars moving east loaded and west empty. Assume that the same engine works the traffic both ways and hauls the cars in lots of 35, at 15 miles per hour eastbound, and 20 miles per hour westbound, and again in lots of 28, at 20 miles per hour. Then we may compute the time and expense incurred in both directions, the engines returning in both instances hauling less than their rating in empty and loaded cars, hence they make the same average speed.

Example.—A represents 15 miles per hour; B 20 miles per hour.

	Miles.	Hr.	Min.
A—140 loads in 4 trains east, 35 cars each at 15 miles pr hr.	400	26	40
A—140 cars* in 4 trains west, 35 cars each at 20 miles pr hr.	400	20	00
8	800	46	40

Distance over division 100 miles in each direction.

	Miles.	Hr.	Min.
B—140 loads in 5 trains east, 28 cars each at 20 miles pr hr.	500	25	00
B—140 cars* in 5 trains west, 28 cars each at 20 miles pr hr.	500	25	00
10	1,000	50	00

*Loaded and empty westbound.

A performs service both directions with....	8 trains.	800 miles	46 hr. 40 min.
B performs service both directions with....	10 "	1,000 "	50 " 00 "
Saving by A—15 miles per hr.....	2 "	200 "	3 " 20 "

Cost per train-mile A.....	800 miles at $0.71	$568.00
Cost per train-mile B.....	1,000 miles at .66	660.00
Saving in favor of 15 miles per hour.....		$92.00

$92.00 saved on 4 trains east = $23.00 per train.
On 10 trains per day, 3,650 per annum x $23 = $83,950 saved per annum.

Ten trains in each direction per day is certainly a low estimate on a main line single-track road, consequently a saving of $83,950 per 100 miles of track is very reasonable.

As regards the profitable speed of freight trains I consider 12 to 15 miles per hour, including delays, as fast as economy or safety will permit even on level track where trains can be at all times kept under control. I must therefore assume that Mr. Wild's figures of freight trains moving at 25, 30 and 35 miles per hour, including delays, are merely to illustrate, and in making my computation I use his figures on 15 and 20 miles per hour, which are least favorable to me.

I fully agree with Mr. Wild that trains are overloaded, and that the roads so overloading trains suffer a material loss. The large engine and the large car have brought about this condition; they have also brought to the railroads a large increase in earning capacity and a decrease in the cost per ton per mile hauled, hence it is safe to assume they will remain with us, and so long as we have 50-ton capacity cars carrying 10 tons now and 55 tons at another time, it devolves on the railroad manager to adopt and put into effect an intelligent basis for loading his locomotives, viz., the equated or adjusted tonnage basis.

Locomotives have a given tractive power. Cars have a given

resistance based on the gross weight of each car. Two cars of 30 tons each have 64 tons drawbar pull, whereas one car of 60 tons has 55 tons of drawbar pull, hence it is folly to expect a locomotive to haul as many gross tons of light loaded or empty cars as it can haul of heavy loaded cars, and railroads must eventually load their engines according to the resistance of drawbar pull of each individual weight of car, otherwise it is impossible to obtain uniform speed in the movement of trains as well as uniform economy in the movement of the traffic.

It is also wrong to rate a locomotive to haul 100 per cent. of its tractive power at all times, even though it has demonstrated in test that it can do so, as the conditions of power, weather, fuel, trains to meet, density of traffic, and even the men handling the engine, have all to be considered. Consequently fair and reasonable concession must be made to the engine, not only in the rating but in loading after rating has been arrived at.

I have gone into this subject very exhaustively in the past eight years, and was convinced at the beginning of my investigations that it is useless to expect yardmen or trainmen to mathematically compute and reduce from gross tons of car and contents to tons of drawbar pull each car as added to train, even though they are supplied with charts, scales, etc., to aid them.

The result of my study of the subject is the perfection of a small adding device that discounts or adjusts and computes drawbar pull of each individual car from gross tons to tons of drawbar pull. Consequently, under this method, the resistance of all trains can be intelligently adjusted, permitting uniform speed to be made—the result that all operating officials are striving for.

J. M. DALY,
Car Accountant, Illinois Central.

The Supply Department.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have been interested in two articles that have appeared recently in the *Railroad Gazette* on the perspective of the supply department on our railroads, and I am disappointed that the question is not being taken up and discussed more generally. The question is a very live one and is being followed very closely and anxiously by the one person all over the country who is most deeply interested personally—the storekeeper. There are a few of us (for I am a storekeeper) who do really take an interest in our work and try to bring it up to its proper level of importance; a few of us who have ambitions beyond the mere routine of our duties; a few of us who would like to feel that the handling and looking after supplies is really a position of some importance, requiring more or less ability, and, therefore, possessing some dignity. I have never really seen it thus but once, and I am sorry to say that where it once was it is no longer, entirely owing to the individual who was at the head. When he resigned, because of poor health, there was apparently no one capable of carrying out his lofty ideas within reach, and they appointed as his successor a man of long experience and immense energy—and he has never developed any other qualification. The result was made apparent very early; his duties were curtailed because he was always too busy; his territory was divided; his work was never done. The superiority of his help fell off, with the resulting evils, and to-day the department is back in the same old rut. Why? It wasn't his fault—he should never have been appointed. The fault lies higher up. And I want to say that just there is where the fault usually lies.

Some day, perhaps, the managers and vice-presidents of our railroads will come to recognize the necessity of appointing good men at good salaries to these positions; will recognize the necessity of bringing the storekeeper in very close touch with the source of his supplies and at the same time keep him independent of that source; will recognize the necessity of putting him in very close touch with the consumer of his supplies and at the same time keep him independent of that consumer; will recognize the necessity of making him responsible to some one individual who will rank high—as high or higher than the purchasing agent or the superintendents of departments, high enough to be independent of them—and then trust to his judgment and the guidance of his superior.

This is the one and only way that the maximum of service may be obtained with the minimum of expense. Afford your storekeeper confidence. Let him work out his own detail in his own way—you will usually find it a good way. Don't interfere if he gives one of his assistants an increase of salary—be assured that he deserves it. Let him know that he is responsible for the economical management of his department, but don't interfere. Let him know that if a shop foreman makes a mistake the storekeeper is not going to be made a cat'spaw of. Let him know that his request for supplies is going to receive prompt and careful attention at the hands of the purchasing agent, and that he is going to get what he asks for—not something "just as good," but exactly what he asks for—and get it when he wants it. And let him know that he and he only is going to be held responsible for his mistakes. There won't be so many of them, take my word. There won't be so very much surplus or obsolete material, and the reason is obvious.

Just a short time ago our general foreman came to me and requested me to provide 12 engine couplers of a certain kind. I put two on requisition. About three weeks later he came to me very confidentially to see if I couldn't have the item canceled or reduced from 12 to two. It appears they had decided at headquarters to discontinue the use of this coupler, and he had been advised to that effect but had forgotten. Who do you suppose would have been blamed for this surplus? About four years ago our superintendent of motive power was possessed of a bright idea in the nature of an emergency coupler. He had about 50 put together of wrought-iron at considerable cost and put into stock, and I have been including them in my inventories ever since because he will not acknowledge their uselessness. These are only two of a great many like instances that speak loud in the interests of an independent storekeeper.

Under existing conditions on most of our railroads there is no one who takes any particular interest in surplus or obsolete materials, but if there was, who do you suppose would be held responsible here?

Some time ago, a good live storekeeper on a small road up north came to the conclusion after a careful study of the question that there were entirely too many different triple valves in service on the engines and tenders. He found he was ordering repair parts for seven and he could not determine that this was at all necessary, so he protested vigorously against it. The authorities in the case agreed with him that it didn't look just right, but they couldn't see how it could be remedied. Without further argument he ordered a small stock of the more up-to-date equipment, refusing to replace old equipment when beyond repair. In this way, and almost without their knowledge, he gradually worked in the newer stock, and to-day we find only three different kinds in service, and they are the best procurable. What does this mean? It means a reduction of 50 per cent. in the value of stock on hand, less labor in making repairs (fewer repairs to make), fewer skidded wheels and broken couplers, and a 100 per cent. better service all around.

The same man, within a year after his appointment, succeeded in reducing his monthly foundry bill from over $2,000 to less than $800, and kept it there.

The supply agent is the one individual to whom the storekeeper is responsible, and the one who is responsible for the storekeeper. He it is who is in close touch with the management and knows what is going on—what is going to be done and what is going to be required to do it. He is the one who sees to it that the required material is on the spot before the labor. If he hasn't got it, he gets it, and he knows what to get and when to get it. He always knows within a few hundred dollars what the value of material on hand is. He knows just where to put his hand on anything that can be made use of—surplus stock. He knows and sees to it that valuable stock is not being put in the scrap bins. He is never short of material important to any particular season because he is wise to conditions and requirements through information demanded and provides ahead. He sees to it that one roadmaster is not being pinched for the very material that another may be hoarding up against a possible requirement. He knows the material and the quality of the material that is most serviceable to the greatest number, and he sees to it that his storekeepers ask for it and get it. He sees to it that there is no unnecessary waste, and that for every air or steam hose sent out there is an old one brought in; or if not, why not. I am perfectly satisfied that a man who understands his business and is in a position to punish carelessness can effect an immense saving right here on most of our railroads.

To do all this and a great deal more your supply agent must know his railroad thoroughly. He must not be tied down by a lot of red tapeism, but be free to go and come as he wills. And he must come and go. It cannot be done thoroughly and well without going over the ground, and that frequently. He must poke into all corners, accepting no man's word for what may be there. His equipment need not be large: a comfortable office (not too comfortable), an experienced office assistant and a stenographer.

I note with much concern the appointment of an official on the Philadelphia & Reading designated Superintendent of Materials and Supplies, gazetted in your issue of January 4th. It seems unfortunate that the pioneer move in this direction should start under such immense difficulties and restrictions. I really cannot imagine such shortsightedness as would prompt any such set of rules as these set out in your article. They are ponderous and unworkable, embodying all the objectionable features possible, it would seem, and no good ones—the maximum of expense with the minimum of service. It is hardly necessary to point out defects in the laws governing this new official and his duties, but I would ask them how they hope to reconcile paragraphs 5 and 7? And the last, "Local storekeepers are to report, etc"! On whose payroll does this unfortunate person appear? On the Superintendent of Materials and Supplies? Then how can he possibly be honest to his superintendent and still obey every Tom, Dick and Harry who happens to have a little authority over a few men in the shop? As a rule these men have an exaited opinion of their supreme importance, and

each one thinks his wishes should receive first consideration. Difficulties insurmountable. Is he paid by the department he serves? Then how can the Superintendent of Materials and Supplies expect unprejudiced service and reports? Why this man's life will be a burden to him!

Time and again I have asked for and insisted on getting certain materials for shopmen, and when inquiries were made direct to them over my head they have repudiated my representations and accepted an inferior article. The storekeeper usually has to stand alone, without support from either side. He is being continually bombarded from one side for demanding so much and from the other for not having enough, and he was never known to give satisfaction to either. Give your storekeeper more independence, and put him under a capable head who ranks high enough to hold his own against the misrepresentations of superintendents and foremen and the arrogance of purchasing agents and their assistants, and be assured of better and more economical service. M.

Railroad Legislation.*

Philadelphia, Feb. 7, 1907.

To the Senate and House of Representatives of the Commonwealth of Pennsylvania.

Gentlemen—It is the general impression that important legislation affecting the railroads of the commonwealth is to be passed at this session of the legislature. A sense of duty to you as legislators, and to the public you represent, as well as to the railroads I represent, impels me to state facts and opinions which may aid you in discharging your legislative duties.

The more important railroads of this state were chartered more than a half century ago. They were given liberal franchises to encourage the investment of the capital required to develop the natural resources of the commonwealth. Many millions are invested in their capital stocks and securities. They have grown to be very large corporations. This growth is the measure of the development of our great commonwealth.

In the development of railroad transportation it is doubtless true that mistakes have been made. Here and there some dishonesty has been disclosed, but it is trifling compared to the magnitude of the work and the enormous sums of money received and expended. Because of careful business scrutiny, the average honesty of officers and employees is not below that of the community.

The railroads have developed their systems and increased their facilities to meet the yearly increase of traffic. The extraordinary prosperity of Pennsylvania is the best evidence of the public service the railroads have rendered—a prosperity which could not exist had it not been for the good service and reasonable rates established by the railroads. Do not overlook the fact that passenger and freight rates have been, from time to time, reduced far below the rates authorized in the charters. Neither the state nor the railroads can arbitrarily fix rates. The laws of trade are the inexorable factors in fixing rates. Railroads are perhaps more interested than any one else in developing business along their lines. Only in this way can they get traffic, and to get that traffic they must fix rates which will enable the manufacturers, merchants and producers of every kind to sell their products in the markets of the world.

There is no necessity for government regulation other than to prevent unreasonable discrimination. Government regulation, because it must be by fixed and rigid rules, can harass and annoy, but it cannot beneficially assist the varying demands of business. Heretofore the railroads of the country have been able to secure the capital required to build additional tracks, to acquire new terminals, to build new lines, to reconstruct their old lines, to obtain equipment, to reduce grades and curves, and generally to create improved facilities to reduce the cost of transportation, and thereby meet competition and reduce rates.

If you study the railroad transportation of other countries and compare it with our own, you will find that, notwithstanding the greater density of population in many European countries (which naturally should bring about lower rates), the fact is that our railroad transportation is the cheapest and best in the world.

Much of the capital invested has produced no return. It is broadly not true that the great railroad systems of Pennsylvania are overcapitalized. It is not true that their capital stock or securities have been watered. It is true that the actual value of their properties is in excess of the book valuation—I speak authoritatively for the Reading system.

When the Philadelphia & Reading Railroad Company was reorganized the stockholders and security-holders paid in in cash assessments $20,456,869. This cash, together with the first preference income mortgage bonds, second preference income mortgage bonds, third preference income mortgage bonds, common stock and the deferred income bonds (making an aggregate of $139,342,483) represent the stock and bonds surrendered and the money paid by the stockholders and security-holders, and for this they received a total of $116,031,300 in first preferred, second preferred and common stock, the amount of first preferred they received being only $7,184,950.

In addition to this no dividends had been paid since 1875, and in the reorganization many of the rentals on leased lines and the rates of interest were reduced. Since the reorganization—a period of ten years—the average dividend received from first preferrd stock has been only 2⅝ per cent. per annum; that of the second preferred stock, $1^{7}/_{20}$ per cent. per annum, and the common stock, ¾ per cent. per annum. Understand that these percentages are for the ten years; in some of the years no dividends were paid. For the past two years 4 per cent. has been paid on the total capital stock.

I am within safe bounds when I say that the actual loss to the security-holders of the Reading company of money and interest—not simply of paper securities—has been in excess of $100,000,000. Instead of "water" in our stock and securities there has been an absolute contraction of capital honestly invested in the past development of the Reading system.

It is nevertheless true that each year heavy expenditures must be made to meet public requirements from which no substantial increase of revenue is obtainable. The abolition of grade crossings, elevation of tracks, new terminals in cities at enormous cost, are examples. The public, I fear, overlook the economic feature. How can the railroads go on making these heavy expenditures, increasing their expenses by higher cost of wages,* materials and supplies and taxes and at the same time decrease passenger and freight rates? Are railroads unlike every other business venture? The power of taxation enables the state to conduct business at a loss. But business men know that no business can be conducted at a continuing loss, and that, in some way, whatever burden is placed on business by control of price, by taxation, or in any other way must either result in the burden being transferred to the consumers or in bankruptcy.

The industrial prosperity of the whole country is primarily due to the extraordinary expenditures which the railroads of the United States have been compelled to make in the past six years. Pennsylvania has profited more than any other state, because the largest industrial operations in the country are located within her territory.

The national state and municipal governments seem to be competing with one another in experimental legislation to take the management of railroads out of the hands of the owners, and the skilled men selected as their agents, and to turn it over to men selected in the ordinary methods of partisan politics, and to men, too, without special training, without personal interest in the results, and whose tenures are not dependent on their work, but on political conditions.

Does Pennsylvania propose to repeat the disasters which followed the state's attempt in the first half of the last century, to operate railroads and canals?

If by new legislation you render the transportation business of the country unprofitable, you will necessarily retard the further development of railroads, because the new capital required cannot be obtained. The timidity of capital is proverbial. Doubts and fears on the part of investors are even now plainly manifest; no one can forecast the measure of coming disasters if honest efforts are not made to dispel, instead of to increase by hostile legislation, these doubts and fears.

If, on the theory that they belong to the capitalist class and, therefore, may be despoiled, no consideration is to be given to present investors, comprising thousands of people who have invested their small and large savings in railroad securities, some thought should be given to the thousands of employees, and the many interests which will suffer when railroads are rendered powerless to go forward and, in a legitimate and progressive way, supply adequate transportation facilities for the business of the country.

The national government (apparently on the assumption that the power to regulate commerce gives a wholesale power to regulate the business of the country) has given the Interstate Commerce Commission large powers over transportation. Time and experience alone can clearly demonstrate the effect of what it may do on the transportation and general business of the country. It will simply be mischievous legislation for Pennsylvania to create a similar commission. It is not needed, and it will serve no useful purpose.

TWO CENTS PER MILE PASSENGER RATE.

We are given to understand that election promises were made which have committed the dominant party to the passage of a law limiting passenger rates to 2 cents per mile. I assume that these pre-election promises—while well enough intended—are subject to reconsideration by men who have assumed official responsibility. One of the judges of the Supreme Court years ago quaintly said that "the first judgment on earth was only pronounced after summons and hearing." The railroads have had no hearing. We are entitled to it before you act.

Let me state the case. The passenger traffic of the railroads is

*Letter of George F. Baer, President of the Philadelphia & Reading, to the Pennsylvania Legislature.

*The increase in wages paid by the Philadelphia & Reading in December, 1906, over December, 1905, was $243,954. The increase in gross receipts was only $87,736.

conducted without profit. As common carriers they are bound to carry passengers. I have had a careful examination made of the passenger business of the Philadelphia & Reading Railway with a view of determining whether it is done at a profit or loss, with the following result:

Expenses of and Income from Passenger Traffic for One Year Based on Figures for Year Ending June 30, 1906.

Repairs and maintenance of passenger equipment		$1,313,623.35
Interest on cost of passenger equipment, $4,639,948.54		278,396.91
Interest on cost of passenger stations, not including Reading terminal, $1,416,482		84,988.92
Interest on P. & R. terminal bonds	$425,000.00	
Less income from Reading terminal	156,616.00	
		268,384.00
Operating expenses		4,264,049.34
Interest on 10 per cent. of cost of Philadelphia subway, $274,000.00 3½ per cent.		9,602.25
Proportion of annual charges exclusive of dividends based on a division of gross earnings as between passenger and freight		1,242,833.97
		$7,461,878.74

Income from Passenger Traffic.

Passenger	$6,216,316.25	
Mail	120,795.11	
Express	572,920.56	
Union News	17,500.00	
		6,927,531.92
Loss in operating		$534,346.82

It may interest you to know that, taking the month of November, the following is the division of passenger receipts based on rate per mile:

	Receipts.	Per cent.	Passengers.	Per cent.
Over 2c. per mile	$180,906.21	35	427,878	17
At 2c. per mile	113,940.45	22	254,676	10
Under 2c. per mile	225,185.79	43	1,893,261	73
Total	$520,032.45	100	2,575,815	100

The average rate of our suburban traffic is one and two-tenths of a cent per mile.

The short haul on the suburban passenger traffic of the Philadelphia & Reading Railway—the average being only a little over seven miles per passenger—largely increases the cost of operation.

The passenger business being done at a loss, the railroads will not voluntarily increase that loss, but will be compelled to increase local rates to make up the loss they will sustain by the enforcement of a maximum rate of 2 cents per mile. I have already stated that, notwithstanding the maximum rate fixed in the charters of the railroad companies, the railroads have voluntarily reduced rates to accommodate the public. The question then arises:

Has the legislature the legal power to name a rate of 2 cents per mile?

The rates named in the charters of the companies incorporated prior to 1857 (without reference to all of them) are exemplified by the rates named in the Pennsylvania Railroad Company's charter of April 13, 1846. The twenty-first section gives the company the power to fix such rates "as to the president and directors shall seem reasonable," with the proviso that "in the transportation of passengers no charge shall be made to exceed 3 cents per mile for through passengers and 3½ cents per mile for way passengers."

The General Railroad Act of February 19, 1849, Section 18, reads: "In the transportation of passengers no charge shall be made to exceed 3 cents per mile for through passengers and 3½ cents per mile for way passengers." This follows exactly the language of the Pennsylvania Railroad Company's charter. Now, where does the legislature of Pennsylvania get the power to change these charter provisions?

The charters themselves contain no provision reserving the right to alter, appeal or amend. Some of the charters contain a reservation that in case of "misuse or abuse of the privileges granted the legislature may resume all and singular the rights and privileges granted to said corporation." But, so far as it pertains to the question of passenger rates, it cannot be an abuse of power to fix a rate within the limit fixed by the legislature. Aside from that, the question of misuse and abuse is a judicial and not a legislative one.

The constitutional amendment of 1857 reserves the power to alter, revoke or annul every charter granted since that time. The effect of the amendment of 1857 was not to give power to revoke a right granted to a corporation prior to 1857. Every right granted since 1857 to old corporations is subject to legislative control. The right to fix rates for passenger transportation, within the limits hereinbefore stated, was granted to the railroads prior to 1857.

Does the constitution of 1874 change this rule? Section 10, Article 16, says:

"The general assembly shall have the power to alter, revoke or annul any charter of incorporation now existing, and revocable at the adoption of this constitution, or any that may hereafter be created, whenever, in their opinion it may be injurious to the citizens of this commonwealth, in such manner, however, that no injustice shall be done to the corporators. No law hereafter enacted shall create, renew or extend the charter of more than one corporation."

The power to alter, revoke or annul any charter of corporations then existing is limited to such charters as were revocable "at the adoption of the constitution of 1874."

Will any one say that the charters of the Pennsylvania Railroad Company, the Philadelphia & Reading Railroad Company, the Lehigh Valley, the Delaware, Lackawanna & Western, the Lehigh & Susquehanna, the Delaware & Hudson were revocable in 1874, at the time of the adoption of the constitution? Even if the legal difficulties which surround this question, and the protection which the law gives corporations, is to be considered no barrier to legislative action, on the general theory that if the law be so the courts in the end will protect us. There are further constitutional limitations to which your attention is respectfully called. One is that the thing to be altered must be injurious to the citizens, and that in removing the injury no injustice shall be done to the corporators. When we show that the transportation of passengers is already being conducted at a loss, how can you find that a greater loss may be inflicted without injury and injustice to the corporators?

If I am correct in my contention that you have not the legislative power to fix rates that will be binding on the older corporations, any act which you pass will only be obligatory on the railroads chartered since 1857. The result would be legislative discrimination against this class of corporations.

INCREASED TAXATION.

Notwithstanding the extraordinary—and some good citizens think, extravagant—sums expended in the construction of a new capitol, there is a considerable balance in the state treasury. This demonstrates that the present tax laws produce more revenue than is required for a government honestly and economically administered. Last year the Reading System (exclusive of the Reading Iron Company and the Central Railroad Company of New Jersey and its affiliated and controlled companies) paid taxes in the State of Pennsylvania to the amount of $1,684,544. The last annual report shows the surplus earnings (that is, earnings remaining after payment of interest, rentals and taxes) to have been $7,843,819. In other words, we paid 21⅔ per cent. of our total net earnings in taxes.

Safeguards on Steam Railroads.

The following paragraphs are taken from the annual report of the Massachusetts Railroad Commissioners:

In the use of the appropriation made by the Legislature of 1906, the Board has made a study at home and abroad of methods of equipping and operating railroads with a view to lessening accidents. Though accidents are not so frequent upon the railroads of England as upon those of the United States, the difference is probably less striking than has been claimed. Accurate conclusions can be reached only through a marshaling of figures with more attention to character of traffic and a more thorough study of the subject than any yet made.

At all events to be close to the scene of the catastrophe of last June on the London and Southwestern railway and to read from day to day in the English papers of accidents at one and another place upon different roads had a tendency to shake any belief that it is absolutely safe to ride upon railroads in England.

In one respect, however, the English practice is superior to our own, and that is in the uncompromising character of the laws against trespassing upon railroad premises and the rigid way in which these laws are enforced.

The public supervision of railroads in England has produced marked results in securing a roadbed and equipment in every way perfected for use before that use is permitted. This means increase in cost and delay in completion, but the end justifies both. In this state the extension of railroad lines almost wholly ceased many years ago. It is with satisfaction, however, that we can refer to the recent extension of the Needham branch of the New York, New Haven & Hartford system as one which upon inspection fulfilled every requirement in construction and equipment before it was opened to travel.

Block signals are practically in universal use upon the English railroads; on main lines the block telegraph system and on branch lines either the block telegraph and electric staff systems combined or the electric train tablet system. The driver of an engine is allowed to pass the distant signal when showing red, though he must stop when the home signal shows red. This distinction between two signals showing the same color, in our opinion, requires on the part of a driver too great familiarity with localities. A similar use of colors was held objectionable by the Board in its review of the Baker Bridge case. The rule then recommended and since adopted by the company is that red should always mean danger and call for a stopping of the train.

An examination of the signals found upon our own railroads where thorough work has been attempted, proves that there is no need of adopting foreign fashions in respect to these safeguards. Upon the Pennsylvania and the Central Railroad of New Jersey between Jersey City and Philadelphia, on the Hudson River division of the New York Central, and in places upon the railroads within this state there are block signals of the highest order of excellence.

The work before our companies is that of a complete installa-

tion of these signals upon all lines of track. The recent order of the board upon this subject reads as follows:

1. The ultimate end to be secured is the installation of some approved form of block signals upon all steam railroad lines within the state at as early a day as may be practicable. This means a substantial outlay by railroad companies in the immediate future.

2. The order in which block signals should be installed must have reference to both amount of traffic and physical conditions. Of first importance is the equipment of lines of railroad embracing two or more tracks, or presenting the conditions of a single track carrying a large amount of traffic and involving heavy grades and sharp curves. Local conditions may, of course, demand at particular places early equipment out of the usual order.

3. Companies are requested to submit to the Board on or before the 15th day of this month (December), a brief description of the block signals now in use upon their several lines within the state, together with an explanation of such action as has been taken in either actually equipping these lines or in making arrangement for their future equipment with block signals, since the first day of January, 1906.

The Board has selected no particular type of signal as the only one which it will approve and has not declared a preference in every instance for an automatic rather than a manual control, for the reason that between most approved types of either class there is no such marked superiority as would warrant such arbitrary action.

The effort to eliminate human infirmity as a contributing factor to railroad accidents has led to the invention of automatic devices intended to overcome any mistake of those in charge of the movement of trains; as, for example, the omission to notice or obey signals. While much has been accomplished in this direction that has been productive of good results, automatic safeguards of this character are as yet in an experimental stage. At the same time the great importance of lessening the number of accidents due to the failure of some human agency, ought to insure a most thorough and unprejudiced testing of all inventions which seem to have substantial merit.

FIRE EXTINGUISHING APPARATUS.

The Board is of the opinion that companies ought to provide trains with some kind of fire extinguishing apparatus. In accordance with our usual practice no particular kind has been designated, companies having been asked to present for approval on or before the first day of May, 1907, such devices for extinguishing fires as they may desire to use, the intervening time affording opportunity for further inquiry as to the merits of different inventions.

New Cars from the Middletown Car Works.

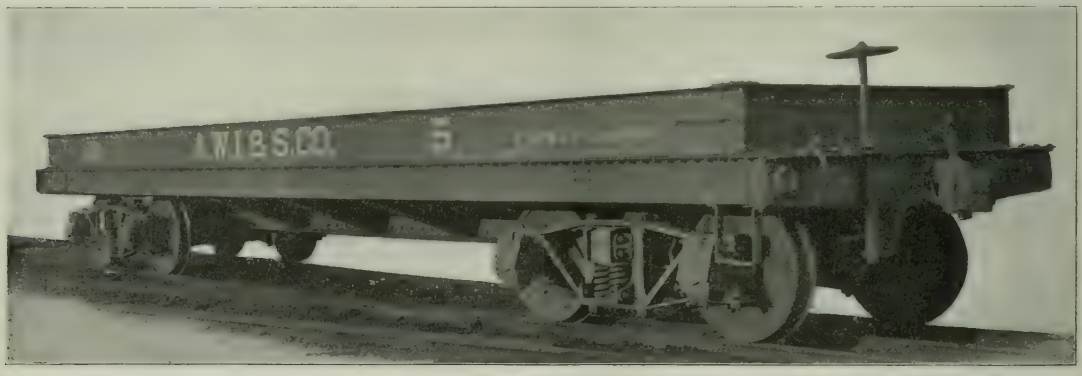
Among the recent cars turned out by the Middletown Car Works are the first of an order for a number of 40-ton wooden flat cars for the Philippine Railway Co. to be used by the contractors, J. G. White & Co., in building the new lines in the southern islands, and some low side steel gondolas for the Alan Wood Iron & Steel Co.

The Philippine Railway flat cars are narrow gage, 3 ft. 6 in., and are 35 ft. long over end sills, 8 ft. 3 in. wide and 3 ft. 7½ in. high from top of rail to floor. They are built entirely of wood except the built-up steel body bolster. The trucks have 30-in. wheels, double I-beam bolsters and channel spring planks.

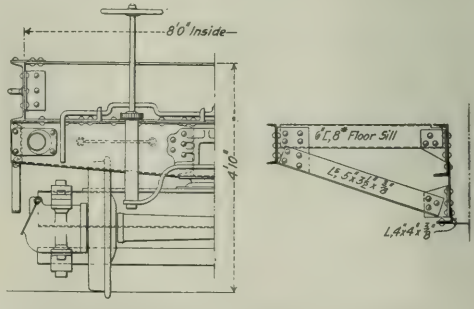
The steel gondolas have underframes somewhat similar to the underframe of the steel gondola for the Newburgh & South Shore illustrated in our issue of December 21, 1906. The principal differences are in the make-up of the fish-belly center sills and the details of the cross-bearers. In the car here illustrated the center sills are made up of a 13-in., 32-lb. channel, a ¼-in. web plate 14 in. deep, and a 4-in. x ⅜-in. bottom flange angle. This angle extends only along the straight bottom edge of the web plate and is not carried up along the beveled ends to the bolsters. The floor plates



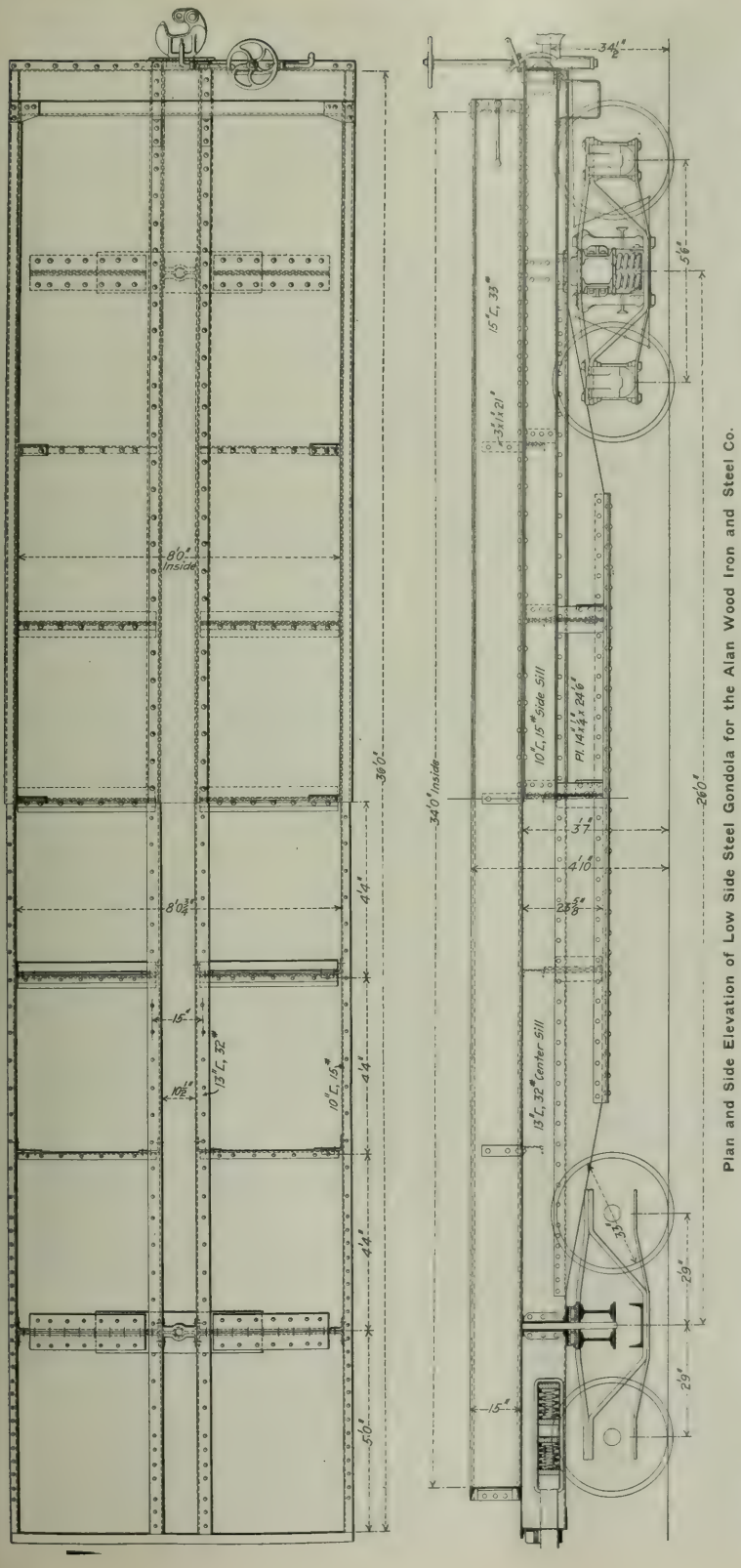
40-Ton Narrow Gage Flat Car Built by the Middletown Car Works for the Philippine Railway.



Low Side Steel Gondola Built by the Middletown Car Works for the Alan Wood Iron & Steel Co.



Half End Elevation and Detail of Cross Bearer.



Plan and Side Elevation of Low Side Steel Gondola for the Alan Wood Iron and Steel Co.

of the car are made in two pieces and are riveted on the top flanges of the side and center sills. The gap over the center sills is covered with a strip or top cover plate riveted on top of the floor sheets. A corresponding bottom cover plate extending the length of the bottom flange angles forms a box girder of the center sills. The cross-bearers instead of being continuous angles bent to shape and passing under the center sills are made up of short pieces of 5-in. x 3½-in. x ⅜-in. angle iron riveted to angle brackets attached to the side and center sills. A short piece of 6-in., 8-lb. channel riveted to similar brackets supports the floor sheets and forms the top member of the cross-bearer. The bolsters are built up around the center sill channels with a ¼-in. web plate and four flange angles. The bottom cover plate which passes under the center sills is crimped at the ends to form the body side bearings. The body of the car is formed by 15-in. channels with flanges out. The car is mounted on diamond trucks with double I-beam bolsters and 33-in. wheels.

We are indebted to Mr. Geo. I. King, Vice-President and General Manager of the Middletown Car Works, for the illustration.

Experience with Electric Traction in London.

At two recent railroad meetings in London the following remarks were made about electrification experience:

Mr. A. L. Stride, addressing the London, Tilbury & Southend shareholders, said he was sorry to say that electric working was more expensive than steam. All the companies that had adopted it were much disappointed, as compared with the estimates of cost previously made. Electric traction, however, was in its infancy, and every day its cost was being reduced, but it was not yet down to anything like the cost of steam traction. Especially at the switches and crossings, the electric rolling stock cut the rails much more than any that had been run with steam traction. On the District Railway they had now laid some hardened steel rails which did not much exceed other rails in cost to meet this difficulty.

Sir Charles McLaren, as chairman of the Metropolitan Company, remarked that the life of the rails on the electric system was much less than it was under steam; indeed, the rails were actually pared away by the wheels, and many parts of their line had had to be relaid with rails of extraordinary hardness, which had added much to the expense. Electrification was undertaken under pressure from the traveling public and the stockholders, but the means of transit in London had since increased enormously, and competition had been very trying. Yet if they had not adopted electric traction when they did they would have been far worse off even than now they were. Sir Charles further remarked that they were very much in the dark as to what the maintenance and depreciation charges on the electric plant and rolling stock would be.

The Shan-tung Railroad (German) in China, 271 miles, in 1905, the first year since its completion, had a train movement amounting to 447,834 miles, equivalent to 2¼ each way daily. Substantially all the trains carried both freight and

passengers, except the work trains. The average train contained about 16 cars, of which about 10 were freight cars. The number of passengers carried was 803,527, of whom 95 per cent. were third class passengers and only ½ per cent. first class. The average distance traveled was 43 miles, and the whole passenger movement was equivalent to 174 persons each way daily over the whole length of the road. The total shipments of freight were 341,530 tons, with an average haul of 111½ miles, equivalent to a daily average movement of 192 tons each way over the whole length of the road. Of the freight tonnage, 51 per cent. was coal (173,926 tons). Beans formed much the largest other item. The gross earnings were $1,912,295 Mexican, equal to $956,148 gold, or $3,528 per mile of road. Sixty-eight per cent. of the earnings were from freight. The working expenses absorbed 47.6 per cent. of the earnings, leaving net $1,849 per mile. The number of employees was 619, which is only 2.3 per mile of road. The number of Europeans was 58, and all the others were Chinese.

Collisions Prevented by Block Signals.

Below is the substance of a report made not long ago to the General Manager of a railroad at the end of its fiscal year showing cases of accidents prevented by the automatic signals on the road in one year. It covers the performance of about 300 miles of automatic block signals on single track, the number of signals being, in round numbers, about 400. It will be noted that 13 butting collisions were prevented. Lives were saved, no doubt, as the line is on one of the busiest single-track lines in the country.

REPORT.

"Herewith list showing accidents prevented by automatic signals since June 30, 190—, including 13 cases of possible butting collisions. We think this makes a good showing and have no doubt other accidents have been prevented, without the facts becoming known. We think this the best argument in favor of the policy of the management to instal safety appliances, and automatic block signals in particular. It has cost, in round numbers, for the maintenance of the automatic signals alone, $50,000; or, including new work, $75,000. At a conservative estimate, considering the local conditions of topography at places where head-on collisions would have occurred without the automatic signals the damage would have been $15,000 per accident; so that the automatic signals have saved $120,000 on account of head-on collisions prevented. We have not kept a record of the rear end collisions that might have occurred but for the use of automatic signals.

"You will note in the list several cases of facing point switches having been left open in the face of passenger trains, and the fact being made known by the automatic signals. We have not taken into account the cost of these possible accidents."

Accidents Prevented by Automatic Signals—Twelve Months.

Date.	Train.	Signal.	Cause.
Sept 30.	No. 2.	263-2	Switch at London standing open
Sept	" 53.	121-2	No. 53 making too close time, met No. 6; had no order against No. 6; No. 6 stopped by block, backed up over east switch at Hawe and let No. 53 in.
	" 6.		
Oct. 24.	" 5.	198-1	Broken rail in track.
Oct. 31.	" 3.	211-1	Cross-over switch open.
Nov. 3.	" 23.	184-1	Broken rail in track.
Nov. 24.	" 3.	194-1	Cross-over switch open.
Nov.	X 1146 East.	125-1	No. 46 failed to have orders.
	No. 46.		
Dec. 8.	" 1.	301-1	Broken rail in track.
Dec. 17.	" 1.	304-1	Broken rail in track.
Dec.	" 32.	151-2	No. 32 at Berlin, end of double track, time order up over No. 35—started to pull out; signal No. 151-2(slotted signal) held train; No. 35 came into Berlin while No. 32 was held by signal. Operator asked for release of signal of despatcher, but was refused.
	" 35.		
Jan. 16.	" 5.	328-1	Draw open on bridge.
Feb. 11.	" 1.	328-1	Draw open on bridge.
Feb. 21.	" 1.	77-1	Bolt wedged in switch point.
Feb. 27.	" 1.	233-1	Broken rail in track.
Mar.	" 54.	175-2	Met between stations: lack of orders.
	X 900 East.	174-1	
Mar.	No. 46.	174-2	Met between stations; No. 46 failed to have
	X 1001 East.	173-1.	orders.
Mar	No. 54.		Met between stations; X 1100 failed to have
	X 1100 East.		orders.
Mar.	No. 96.	125-1.	Meeting point. First to meet at Paris; this
	X 1050 East.	126-2	changed to Cherbourg. Operator at Havre "busted" wrong order. X 1050 started to Paris; stopped by signal; No. 96 flagging block, flagmen met between blocks.
	No. 36.	135-1	X 950 failed to have orders.
	X 950 East.		
	No. 3.	123-1	2d. No. 46 doubling into Manhattan; imperfect flagging; signal stopped No. 3.
	2/46		
May 21.	No. 44.	184-1	No. 44 had no orders; X 925 had orders over
	X 925 East.	186-2	No. 44; flagmen met about center of block.
	No. 31.	149-1	No. 31 ahead of time, running extra; No. 54 had right of track over them to Alaska; No. 31 flagged 149-1, preventing their side-wiping No. 54.
———	No. 31.	135-2	Extra engine flagged 135-2; No. 31 coming in to station; confusion of orders due to change from night to day office; No. 31 did not have right order.
June 22.*	No. 44	121-2	No. 44 flagging block met X 913 and stopped
	X 913 East.		them; No. 44 had orders to use eastbound track; X 913 had no orders.

*On double track.

Captain George J. Grammer.

The following estimate of the late Captain Grammer, Vice-President in charge of freight traffic of the New York Central Lines, comes to us from two of his fellow officers:

Humanity consists, generally speaking, of two classes of people, "types" and "individuals." Those who belong to the class of those who may be termed "types" perform their life's work along set lines and according to fixed and predetermined rules; their personality is merged in the monotonous sameness of the innumerable class to which they belong, and their identity is minimized to the point of effacement. Even when successful, their lives have little effect on current events, and their impressions on their friends and associates are vague and indefinite. When they pass from the field of active work, the ranks close up, the vacancy is filled, and the march of events continues undisturbed and without interruption.

All men, however, are not types. This great country of ours, with its newness and its uncounted opportunities for development, has produced individuals, men who think for themselves along lines of original thought and act for themselves along lines of independent action; men who lead their own lives, think their own thoughts and perform their own deeds; guided in their judgment of right or wrong only by their own consciences, and governed in their relations to their fellow-men by the rule which permits them to do to others only those things which it is their desire to have others do to them.

Of this class of men Captain Grammer was the highest; as original in his thoughts as though he was the first thinker; as positive in his convictions as though the universe depended upon the impregnability of his positions. No question was too great for his mind to settle as his intellect deemed it should be settled, and no incident was too small to demand the concentration of his entire force, both mentally and physically, to bring about its adjustment in the manner which he thought proper.

Like all men of great individuality, Captain Grammer was intense in his emotions of love and friendship. His love for his family amounted to idolatry, but only in its nature exceeded the affection in which he held his friends. Every exaltation and success which came to him in business life, but seemed to draw tighter the bonds of family love which bound him to the circle of his immediate relationship, and the lapse of years seemed but to mellow and ripen the friendship in which he held his companions and associates of earlier days, while in the capacious depths of his great heart he appeared to have not only room but intense appreciation for those who came later into his life.

One of the strongest characteristics of Captain Grammer's individuality was his intense dislike for anything which savored of red-tape or circumlocution. His clear, vigorous and active mind, which carried him at once to the heart of any proposition under discussion, rendered intolerable to him any roundabout or devious methods of performing any work or arriving at any conclusion. As the straight line is the shortest distance between two points, so Captain Grammer's mind suggested to him the quickest and most expedetious methods of performing the duties to which he applied himself.

It was this feature of Captain Grammer's individuality which brought into play his well-known use of the illustrative story or incident, a characteristic exceedingly familiar to all who have been at any time associated with him. Captain Grammer was not a story-teller in the general sense of that term, although one could not be with him on any occasion for any length of time without hearing him make use of one or more illustrative stories. These stories always related to the subject under discussion, and were used as a short cut to the conclusion which Captain Grammer reached and to which he desired to carry his listeners. Captain Grammer's memory was stored with countless numbers of these, accumulated during a lifetime which in even its all too short duration embraced a period and covered a territory as interesting and strenuous as was ever allotted to any man. The effective use of these stories will be long remembered not only by those who happened to be on the same side of the discussion as Captain Grammer, but by his many times discomfited opponents.

Captain Grammer's expert knowledge was not confined to railroad matters; he kept familiar with the details of trade conditions all over the country. From his own sources he gathered statistics showing the condition of crops and the probable grain yield, etc., for all sections of the country, and tabulated them in advance of the government reports; his conclusions were surprisingly right. He always took a leading part in meetings of railroad officials, because, aside from the value of his detailed information, he had an analytical mind and naturally expressed himself easily.

In all men will be found many varying qualities of different degrees of intensity. In Captain Grammer's nature the quality of justice seemed to outweigh all other virtues. As he demanded justice for himself and the interests he represented, so he demanded from himself and from the interests of which he was in charge justice to those with whom he occupied business relations, whether

the relations were those of friend or foe. From that grand character which Captain Grammer built up for himself during a life of trials, temptations, failures and successes, the element of injustice was absolutely omitted.

It was this spirit of fairness and justice which made service under Captain Grammer such a delight to all of his subordinates, and especially to the young men desirous of following in his footsteps and emulating his successful career. To these young men credit was given where credit belonged, and "each tub was expected to stand on its own bottom." Captain Grammer's policy of sticking fast to the old tried and true employee, while at the same time giving the young man an opportunity of showing what he could do, resulted in his surrounding himself with a staff of associates who served him loyally as their chief, loved him as their friend, differed with him when the independence of thought which he had inculcated in them suggested it, and through it all believed in him with all their hearts, trusted him with all their strength and rested confident in the faith that their duties properly performed would bring them the reward to which their merits entitled them.

As a stone dropped into still waters disturbs the surface and sends the waves sweeping across the lake until they fade into the indefinite distance, so the removal from active life of a man like Captain Grammer disturbs the lives of his friends and associates, and the effect of his death sweeps across the years and touches all who have at any time come in contact with him. He will not be remembered as a type of the citizen produced by this country following the Civil War, and he will not be remembered as a type of railroad man produced by the conditions prevailing during the closing years of the nineteenth century, but as long as men love to revere the memory of those who have done great things, thought greater thoughts and dreamed the greatest of dreams, so long will they remember Captain Grammer, the individual.

Government Accident Bulletin No. 21.

The Interstate Commerce Commission has issued accident bulletin No. 21, embodying its report of railroad accidents in the United States during the three months ending September 30, 1906. The number of persons killed in train accidents was 267, and of injured, 3,891. Accidents of other kinds bring the total number of casualties up to 19,850 (1,182 killed and 18,668 injured). These reports deal only with (*a*) passengers and (*b*) employees on duty.

TABLE NO. 1. *Casualties to Persons.*

	Passengers.		Employees		Tot'l persons reported	
	Kil'd.	Inj'd.	Kil'd.	Inj'd.	Kil'd.	Inj'd.
Collisions	27	971	115	1,030	142	2,001
Derailments	25	918	80	577	105	1,495
Miscellaneous train accidents	..	19	20	376	20	395
Total train accidents	52	1,908	215	1,983	267	3,891
Coupling or uncoupling	..	....	81	942	81	942
While doing other work ab't trains, etc	..	....	73	4,432	73	4,432
In contact with overhead bridges, etc	3	15	32	397	35	412
Falling from cars or engines or while getting on or off	42	572	189	3,026	231	3,598
Other causes	13	803	482	4,590	495	5,393
Total, other than train accidents	58	1,390	857	13,387	915	14,777
Total, all classes	110	3,298	1,072	15,370	1,182	18,668

The totals in Table No. 1 continue large. In some few details there are small decreases from the corresponding quarter one year ago, but in general there is no improvement. The causes of the great losses of life and property here shown have been repeatedly discussed in preceding bulletins. The number of passengers killed in train accidents (52 in this quarter) is large, though it includes the results of only three particularly notable cases, namely, collision No. 28 and derailments 10 and 12. The comparison with Quarterly Bulletin No. 17 (a year ago) and also with Bulletin 20 shows the following numbers killed:

	Bulletins No. 21.	No. 20.	No. 17.
1. Passengers killed in train accidents	52	27	43
2. Passengers killed, all causes	110	81	122
3. Employees killed in train accidents	215	167	229
4. Employees killed in coupling	81	68	74
5. Total pasgrs. and employees killed, all causes	1,182	933	1,053

TABLE NO. 2.—*Collisions and Derailments.*

	No.	Loss.	Persons Killed.	Injured.
Collisions, rear	424	$388,807	40	463
" butting	257	428,762	59	703
" trains separating	183	92,787	4	83
" miscellaneous	1,027	464,684	39	752
Total	1,891	$1,375,040	142	2,001
Derailments due to:				
Defects of roadway, etc.	318	$255,625	14	353
Defects of equipment	808	620,360	19	224
Negligence of trainmen, signalmen, etc	118	138,830	19	157
Unforeseen obstruction of track, etc.	93	146,814	17	279
Malicious obstruction of track, etc.	18	26,924	5	19
Miscellaneous causes	426	368,967	31	472
Total	1,781	$1,557,720	105	1,495
Total, collisions and derailments	3,672	$2,932,760	247	3,496

Following is the usual list of Class A train accidents—mostly cases in which the damage is reported at $10,000 or over:

TABLE 2a. *Causes of Forty-five Prominent Train Accidents (Class A).*

[NOTE.—R. stands for rear collision; B., butting collision; M., miscellaneous collisions; D., derailment; P., passenger train; F., freight and miscellaneous trains.]

COLLISIONS.

No.	Class.	Kind of train.	Killed	Injured	Damage to engines, cars, & roadway.	Reference to record.	Cause
1	R.	F. & F.	2	2	$440	86	2 passengers killed in freight caboose. Train standing at station (1 a. m.) with indistinct tail lights.
2	M.	P. & F.	0	0	600	15	Collision at crossing; signalman disconnected interlocking so that signals could be set clear for both roads at the same time and went out for a social evening; while he was gone, yardmen disobeyed his verbal instructions not to enter upon the crossing.
3	B.	F. & F.	1	16	2,300	45	Conductor of work train failed to arrange for flag protection; 16 laborers injured.
4	R.	F. & F.	0	0	2,535	78	Block-signal operator became confused and gave false clear signal; engineman approached station, disregarding rule to run under control.
5	R.	P. & F.	0	3	2,700	53	Flagman mistook whistle signal to go out, interpreting it to mean come in.
6	R.	F. & F.	0	1	3,000	4	Automatic block signal showed clear falsely; cause not discovered, but believed to be residual magnetism due to lightning.
7	R.	P. & F.	2	6	3,045	64	Wrong signal given at interlocking. See note in text below.
8	B.	F. & F.	0	4	3,113	99	Extra train, waiting on side track for two trains, started out after passing of one train; had answered whistle signal of passing train.
9	R.	F. & F.	7	16	3,420	61	Fast Running under permissive block signal. See note in text.
10	B.	F. & F.	2	3	3,600	51	False clear block signal. See note in text.
11	R.	F. & F.	1	2	3,700	57	Occurred 3 a.m. signalman at B. (3 months' experience) gave false clear signal; the signalman at C, a man of 6 months' experience, claims that he told B to give a permissive signal; flagman of leading train was killed while sitting in his caboose.
12	B.	F. & F.	0	4	3,700	97	Operator, with 4 train orders in his possession, delivered wrong one to a conductor; had sent conductor's signature to despatcher before train arrived.
13	B.	F. & F.	1	2	3,720	6	Butting collision of extra trains; despatcher (4 years' experience) forgot both and sent meeting orders to neither.
14	M.	F. & F.	0	2	3,930	41	Cars broke away from rear of train and ran back down grade. See note in text.
14*a*	B.	F. & F.	0	2	3,980	89	Error in order; despatcher sent it "Right over 27." Operator, 20 years 9 months of age, copied it "Right over 25," and despatcher did not detect wrong repetition.
15	B.	P. & P.	2	5	4,200	80	Mistake in order; receiving operator omitted two words, and despatcher failed to check the error in the repetition.
16	R.	F. & F.	2	0	4,900	90	Inefficient flagging; train approached station not under control; men on leading train on duty 22 hours; on following train, 19 hours.
17	B.	F. & F.	0	1	5,013	55	Continued trip after losing right to road by being 12 hours late; engineman 1 month in the service; conductor, 4 months.
18	M.	F.	1	2	6,500	46	Train parted; rear portion ran into forward; 32 cars in train, only 10 air-braked. Conductor entrusted making up of train to brakeman; this brakeman killed.
19	R.	P. & P.	3	36	7,035	95	Failure of air brakes. Angle cock closed in middle of train. Report says cause unknown.
20	B.	F. & F.	0	0	7,880	54	Engineman overlooked meeting order. See note in text.
21	B.	F. & F.	1	5	10,000	60	Mistake in writing name of station in train order. Operator (experienced) cannot explain.
22	M.	P. & F.	4	35	11,000	91	Freight train switching on main track on time of passenger train.
23	B.	F. & F	1	2	12,600	13	Engineman, southbound, overlooked meeting order; conductor slow in applying brakes.
24	M.	P. & P.	2	3	12,750	81	Passenger train on siding drifted out onto main track while engineman was reading orders; train struck by express train passing in same direction.
25	M.	P. & F.	0	3	12,800	79	Freight train on siding broke in two; 14 cars ran back down grade. Conductor and brakeman tried to stop cars, but brakes were defective.
26	B.	F. & F.	7	1	13,150	92	Engineman ovedlooked orders; engineman and conductor killed. A brakeman called engineman's attention, but while he read order to verify brakeman's assertion, collision occurred.
27	M.	F. & F.	0	0	13,600	94	Collision at meeting point; southbound approached not under control. See note in text.
28	B.	P. & F	17	56	14,500	12	Confusion of orders. See note in text.
29	B.	F. & F.	2	5	15,000	3	Conductor, engineman and flagman forgot meeting order. Flagman had

No.	Class.	Kind of train.	Killed.	Injured.	Damage to engines, cars, & roadway.	Reference to record.	Cause
							signed for conductor; conductor asleep in caboose at time of collision.
30	B.	F. & F.	2	4	16,083	8	Misinterpretation of orders; conductor and engineman, on duty 18 hrs.; used main track until 9:30 when order gave them only till 9.
31	B.	F. & F.	0	0	16,835	87	Train stalled 35 mins. failed to flag; men on duty 14 hrs. 35 mins.
32	B.	F. & F.	3	5	29,200	98	Conductor and engineman of extra train overlooked regular.
Total.....			66	226	$256,529		
				DERAILMENTS.			
1	D.	P.	0	7	$2,600	35	Misplaced switch; switch tender having several switches to watch, forgot this one; on duty 18 hrs, the yard being short of men.
2	D.	F.	0	1	4,050	33	Passenger car and 9 freight cars ran away down steep grade; conductor and brakeman carelessly left cars with hand-brakes not properly set.
3	D.	P.	0	12	5,100	20	Track out of gage ½-in.; engine swayed so violently as to break a splice bar. Sped, 50 miles an hour; center of boiler 9 ft. 6 ins. above rail.
4	D.	F.	0	3	5,700	105	Freight cars ran back down 3 per cent. grade; brakeman neglected to set enough hand brakes.
5	D.	P.	0	32	6,000	106	Washout; 5:45 a.m.; section foreman blamed for not going out promptly in storm.
6	D.	P.	2	4	7,000	115	Open draw; engineman (good record) killed.
7	D.	P.	0	36	8,200	102	Ran into burning trestle bridge, 6:50 a. m.; fire probably set by spark from a locomotive.
8	D.	F.	2	2	8,780	34	Runaway on steep grade; engineman lost his head and did not recharge air reservoir.
9	D.	F.	0	0	11,600	21	Bridge knocked down by boom of steam shovel.
10	D.	P.	7	40	18,265	23	Excessive speed. See note in text.
11	D.	P.	5	60	38,000	108	Pile bridge weakened by high water; bridge rebuilt in 1904; 17½ ft. high, spans 15 ft.
12	D.	P.	9	43	57,300	101	Misplaced switch; switch light not burning, having been extinguished by high-wind; train approached at 60 miles an hour.
Total.....			25	240	$172,595		
Grand t'l..			91	466	$429,124		

Collision No. 28, the worst in the list, killing 17 persons, was between an eastbound passenger train and a westbound freight. The collision occurred between R and H (H being six miles east of R). At R the night operator held an order for the passenger train to meet the freight at R, but while he was outside of his office with this order, intending to deliver it to the men in charge of the passenger train, the day operator, who had gone off duty a short time before, went back into the office and, hearing a call from the despatcher, took an order annulling the one which had been carried out. This order would have the effect of permitting the train to proceed, but without waiting for the final approval ("complete") of the despatcher, which, under the rule, is absolutely necessary before it is permissible to act on an order, he shouted through the window to the operator outside to permit the train to proceed. This was done, and the train went on to its destruction. The westbound train had, meanwhile, passed H, because the original order, to meet at R, as delivered to that train, was still in force.

The operator who recklessly allowed the eastbound train to proceed on the authority of an order which had not been approved was 21 years old, and had been in the service of the company over four years.

Collision No. 7 occurred at about 10 p.m., and was due to confusion at an interlocking tower on a four-track line. A locomotive (without train) approaching on the eastbound passenger track was to have been diverted to the freight track, and (after the engine had stopped) the switches and signals were so set. After the engine started the leverman began to set the signals and switches for a following passenger train (approaching on the same passenger track), but acted so quickly that he threw the cross-over switch before the empty engine reached it, though it had passed the signal. The engineman, seeing the mistake, stopped; but knowing the passenger train was due he started ahead again slowly, thinking the signal was meant to direct him to proceed to the limits of the interlocking. The leverman then signalled the engine to stop, and immediately followed this with a signal to set back. The engineman, not being satisfied with this, whistled for signals again. He was then given a violent signal to back up, the leverman believing the engine to be on the freight track, to which he supposed it had crossed. The engineman started to back his engine, but just then saw the passenger train approaching at a high speed. He reversed his engine, starting it in the same direction as the passenger train was running, and by so doing lessened the shock of the collision considerably, though the passenger train was running about 50 miles an hour when it struck. Both the leverman and the signalman (his superior) were men of experience, but both of them thought that the empty engine passed the tower on the freight track.

Collision No. 9 in which a work train, not in motion, was run into at the rear by a following freight train, killing seven and injuring 12 of the workmen on the work train, was due to the excessive speed at which the freight train was running. The work train had stopped to take water and the freight train had been allowed to proceed into the block section under a permissive signal, which required the engineman to run at a rate of speed sufficiently low to avoid the possibility of colliding with any standing train; but this requirement was violated. The experience of this engineman was one year eight months.

Collision No. 10 was due to what appears to have been gross carelessness on the part of a block signalman on a single-track line. After giving a clear signal to a northbound train, the train was delayed so that it could not accept and use the signal. The train despatcher then directed the signalman to change the signal to stop, but he did not do so, and the northbound train soon afterwards started and collided with a southbound which had been admitted to the block section under the authority of the train despatcher after he had ordered the change from "clear" to "stop." The signal man absconded immediately after committing this error.

Collision No. 14, occurring at night, was due to a defect in coupling apparatus and to cars being left standing on a steep grade without sufficient hand brakes being set to hold them. A train of 11 cars and a caboose arrived at W., and entered a side track to unload freight. In moving the train back a short distance, the eleventh car became uncoupled from the tenth, and with the caboose behind it ran back down grade five miles to the point of collision. The trainmen were busy unloading freight and did not discover the breakaway until too late to stop the detached cars. The separation of the caboose and express car from the rest of the train was due to the clevis of the lock pin of the coupler of the freight car ahead becoming caught on the buffer of the express car, lifting the pin. The report indicates that the hand brake was set on the caboose, but this was not sufficient to prevent the two cars from running down the grade. The collision wrecked the express car and the caboose, and the wreck took fire. The damage due to the collision and fire together amounted to $3,930.

Collision No. 20 was a butting collision due to forgetfulness on the part of an engineman 21 years old, who had been on duty 39 hours and 25 minutes. He had received a meeting order, but had put it into his pocket without reading it. He ran past the meeting place and struck the opposing train at about 12 miles an hour. This engineman had been in the service four years, having been appointed fireman at the age of 17, and had been an engineman about 10 months. He had been on duty from 11 p.m. on Friday until 2.50 p.m. on Sunday. The conductor, who had been on duty the same length of time, tried to signal the engineman to stop. If, instead of this, he had applied the air-brakes he might have prevented the collision.

Collision No. 27, causing damage to engines and cars amounting to $13,600, was due apparently to extraordinary carelessness in running a heavy freight train down a steep grade, depending entirely on the hand brakes as a means of controlling the speed. It was a southbound freight train. The air-brakes had been made unserviceable by the breaking of the reversing rod of the air-pump on the engine. The conductor notified the train despatcher at A that he should not dare to start for B, the grade being 124 ft. per mile, descending, unless the up freight, which he expected to meet at B, could take the side track (the rule requiring that ordinarily southbound trains should take the siding). The despatcher, who had been on this division only three weeks, at once gave the desired order, and the southbound train proceeded. It consisted of 61 cars, 17 of them loaded. The conductor, two brakemen, and the fireman manned the brakes, but they were unable to control the train, and it struck the northbound train, at about 15 miles an hour, just as the latter was entering the side track at B. The wreck took fire, presumably from the wrecked engine, and the damage was largely due to the fire. The despatcher, who should have ordered the southbound train held until another engine could be procured, which would not have been long, had had 20 years' experience on other roads. The conductor and the engineman of the southbound train, as well as the two brakemen, had had long experience on trains. They had been on duty only a few hours.

Derailment No. 10 occurred on a 10-deg. curve (superelevation 5½ in.) at the exit of a tunnel, and the engine and first two cars fell into a lake, the engine and tender being entirely submerged. A gas tank of the baggage car exploded and set fire to the smoking car, burning several persons. The tender was the first vehicle to jump the track, but as no defect could be found in its wheels or running gear, the conclusion is that the derailment was due to excessive speed. The train was running at about 45 miles an hour. The engineman was killed, his body being found in the cab of the locomotive at the bottom of the lake. Of the other persons killed, three were passengers.

Snow Test of New York Central Motor Car Trains.

The heavy snow storm on February 4 and 5 afforded a good opportunity to test the recently inaugurated suburban electric train service of the New York Central under actual running conditions. The storm began in the morning of February 4 and by night about 4 in. of snow had fallen. A strong wind caused the snow to drift badly. The storm continued during the night and until noon of the next day, when the official records showed a fall of 10.7 in. Rough estimates gave the fall as 12 in. on the level, but the drifts in many exposed places were from 2 ft. to 4 ft. deep. Train service on most of the lines out of New York was delayed from one to three hours on the morning of the 5th.

Within the present limits of the electric zone on the New York Central—below High Bridge, on the Hudson division, and Wakefield, on the Harlem division—the train sheets showed no delays of more than three or four minutes, and these were due to slow working of the interlocking plants, which were kept clear with some difficulty. The electric motor trains ran through on schedule time in every case, and no failures of any kind were reported. As will be seen in the accompanying illustrations from near High Bridge the snow in places completely covered the third rail. The under-running contact shoes, however, cut out a channel under the rail and gave perfect contact. No flanger was run over the road, because the numerous switches below High Bridge make it impossible to keep the blades down on the track for any considerable distance. The performance of the motor car trains in their first encounter with heavy snow was quite as satisfactory in every way as the performance of the electric locomotive on the test track near Schenectady last winter, which was reported in the *Railroad Gazette* February 16, 1906.



Hudson Division near Morris Heights Showing Third Rail Buried in Snow.



Hudson Division North of High Bridge with Snow Up to the Top of Third Rail.

The Lackawanna Fast Freight Service.

The traffic which has been handled by the railroads during the past year and a half has been so great that all facilities have been greatly overtaxed and as a result there have been many serious delays to shipments. New York and Chicago in particular have been congested points where prompt movement has been difficult. The delays have caused great losses and much dissatisfaction among shippers, whose business has often been much interfered with because of them. The modern traffic department works under a different theory from the one in vogue 20 years ago, when rate cutting to secure business was common. To-day the railroads are more than content to maintain a common standard of rates and the competition between different roads is in service and facilities rendered. As an example of the improvement made in the methods of handling the more highly competitive traffic, the fast freight service of the Delaware, Lackawanna & Western is interesting. Its practical results may be judged from the fact that a few years ago the Lackawanna was the seventh road in point of first class tonnage westbound from New York (including other classes of tonnage reduced to a first class basis), while to-day only three trunk lines carry more first class westbound tonnage out of New York.

In developing this fast freight service there have been two distinct aims, first, prompt and regular service, and second, to keep the consignee in touch with the movement of his shipment. The Lackawanna receives through fast freight at any of its various Brooklyn terminals up to 3.30 p.m., and at its New York terminals up to 4.30 p.m. of each day. Instead of designating a particular receiving station for assembling freight for a certain through car, shipments for the various cars are taken at any of the regular stations in New York or Brooklyn. These shipments move westbound in fast freight trains leaving the Hoboken terminal in the evening, and are due in Chicago and St. Louis in 60 hours, or on the morning of the third day. The following is a list of the principal points to which through cars are loaded daily from New York City and vicinity with the schedule time between New York and each point. These schedules are in the majority of cases carried out in actual operation. When there are delays they are seldom of more than a day or two.

Scranton	8 hours.	Columbus	3d morning.
Binghamton	11 "	Cincinnati	3d morning.
Elmira	14 "	Chicago	60 hours.
Utica	17 "	Indianapolis	3d morning.
Syracuse	16 "	Kansas City	4th morning
Buffalo	25 "	Memphis	4th morning
Cleveland	36 "	St. Louis	60 hours.
Toronto	2d morning.	St. Paul	5th morning
Detroit	36 hours.	Minneapolis	5th morning
Toledo	40 "	Rochester	36 hours.
Milwaukee	4th morning	San Francisco	13 days.

The movement of shipments to destination is followed up by the traffic department. Consignees are advised in advance of the forwarding of their freight, name of shipper, number of packages, commodities and weight. Thus they know when to expect their shipments and have at hand the necessary facts for tracing in case of delay. Report is made to the freight agent in charge at New York of the important facts about the movement of all fast freight shipments, including the time of arrival at Chicago, the time of placing at the Chicago transfer freight house and the time of forwarding by connecting lines.

A number of different fast freight lines are operated over the Lackawanna. They are the Lackawanna Line, which runs over the New York, Chicago & St. Louis (Nickel Plate), the Lackawanna-Grand Trunk Line, the Wabash & Lackawanna Despatch, the Lackawanna-Pere Marquette Line, the Lake Shore-Lackawanna Line and the Michigan Central-Lackawanna Line. Freight is shipped by the line which best covers the routing of the shipment. There are three through fast freight trains westbound daily. No. 51 leaves Hoboken at 7 p.m. and runs to Port Morris, which is about 50 miles west of Hoboken, carrying both through fast freight for points west of Buffalo, and for points east of Buffalo. Port Morris is the junction point where through New England freight is received from the New York, New Haven & Hartford over the Poughkeepsie bridge, Central New England and Lehigh & Hudson River. At Port Morris No. 51 is broken up into two sections, the first carrying through freight from New York and New England to points west of Buffalo, the second carrying freight from New York and New England for local points along the Lackawanna lines like Scranton, Binghamton, Elmira, Syracuse, Oswego and Utica and other New York State points. Two other fast freights leave Hoboken a little later in the evening, first No. 53 at 8.30 and second No. 53 at 8.40. These both run through solid to Buffalo, carrying through fast freight for points west of that gateway. At 10.30 No. 55 leaves Hoboken, carrying fast freight for Buffalo and intermediate points on the Lackawanna. First No. 51 is due at Buffalo at 4.20 the next afternoon and first No. 53 twenty minutes later, making 20 hours and 10 minutes as the running time between Hoboken and Buffalo of first No. 53. At Buffalo the through cars are distributed to the different connections and forwarded to western points.

In order to insure prompt movement of cars the agent at New York mails a list each morning to the agents of the different fast freight lines at Chicago, for instance, of all cars which moved westbound the night before from Hoboken for Chicago. This notice reaches the Chicago representatives of the fast freight lines in time for them to notify local agents to look out for and give special attention to the movement of the fast freight cars on the list. On arrival at the different junctions near Chicago, the train is broken up and the cars sent to the transfer freight stations of the different western roads by special delivery; that is, by special switch engines which begin switching at once without waiting for other cars. This, in the case of l.c.l. freight, saves much time over handling between stations by team transfer. Not only is the time of delivery to the western connection reported to the agent of the Lackawanna in New York, but the time at which the car has gone forward on that road, or in the case of l.c.l. freight the time at which the foreman of the transfer station of the western road reports that the car has been distributed and the freight loaded for western points. Thus a prompt and complete record of fast freight movement is constantly at hand at the eastern traffic headquarters. By means of reports from the operating department of the home road and from the agents at Chicago it is possible for the New York agent to locate delays in movement of cars at any point up to and including Chicago, and to take prompt action toward preventing their repetition. For instance, by the report of deliveries to Chicago connections and forwarding of cars by them a congestion of cars at the terminal of any one of the western roads is at once evident by the slower forwarding of shipments by that line.

By means of the prompt movement of cars obtained by these methods it has been possible for the Lackawanna to compete for shipments to points not formerly considered to be in its territory. At least one car is loaded daily for Memphis, Tennessee. This is sent by way of the Nickel Plate to Continental, Ohio; the Toledo, St. Louis & Western (Clover Leaf), to Neoga, Ill., and the Illinois Central to Memphis, thus avoiding the congested territory of the Cincinnati, Louisville and Evansville gateways, where under present conditions a delay of 40 hours can be counted on. In this way cars can be delivered in Memphis the fourth morning. There is also the opportunity to accommodate the service to the traffic. The road has a standing offer to put on a through car to any point for which the daily shipments average 10,000 lbs. A through car to Minneapolis over the Illinois Central and Minneapolis & St. Louis has recently been put on because daily shipments came up to the required minimum.

The congestion of traffic brings up many problems for the railroad man but none more important both for successful operation of the railroads and the good will of patrons than the prompt and regular movement of freight from shipper to consignee. The experience of the Lackawanna in developing this fast freight service shows what can be done toward accomplishing these results.

Lower Passenger Rates on Italian Railroads.

Beginning with Nov. 1, 1906, the passenger rates on the Italian State Railroads have been materially lowered. Instead of a fixed rate per kilometer, differential rates based on a division of the distance traveled into zones or groups have been established. This is similar to the scheme followed in Sweden, Norway, Russia, and especially in Austria.

The new tariff for passengers is as follows:

For a distance of:	Class—First.	Second.	Third.
93.8 miles	$3.85	$2.70	$1.75
124.2 "	4.82	3.37	2.18
186.3 "	6.70	4.66	3.01
248.4 "	8.40	5.76	3.71
310.5 "	9.90	6.66	4.26
372.6 "	11.20	7.36	4.67
434.7 "	12.20	7.96	5.07
496.8 "	12.95	8.51	5.46
552.9 "	13.60	8.96	5.76
621.0 "	14.20	9.36	6.01
683.1 "	14.80	9.76	6.26
745.2 "	15.40	10.16	6.51
807.3 "	16.00	10.56	6.76
869.4 "	16.60	10.96	7.01
931.5 "	17.20	11.36	7.26
962.5 "	17.50	11.56	7.36

Each distance zone is subdivided into 5, 10 and 20 km., varying with its distance from the starting point, for the purpose of proportioning the rate to the exact distance. Tickets are good for as many days as there are kilometers in the journey. Stop-overs are allowed as follows: For 300 km., one; for 600 km., two; for 90 km., four, and for distances over 1,000 km., five. To show the difference between the former and the present passenger tariffs the following will serve for illustration:

Lower Passenger Rates on Italian Railroads.

	Distance, miles.	Former rate. Class—First.	Second.	Third.	Present rate. Class—First.	Second.	Third
Turin to Rome	408.6	$16.80	$11.76	$7.64	$11.88	$7.72	$4.95
Naples to Verona	496.8	20.42	14.30	9.28	12.95	8.51	5.50
Milan to Naples	549.0	22.56	15.80	10.26	13.56	8.94	5.71
Modane to Brindisi	739.0	30.17	21.29	13.81	15.34	10.20	6.46
S. Eufemia to Pontedra	804.8	32.39	22.63	14.73	15.82	10.48	6.71
Palermo to Iselle	1,057.6	43.47	30.43	19.76	17.50	11.56	7.36
Gigenti to Modane	1,110.3	44.37	31.05	20.17	17.50	11.56	7.36

The Territory of the Alaska Central Railroad.

BY A. S. ATKINSON.

The enormous growth of Alaska in the last few years is beginning to be reflected in its railroads, which are pushing across seemingly impassable country, fording rivers and marshes, and climbing mountain ranges. If we include the Alaska Midland, which is projected to run from Valdez to the Seward peninsula, there are more than 2,000 miles of railroads projected in Alaska and nearly 300 miles in operation. The Alaska Central is to be 400 miles long, from Seward to Atwood. It has 60 miles in operation to-day, and nearly $2,000,000 has been spent on wharves, buildings and roadbed. Running from Seward, at the head of Resurrection Bay, the road crosses the Kenai peninsula to the coal fields of the Matanuska river and to Knik, the head of salt water and the northernmost fjord of Cook's inlet. It will thus penetrate far into the region of eternal snow and carry freight and passengers to the Arctic circle.

The direct reason for any Alaskan railroad has been the opening up of new mining regions. But the railroads had to consider permanency of mineral resources, and before surveys of routes were finally passed upon mining engineers were employed to make careful examinations of the region. Every Alaskan railroad has some mining region as its objective point. The Nome & Arctic Railway followed the settlement of Nome after the discovery of rich deposits near that city, and the Council City & Solomon River sought to tap the many mining regions in another direction. The Wild Goose Railroad had in view the permanent mining resources on Ophir creek, and the Tanana Mines Railway was built from Fairbanks to the Creeks with a full knowledge of the value of mining deposits in the Tanana valley.

In the same way the Alaska Central has fully estimated the rich resources of its territory. In crossing the Kenai peninsula it had comparatively easy grades, reaching a total elevation of 1,000 ft., but when the road comes to cross the Broad Pass range on its way to Fairbanks it will encounter some great engineering difficulties. The route of the road is northwesterly from Knik to the Sushitna river and thence up this river to the head of navigation on the Tanana river. Before the railroad's engineers had made a thorough survey of the long route the lowest pass that could be found crossing the mountains had a elevation of 2,700 ft., and previous to that the lowest was considered 3,700 ft., but the route of the railroad goes through a pass only 2,300 ft. high.

The road passes up the Sushitna river valley, one of the most fertile in Alaska, where one growth of grain can be raised in spite of short summers. It is expected that this region will eventually provide homes for thousands of farmers whose products will have ready sale to the rapidly increasing population of the mining cities and camps. The valley is some 100 miles wide and 150 miles long, and is clothed abundantly with native grasses, while Indians raise abundant crops of oats and rye. The valley is composed of open bottom lands and dense spruce forests. The climate of this immense fertile region is temperate and equable for Alaska because great rugged mountain ranges inclose the whole Sushitna valley so that winds and storms are diverted from it. The average height of these ranges is from 8,000 to 10,000 ft., while many peaks run up from 12,000 to 20,000 ft. elevation. Mount McKinley, the highest peak on the North American continent, 20,464 ft. high, is on the outskirts of this valley. The mountains on all sides are not only lofty and large, but rugged, bold and picturesque. Two other ranges have peaks reaching 14,000 and 15,000 ft. in height. The peaks of these mountains are naturally snow-capped the entire year, but from June to September the valley is clothed with green. The Sushitna river drains this region, and with its tributaries supplies an abundance of water for irrigation the year round. The streams are not swift and turbulent, but flow on an average four and five miles an hour.

While the valley up which the road winds its way is fertile and rich agricultural land, the abundance of minerals in the mountains is evident. Gold has been washed down from the mountains in rich deposits, and placer mining is carried on often on the very farms where grains and vegetables are raised. A number of large hydraulic plants are in operation in the valley, and there has been a great influx of miners to the valley within the past year. The railroad hopes, however, to encourage farmers to settle in the valleys, for it is predicted that within a few years more money can be made in raising grains and vegetables than in prospecting for gold. The cost of supplies can be materially reduced in Alaska at the present rate of increase in population only by raising home products.

The coal fields of the Mantanuska river, a tributary of Knik arm, is one of the objective points of the railroad. The need of coal in Alaska is important, for the dearth of trees and firewood in many mining camps makes all sorts of mechanical work costly and difficult. Wood for fuel in many parts sells as high as $50 a load. The big mining plants, equipped with mechanical devices for dredging and smelting, have increased the demand for fuel. The railroad which can tap a valuable coal field and transport this fuel to the camps must eventually prove a profitable investment. The early surveys of the government engineers showed that the low-grade lignite coals around Cook's inlet were of little real value, for they were not only inferior for burning but were mixed with slate, clay and sand. But the railroad engineers in surveying for their route discovered that some 50 miles up the Matanuska river there were abundant deposits of a higher grade coal. This coal gave fair burning qualities and appeared in outcropping seams varying from 5 to 35 ft. deep. At Chickaloon creek the outcropping seams run as deep as 35 ft., and at Moose creek coal can be dug from the surface. Some of the coals have shown as much as 75 per cent. of fixed carbon, and the deeper down the better the grade appears.

So far these new coal fields are the richest and best in southwestern Alaska, and it is even anticipated that it will pay to ship the coal to the seaboard and export it to the coast towns. At Port Williams it could be extensively used for smelting purposes, and throughout the Seward peninsula there are many uses to which it could be put. The development of these coal fields will undoubtedly add greatly to the profit and traffic of the Alaska Central and its promoters have this in view in extending the route over a rather tortuous and mountainous region. With coal mines at one end, with abundant rich agricultural lands along the route and a series of seaports at the other end, the railroad should prove a rich investment in the near future.

The future of the Matanuska and Controller Bay coal fields is considered by many to-day as having a more direct bearing upon the development of Alaska than all of her recently discovered gold fields. The former coal fields are not as well developed as the latter and less is known of their probable output and extent, but judging from the work around the Controller Bay coal fields, the complexion of this whole region must within a few years be completely changed. The railroad has had its engineers studying not only the best routes for its lines, but exhaustive examinations have been conducted secretly in the coal fields. It is intimated by some that there are possibilities of coal being found at lower levels as high grade as that of Behring river, which makes a good steaming fuel for any kind of work. A far northerly coal station within steaming distance of the Great Circle route from Puget Sound to the Orient is a factor in the development of the trans-Alaska-Siberia project which may be of deciding importance.

The mineral possibilities of the upper Sushitna and the Cantwell river from Broad Pass to the Tanana are also of much promise. Miners who have advanced into this region report great deposits of gold, copper and other minerals. The possibility of Alaska becoming a great copper exporting region has only recently been known. Her gold has for so long overshadowed every other product that little attention has been directed to the vast coal and copper resources. The copper deposits are enormous, and shipments to the various smelters on Puget Sound have already been sufficient to indicate something of the future of this new industry. Three years ago Alaska produced 1,200,000 lbs. of copper; last year about 60,000,000 lbs. At this rate Alaska copper should prove within a few years a large factor in the copper market of the world. The steady advance in the price of copper has made its mining one of the most profitable industries, and the copper shipped from Alaska the past two years has paid as heavy interest on the investment as the gold mined there. With a new railroad tapping the copper producing regions a great impetus will be given to copper mining.

It is promised by the engineers of the railroad that great areas of copper will be opened up by the Alaska Central which will be second in importance only to those found east of Seward in western Prince William Sound. At La Touche islands in this sound the copper ore occurs in a sloping face of bare iron-stained sandstone and shale, and shipments are made above 9 per cent. copper with but little sorting. The ore from this and neighboring islands is shipped at the rate of 4,000,000 lbs. a month for each mine to the Tacoma smelters as ballast for the steamers returning to Seward from Valdez. The rates of charges to Tacoma are from $2 to $2.50 a ton, which leaves a large profit. With similar copper regions opened up in the region of the Broad Pass the Alaska Central Railroad would find an abundance of freight traffic to keep it busy all the year.

The Alaska Central reached the Matanuska coal fields this fall, but further developments of the region must of necessity be left until spring opens. Preparations have been made to rush a great number of miners to the region, and next summer will witness important development in the mines. Machinery has gone through to the mines, and work of placing this machinery for early spring operations will keep the men busy through the cold weather.

The greatest difficulty found by the railroad has been the labor problem. Laborers to go north and stay have been hard to find. Once in the north the gold fever seizes many and they start out to prospect. Fully half the workmen shipped north have deserted in this way within a few months after arriving. Many stranded adventurers have taken this opportunity to reach Alaska and try their luck in gold hunting. The summer is the season when the

temptation is strongest for prospecting. In winter little more than tunnel and rock work can be carried on and unskilled labor is in less demand. But in winter laborers who have found their summer's prospecting unprofitable are anxious to get work to carry them over another winter. The railroad builders have thus had to work under great labor difficulties, and have had to do a good deal of work in the winter that properly belonged to summer. However, in spite of these discouragements the road has been pushed steadily forward, and to-day it stands a monument to the pluck and skill of American railroad engineers.

The Canal System of Canada.

The St. Lawrence river, with the system of canals established on its course above Montreal, and Lakes Ontario, Erie, St. Clair, Huron and Superior, with connecting canals, afford a course of water communication extending from the straits of Belle Isle to Port Arthur, at the head of Lake Superior, 2,200 miles. The distance to Duluth is 2,343 miles; the distance to Chicago, 2,272 miles.

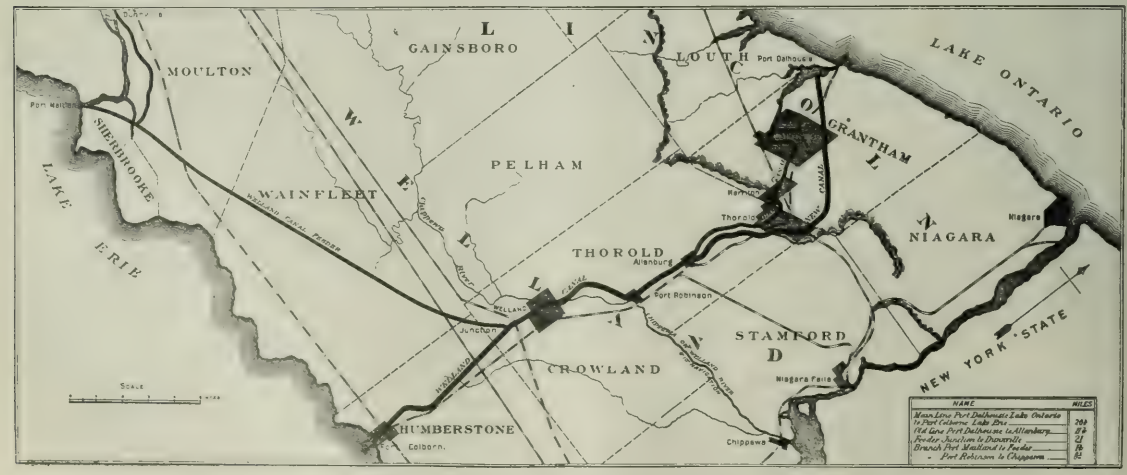
From the straits of Belle Isle, at the mouth of the St. Lawrence, to Montreal, is 986 miles; from Quebec to Montreal, 160 miles. Owing to the shallow water on parts of the river between these two places, particularly through Lake St. Peter, vessels drawing more than from 10 to 12 ft. were formerly barred from passage for the greater part of the season of navigation. In 1826, the question of deepening the channel was first definitely mooted, but it was not until 1844 that any dredging operations were begun. In that year the deepening of a new straight channel was commenced, but the scheme was abandoned in 1847. In 1851 the deepening of the present channel was begun. At that time the depth of the channel at low water was 10½ ft. By the year 1869 this depth had been increased to 20 ft., by 1882 to 25 ft., and by the end of 1888 the depth of 27½ ft. at low water was attained for 108 miles from Montreal to a point within tidal influence. This work is now being continued by the government of Canada. The channel has a minimum width of 300 ft., extending to 550 ft. at points of curvature. The channel is lighted and buoyed. Navigation, which is closed by ice during the winter months, opens about the end of April.

Montreal has by this work been placed at the head of ocean navigation, and here the canal systems of the River St. Lawrence begin, overcoming the various rapids by which the river channel above is obstructed, and giving access through the St. Lawrence canals, the Welland canal, the great lakes and the Sault Ste. Marie canal, to the head of Lake Superior. The difference in level between the point on the St. Lawrence, near Three Rivers, where tidal influence ceases, and Lake Superior, is about 600 ft. The Dominion canals, between Montreal and Lake Superior, are the Lachine, Soulanges, Cornwall, Farran's Point, Rapide Plat, Galops, Murray, Welland and Sault Ste. Marie. Their aggregate length is 73 miles; total lockage (or height directly overcome by locks), 551 ft. A vessel passes through 48 locks in its passage from Montreal, at the head of ocean navigation, to the head of Lake Superior.



St. Lawrence, Ottawa, Rideau and Richelieu Canals.

Communication between Lakes Huron and Superior is obtained by means of the Canadian Sault Ste. Marie canal, and also by the St. Mary's Falls canal, situated on the United States side of the River St. Mary. Both these canals are free of toll. The improvement of the United States channels in St. Mary's river has been continued from year to year, so that the dredged areas now total 34 miles in length, with a minimum width of 300 ft., which is increased at angles and other critical points to 1,000 ft. The depth



Welland Canal, Showing Old and New Channels.

is 20 ft. at the mean stage of water. Excavation has now been commenced to afford 21 ft. at the lowest stage of water.

The enlargement of the canals on the main route between Montreal and Lake Erie comprises locks of the following minimum dimensions: Length, 270 ft.; width, 45 ft.; depth of water on sills, 14 ft. The length of vessels to be accommodated is limited to 255 ft. At Farran's, in the Farran Point canal, the lock is 800 ft. long.



Trent Navigation and Murray Canal; Proposed New Water Route Between Lake Huron and Lake Ontario.

There is a similar lock at Iroquois on the Galops canal. The object of these long locks is to pass a full tow at one lockage.

The following table shows in detail the through route, with a minimum depth of 14 ft. of water, between Montreal and the head of Lake Superior. The distances by this route are as follows: Montreal to Port Arthur, 1,223 miles; Montreal to Duluth, 1,357 miles; Montreal to Chicago, 1,286 miles.

	Miles
1. Lachine Canal	8½
Lake St. Louis and River St. Lawrence	16
2. Soulanges Canal	14
Lake St. Francis and River St. Lawrence	33
3. Cornwall Canal	11
River St. Lawrence	5
4. Farran's Point Canal	1
River St. Lawrence	10
5. Rapide Plat Canal	3½
River St. Lawrence	4
6. Galops Canal	7½
River St. Lawrence and Lake Ontario	236
7. Welland Canal	26¾
Lake Erie, Detroit, River, Lake St. Clair, Lake Huron, etc.	580
8. Sault Ste. Marie Canal	1¼
Lake Superior-Port Arthur	266
Total	1,223¼
To Duluth	1,357
To Chicago	1,286

The Lachine canal extends from Montreal to the town of Lachine, eight miles, overcoming the St. Louis rapids, the first of the series of rapids which border the ascent of the St. Louis river. It has five locks with a total rise of 45 ft. From the head of the Lachine canal to the foot of the Soulanges canal is 16 miles. The Soulanges canal is 14 miles long and has four lift locks with a total rise of 84 ft. From the head of the Soulanges to the foot of the Cornwall canal there is a stretch of 38¾ miles through Lake St. Francis, which is being made navigable for vessels drawing 14 ft. The Cornwall canal is 11 miles long and has six locks with a total rise of 48 ft., and it extends past the Long Sault rapids from the town of Cornwall to Dickenson's Landing. From the head of the Cornwall canal to the foot of the Farran's Point canal the distance on the St. Lawrence river is five miles. The Farran's Point canal enables vessels ascending the river to avoid the Farran's Point rapids, passing a full tow at one lockage; descending vessels run the rapids. The Farran's Point, Rapide Plat and Galops canals are collectively known as the Williamsburg canals. From the head of the Farran's Point canal to the foot of the Rapide Plat canal there is a navigable stretch of 10½ miles. The canal was built to enable vessels going up the river to pass the rapids at Rapide Plat. Descending vessels run the rapids with safety. From the head of the Rapide Plat canal to Iroquois, at the foot of the Galops canal, the St. Lawrence is navigable for 4½ miles. The canal enables the vessels to overcome the rapids at Pointe aux Iroquois, Port Cardinal and the Galops. These three canals are 12 miles long and have a total rise of 30½ ft. The Murray canal is 5⅛ miles long and extends through the Murray isthmus, giving connection westward between the head waters of the Bay of Quinte and Lake Ontario, thus enabling vessels to avoid the open lake navigation. The main line of the Welland canal is from Port Dalhousie, on Lake Ontario, to Port Colborne, on Lake Erie, 26¾ miles. This canal has several branches, one of them 21 miles long, but these are all for vessels of smaller draught than 14 ft. From the head of the Welland canal there is deep water navigation through Lake Erie, the Detroit river, Lake St. Clair, the St. Clair river, Lake Huron and St. Mary's river to the Sault Ste. Marie canal, about 580 miles. From the "Soo" canal to Port Arthur is 266 miles, and to Duluth 400 miles.

The Sault Ste. Marie canal is a little over one mile long and has one lock with a total rise of 18 ft. The canal is built through St. Mary's Island, on the north side of the St. Mary's rapids, and, with the St. Mary's river, gives communication on Canadian territory between Lakes Huron and Superior. The following quotation from the report of the Superintendent of this canal is interesting:

"The day of big boats has come, and there are now several building that have too much beam for passing through this lock, which is 60 ft. wide. The other day we locked through the steamer 'J. Pierpont Morgan,' being 600 ft. long and with 58 ft. beam. We did this without any difficulty; this vessel was built by the Steel Trust and was built with several others to fill the capacity of this lock, and not to be at the mercy of the American lock as to size in case of accident to that lock. The question of a new and wider lock must soon be taken up by this department, and as called to your attention last winter, some lands lying between the present canal reserve and the rapids should be procured from the Crown Lands of Ontario before they are taken up by some private corporation, so as to enable a new lock to be built, and by so doing obviate the trouble that the American government is now having across the river in obtaining lands required for a new lock, it having been taken up and built upon by private parties."

One of the accompanying maps shows the Canadian ship canal at Sault Ste. Marie, and also the Mary's Falls canal, on the United States side of the river, another the line of the Welland canal between Lakes Erie and Ontario, showing the old and new channels. As will be seen from this map, from Port Dalhousie to Allanburg, 11¾ miles, there are two distinct lines of canal in operation, the old and the enlarged or new line. From Allanburg to Port Colborne, 15 miles, there is only one channel, the old canal having been enlarged. Another map shows the St. Lawrence, Ottawa,



Sault Ste. Marie Canals.

Rideau and Richelieu canals, and a fourth the Trent navigation and Murray canal.

Besides the through route from tidewater to the Great Lakes, the Canadian canal system has other branches. There is a canal route 245 miles long between Montreal, Ottawa and Kingston. This passes through the Lachine canal, the navigable part of the lower Ottawa river and the Ottawa canals, to the city of Ottawa, thence by the River Rideau to Kingston, on Lake Ontario.

There are 55 locks, and the total lockage, not including that of the Lachine canal, is 509 ft., of which 345 ft. is rise and 164 ft. fall.

The Richelieu and Lake Champlain system begins at Sorel, at the confluence of the St. Lawrence and Richelieu rivers, 46 miles beyond Montreal, and extends along the Richelieu river, through the St. Ours lock, to the basin at Chambly, thence by the Chambly canals to St. Johns, and down the Richelieu river to Lake Champlain. The distance from Sorel to the United States boundary line is 81 miles. At Whitehall, the southern end of Lake Champlain, there is connection with the Hudson river, and thence with New York City. From the international boundary line to New York the distance is 330 miles, making a total of 411 miles from Sorel to New York. The Trent navigation is a series of water stretches which do not yet form a connected system of navigation, but are valuable only for local use. By extensions of this system, now in progress and contemplation, a through route is to be opened between Lake Ontario and Lake Huron. The system is composed of a chain of lakes and rivers extending from Trenton, at the mouth of the river Trent, on the Bay of Quinte, on Lake Ontario, to Lake Huron. The course is as follows: Through the River Trent, Rice lake, the Otonabee river and Lakes Clear, Stony, Lovesick, Deer, Buckhorn, Chemong, Pigeon, Sturgeon and Cameron to Lake Balsam, the summit water, about 165 miles from Trenton; from Lake Balsam by a canal and the Talbot river to Lake Simcoe; thence across Lake Simcoe to the Severn river; thence by the Severn river to Georgian Bay, Lake Huron; the total distance being about 200 miles, of which only about 15 or 20 miles will be actual canal. The distance by this route is 215 miles, of which 150 miles are now navigable and 65 miles unnavigable. This is the route by which Mr. J. J. Hill, President of the Great Northern, has urged the Canadians to build a deep canal to be used for export grain from the Canadian Northwest.

In connection with the question of canal versus railroad transport of grain from the West, the following is a quotation from the recently issued annual report of the Department of Railways and Canals of Canada: It may be noted that whereas 341,431 tons of grain passed down to Montreal through the Welland and St. Lawrence canals, an increase of 143,185 tons over the previous year, the quantity carried to Montreal via the Canadian Pacific and Grand Trunk railroads amounted to 148,377 tons, a decrease of 6,248 tons. Over the route from Depot Harbor on Georgian bay, Lake Huron, via the Canada Atlantic to Coteau Landing, at the head of the Soulanges canal, thence by barge to Montreal, in the season of 1903 the total freight carried was 315,779 tons. 109,937 tons corn and 175,954 wheat; in 1904 the total freight carried was 209,260 tons, 61,675 tons corn and 137,338 tons wheat; in 1905 the total freight was 254,378 tons, 54,272 tons corn and 168,966 tons wheat.

The quantity of grain carried to tidewater on the New York state canals was 216,237 tons, a decrease of 10,630 tons, while the quantity carried by the railroads of the state to tidewater amounted to 3,164,540 tons, a decrease of 115,967 tons. Of the total east and westbound freight carried by the state of New York canals (the Erie, the Champlain, the Black river, the Cayuga and Seneca, and the Oswego), and the competing railroads (the New York Central and the Erie) respectively (amounting in 1905 to 73,753,141 tons—less by 5,242,646 tons than in 1904), the proportion carried by the canals has fallen steadily from 68.9 per cent. in 1859 and 47.0 per cent. in 1869 to 6.8 per cent. in 1898, 7.2 in 1899, 5.2 in 1900, 5.1 in 1901, 5.5 in 1902, 5.6 in 1903 and 4.6 in 1904, and 4.5 in 1905. These canals carried in 1905 3,226,896 tons, an increase of 88,349 tons.

Education of Apprentices on the Missouri Pacific.*

BY S. M. DOLAN, MASTER MECHANIC.

There is nothing new in the idea of affording boys who are learning a trade an opportunity to supplement their work and instructions in shop with studies in arithmetic and higher branches of mathematics, as well as mechanical drawing and other studies. In this, however, the education of apprentices at the Sedalia shops of the Missouri Pacific differs from the plan followed by any other railroad so far as I know, because the students recite their lessons during the regular working hours of the shop and without loss of time to the boys themselves. The beginning of this school was on April 20, 1906. The general manager of a well-known correspondence school brought instructors to Sedalia, assembled all of the 62 apprentices, and explained what it was proposed to do for them. The only restrictions were that the apprentice be under 21 years old, as boys of that age were nearly out of their time, and had reached an age of mind that did not easily take new impressions. The various trades represented were: Boilermakers, machinists, blacksmiths, electricians, tin and coppersmiths, painters and carpenters.

No regular school room being available, the coach paint shop, at that time unoccupied, was used, and being well lighted and heated, proved a very satisfactory location. The boys were divided into squads of three to five without regard to occupation, the foreman being consulted as to the time each boy or group could be spared. The co-operation of foreman was readily given. They were invited by the master mechanic to spend at least 15 minutes a day in the class-room during the time boys in their own gang or department were reciting. After the squads were made up, an assignment of time was made. Squad one reported at 7 a.m., squad two at 7.30, squad three at 8 and so on, last squad reporting about 2 p.m. At the end of 30 days a readjustment was made, the five boys who lead in their studies being assigned to the same squad, this plan being as closely followed as possible. A similar adjustment has been made each month. Soon after opening the school, sets of drawing instruments were offered to the five students who had made the best progress in their studies at the end of 60 days. This had a stimulating effect on all. The squad who won this contest were apprentices in the tin and copper shop, and studied almost every night at the home of one of the boys, each assisting the other. Later on fountain pens were given to all who performed a certain number of examples during 60 days; 16 of the students qualified in this contest. When the class first opened, and for the first 60 days, instruction was given by two young men with university training. Later on this work was assumed by an instructor with university training, supplemented by correspondence school study, also eight years as locomotive fireman and engineer. There is no doubt that this personality has contributed in a marked degree to the success of the school. As the Sedalia shops only went into operation in October, 1905, practically all of the boys were in the first year of their apprenticeship, the only exceptions being those transferred from other shops. The rules of the company require that all applicants for position of apprentice before being employed, pass successfully an examination, consisting of four examples in arithmetic, and receive at least 75 per cent. in writing and spelling. This rule was rigidly enforced at Sedalia. The standing of the apprentices at school previous to employment was as follows:

Graduates from high school	1
Second year in high school	5
First year in high school	4
Eighth grade	17
Seventh grade	11
Sixth grade	11
Fifth grade	4
Fourth grade	9

After eight months of study the entire number completed their arithmetic. Other subjects were covered by the number shown in each case below:

Algebra	22
Logarithms	8
Geometry and trigonometry	2
Geometrical drawing	13
Mathematics entirely	2

Mechanical drawing, none, but five will probably complete by February 15. Subjects taught are arithmetic, elements of algebra, logarithms (common), geometry, trigonometry and drawing. Arithmetic includes addition, subtraction, multiplication and division of whole numbers, fractions and decimals, percentage, involution and evolution, ratio and proportion. Algebra includes addition, subtraction, multiplication and division, to and including quadratics containing two unknown quantities. Geometry and trigonometry take up the study of geometrical construction, mensuration and part of plane geometry. Under trigonometry the handling of the functions, tables, etc., and how obtained. The course in drawing has been made to conform as nearly to actual office practice as possible. It includes geometrical and mechanical, 30 plates in these two subjects being required of each student; practical projections, four plates; development of surfaces, 10 plates. Mechanical drawing also gives detailed information regarding handling and making of blue prints.

The progress made is suggested by the following report of the instructor on individual apprentices:

Student A, machinist apprentice, never reached the 6th grade in public schools, and could scarcely add two fractions, knew nothing of decimals or beyond that. Has finished arithmetic, and can use it, is finishing algebra and doing splendid work in mechanical drawing.

Student B, machinist apprentice, 6th grade in public schools, has finished arithmetic, is finishing algebra, and is progressing well in mechanical drawing.

Student C, blacksmith apprentice, never finished 4th grade in public schools, couldn't do a long example in long division, has finished arithmetic, is now in algebra, and doing some of the best work in the class in mechanical drawing.

Student D, boilermaker apprentice, did not get beyond the 4th grade in public schools, has finished arithmetic, is now in algebra, and just beginning mechanical drawing proper.

The boy now farthest advanced in all studies had only reached the 5th grade in public schools. The time lost by apprentices from their regular shop work will average 20 minutes a day, as all their studying is done on their own time, usually at home, but a large number use the study room of the correspondence school located conveniently in the city. No great difficulty was experienced in the beginning in securing regular attendance. As the novelty wore off and lessons required night work and considerable self-denial, interest began to lag. The laggards were taken to task one by one

*A paper read before the St. Louis Railway Club.

by the master mechanic, and kindly but firmly given to understand that regular attendance and progress in studies were as necessary as satisfactory service in shop. Two quit, no doubt rather than pursue their studies; one was dismissed, refusing to study, his work in shop justifying this course. While the difficulty of maintaining interest did not end here, there was a marked improvement, which has continued without interruption to the present time. In fact, the greatest friendly rivalry exists between the different squads and individual students.

You are no doubt by this time convinced that the school has been a good thing for the apprentices, but are probably wondering where the company gets returns for its investment. It took a broad minded, liberal and far-seeing management to start a school of this kind, for with best results, immediate returns could not be expected. This question recently came up, and I will refer to letters from different men. Here is letter from foreman of machine shop:

As far as I am able to judge, the present system is of great benefit for the boy, as well as from the company's standpoint. Especially will this be true later when practical results follow. In offering this advantage and compelling it, as we do here "in individual cases," the company is fortifying itself against incompetency. As a whole the boys are more attentive and more regular in service than before this innovation. I consider them more industrious and appreciative than those who do not enjoy this privilege. The advantages now offered the apprentice is a practical business education in his line.

From foreman of boiler shop:

I have noticed a remarkable improvement in the interest the apprentices are taking in their work in the past six months. I know this from experience, as the boys are constantly asking me questions about the construction and repairs of boilers. All of our boys in the boiler shop that are attending this school are doing some of our best boiler work, and I am satisfied that at the end of four years, these boys will be finished mechanics. It is my opinion that this school given to apprentice boys here, is a great advantage, and I know the boys appreciate it.

From foreman of tin and copper shop:

As you are aware, the boys of our department, I am proud to say, lead the classes. During lunch or noon hour, they are off to their class room, while it is common to hear them discussing having to stay at home at night and work on projections, plates, etc., at washing up time in the evening. These boys can now draft patterns for elbows, tees, cones, etc., which they would not have been able to do had they not taken the course. They also make steam chest and dome gaskets, together with considerable copper pipe bending and brazing. I consider that I have the most apt and progressive lot of boys I have had under my supervision in 15 years' experience as a foreman, and attribute it to this manual or technical course solely.

From Master Mechanic to Superintendent of Machinery:

I am attaching copies of letters received from the various foremen whom the apprentices are directly under. You will note there is a diversity of opinion as to the benefits of this plan. As to my own personal views, I would say that the benefits to the apprentices themselves would justify what might appear to be extravagant claims. Boys who became bread-winners, either through necessity or otherwise, before they had gained even a primary education, have been enabled, practically without cost, to secure an education of a kind best suited to their position. As to the immediate and present advantage to this company to offset the cost through loss of time while they were reciting their lessons and the expense of instruction, it would be difficult to determine, and might be compared to an improvement on the locomotive that we felt satisfied was resulting in a more economical operation, but would be unable to determine its value in dollars and cents. I claim as an advantage to us, that it has resulted in less laying off among the pupils for the reason that their absence from work meant absence from their recitations, and an increased effort to hold their own with the class. It has also aroused a spirit of inquiry that extends to their work, and has made them more useful employees through their ability to do work, knowledge of which might have not been acquired until the latter part of their apprenticeship, if at all. It has also created a feeling of emulation among aspiring and ambitious mechanics, with whom these boys are associated and whose knowledge gained in the school, enables them to lay out work and solve problems that could not be done by the ordinary mechanic. I believe that I can safely say that the company is and will continue to be, the gainer by furnishing this education to their apprentices, and certainly if it retains in its employ only 50 per cent. of the apprentices that pass through this school, it will have a high grade class of mechanics, that will enable the shops to be operated more economically than with the present class of men they are able to secure.

Such classes mean a great deal of self-denial and sacrifice of amusements on part of boys. Their interest must not be allowed to lag. At Sedalia, the instructor makes a weekly report to the master mechanic, showing examples worked, lessons recited, and attendance. If a boy is absent from one or more lessons, the master mechanic goes to him in the shop and asks for explanation, but before doing so has time-keeper check list to see if boy had been absent from work that day. There are only a few cases of non-attendance recorded where boys have been at work; here authority from foreman must be shown. It was thought at first that it would be necessary to inaugurate some system of checking and prevent boys loitering to or from class-room. This has never been found necessary, as they seem anxious to get back to their work and give such service as would eliminate loss of time occupied while at school.

The question of using motor cars on the New Zealand railroad lines has been receiving considerable attention, and, as a result of observations made and information obtained by the General Manager of Railways during his visit to America and Europe last year, it has been decided that the most suitable method of working such a service is by a small locomotive with a combination car and van attached. This system has been adopted on several of the principal railroads in England, and is found to possess many advantages over the self-propelling motor car, and is being adopted by lines which at the outset had favored and even gone to the expense of running self-propelling motor cars. In order to give the system a trial a car 60 ft. long, with accommodation for 24 first class and 48 second class passengers, in addition to a compartment for guards, parcels and luggage has been built. Should the service prove successful it will be extended as circumstances warrant.

Closing Latest Break of the Colorado River Into the Salton Sea.

The latest break in the barriers which the Southern Pacific engineers have been building to divert the flow of the Colorado river from the Salton Sea back to its original channel, as is pretty generally known, occurred about half a mile south of the closure works built across the previous break, by means of which the engineers had apparently finally subdued the river. As reported at the time, the new break was caused by water finding its way beneath and undermining the levee which had been built along the west side of the river for a considerable distance above and below the old break. When it had become sufficiently weakened the levee collapsed, the crevasse rapidly widened, and the waters formed the new channel indicated on the accompanying map of the new break (Fig. 1).

As the map shows, the closure works for the previous break consisted of earth dams built out from the north and south sides of the crevasse to bulkheads 600 ft. apart about the middle of the

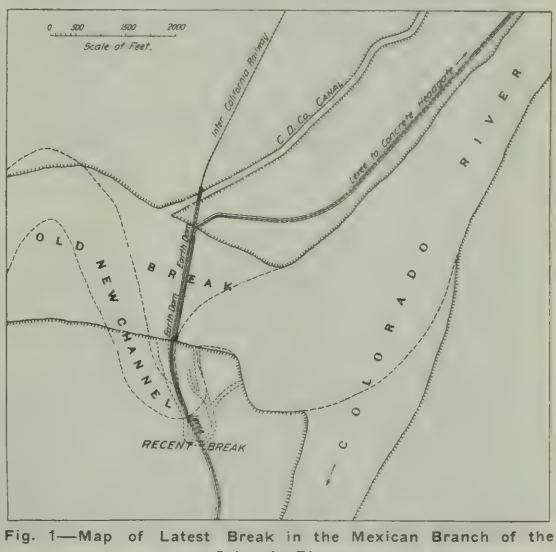


Fig. 1—Map of Latest Break in the Mexican Branch of the Colorado River.

channel. The spur track (called the Inter-California Ry.) built down from the main line to bring material was carried out along the dam, crossing the 600-ft. opening on pile bents, and continued along the south portion of the dam. A brush mattress had been laid on the bottom of the central opening to form a foundation for a rock fill, and the opening was then closed by rock dumped from trains on the trestle. This very brief outline conveys no idea of the tremendous difficulties overcome in accomplishing the task, of the vast quantities of material handled under the most adverse conditions, and the urgent need of rushing the work with all of the energy possible to concentrate upon it. The work had barely been completed and the river restored to its original channel when an 8-ft. rise came and the weakened levee, unable to withstand the pressure, let go, and the waters quickly found their way back to the Salton Sea channel, compelling the work to be done all over again at another point—the seventh attempt to control the river.

The work referred to in the previous paragraph constituted the fifth and sixth attempts, and during the latter a second trestle was thrown across the channel 30 ft. above the first one, from which rock was also dumped, enabling a much greater width of rock-fill dam to be obtained than was possible from the single track. In the present work the same methods are being followed as in the previous attempt. The track was extended southward to the new break and a trestle built across the channel. Work on this trestle



Fig. 2—Looking Upstream, Jan. 23, Through Break in Trestle Caused by Second Rise.



Fig. 3—Jan. 24—North End of Trestle Showing Break Nearly Repaired.



Fig. 4—Jan. 28—Lower Line of Trestle Completed and Pile Drivers Working at Each End of Upper Trestle.
(Appearance of curve due to camera.)



Fig. 5—Jan. 28—Unloading Large Rock from Cars by Hand; Repairing Colorado River Break.

was hampered and delayed by rises in the river, two more of which have occurred since that causing the present break, both of which washed away portions of the trestle. It was finally completed, however, on January 26, and closure of the crevasse immediately begun by rock filling. Meantime an auxiliary trestle was being thrown across above the first, as in the previous case. Rock has been deposited at the rate of 3,000 cu. yds. a day.

Through the courtesy of Mr. J. Kruttschnitt, Director of Maintenance and Operation of the Southern Pacific, we are enabled to show herewith some snap-shot progress views of the work, numbers of which are sent to him in connection with daily reports on its progress. They convey some idea of the magnitude and character of the task. Fig. 2 was taken on Jan. 23 and shows the second break in the trestle caused by the last rise in the river. And it is of interest to know that this river, wild and uncertain as it is known to be at all times, subject to sudden and unexpected floods, has during the period since the efforts at its restoration were begun acted almost as if bewitched. Never before have such a rapid succession of rises been known, some of a volume as large as ever recorded; and several of them occurring at critical stages of the work, almost as though the premeditated act of something of intelligence. It is this feature of the river's action that has enabled it to baffle the previous efforts of the engineers to control it.

Fig. 3 was taken on the upstream side of the break shown in Fig. 2 on the day following the latter, and shows the progress made toward closing same during the 24 hours; also the north end of the second trestle is seen. An idea of the swiftness of the current may be gained from this view. The completed lower line of trestle is shown in Fig. 4, and the pile drivers working on the upper line. A fair idea of the width of the break is conveyed by this view. Fig. 5 shows a rock train being unloaded. All of this work had to be done by hand, of course, the large boulders being pinched off with bars, as appears in the photograph. The break was finally closed at 6 p.m., Feb. 11; 15 days and 2 hours after the first dump-



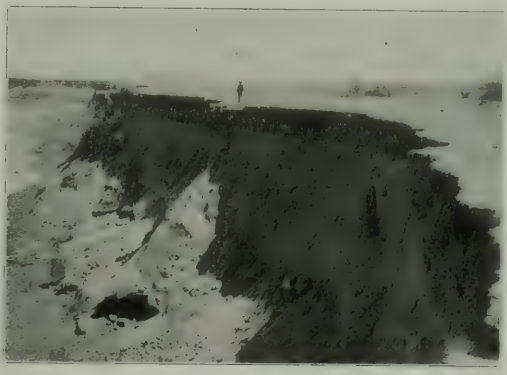
The Salton Sea, Showing Section of Submerged Track.



Washed Out Railroad Tracks.



Building Dikes.



New Channel of the Colorado River.



Train Crossing Salton Sea.



California Development Co.'s Steamer at the Colorado River.

ing of rock. Seventy-seven thousand yards of material, mostly rock, were used. The depth of water at the beginning was 34 ft., and there was a 4½ mile current.

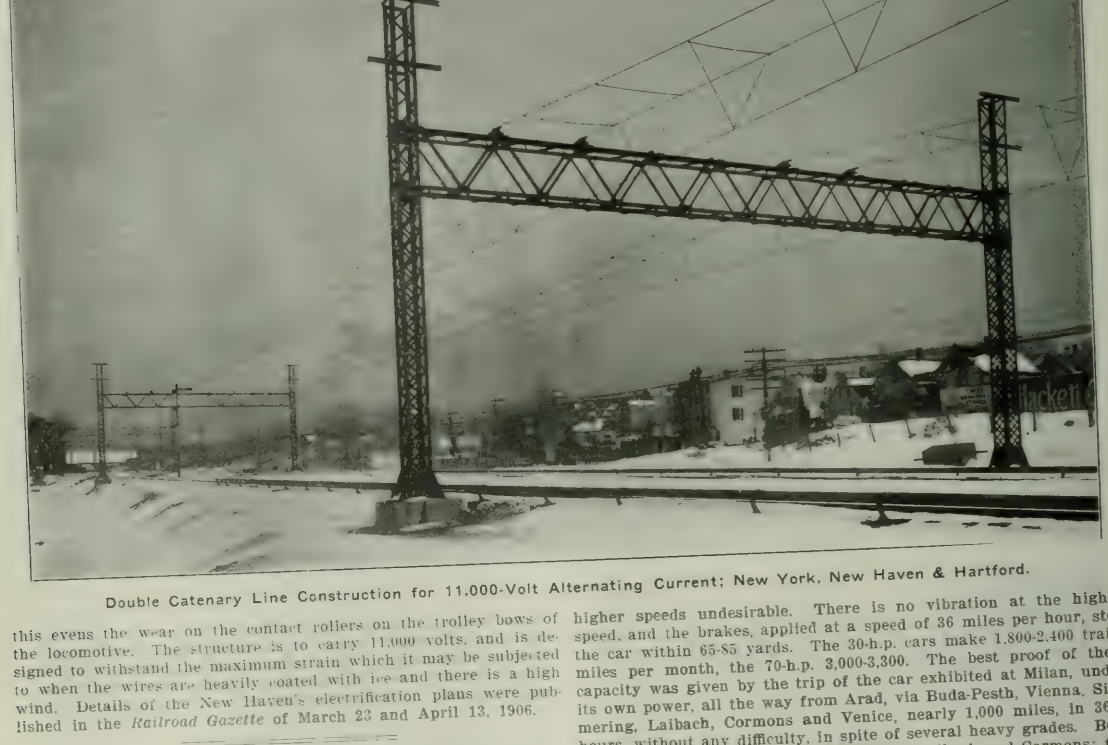
New York, New Haven & Hartford Overhead Construction.

The accompanying photograph shows the overhead construction on the New York, New Haven & Hartford near Wakefield, N. Y. The photograph was taken at the point where the New Haven meets the New York Central's electric division, and the third rail used on the latter's line is shown in the engraving.* The overhead construction is known as the double catenary type, and consists of two steel cables carrying the copper trolley wire by means of triangular supports placed about 10 ft. apart. The trolley wire is held to the triangular supports by clamps which grip the wire in grooves drawn in its sides. The supporting bridges are at intervals of about 300 ft.; the sag of the supporting or messenger cables between these points is about 6 ft., while the trolley wire is held nearly horizontal about 22 ft. above the track. The messenger cables are fastened to heavy insulators on the bridges, but the trolley wire passes underneath without any suspension other than the triangular supports. The trolley wire and messenger cables are mechanically and electrically connected. The line is "staggered," that is, strung between each two bridges at a slight angle to the direction of the track, so that it zigzags back and forth, making at each bridge a variation of a few inches from the center line; this evens the wear on the contact rollers on the trolley bows of the locomotive. The structure is to carry 11,000 volts, and is designed to withstand the maximum strain which it may be subjected to when the wires are heavily coated with ice and there is a high wind. Details of the New Haven's electrification plans were published in the *Railroad Gazette* of March 23 and April 13, 1906.

* The bridges shown are designed to span four tracks, but only two tracks are in use at this point, pending changes to be made when the New York Central begins rapid transit running on its Hudson Division.

The car is provided with Boker air-brakes, hand-brake, acetylene lights and hot-water heat. The net weight is 36,000 lbs. and the maximum weight on the axle is 22,000 lbs.

These motors have been adopted to encourage traffic in sparsely populated districts, in connection with lower fares and more frequent service. Whereas the locomotive passenger service shows traction expenses of 18.2c. and revenue of only 13.2c. per train-km., the motors show 4.38 and 26.4 respectively, with a rise in passengers per train-km. from 1.45 to 1.7 in three years. The economy is due to the lighter weight of the vehicle, which can further carry enough benzine for 250 train-miles, while the steam motors can carry economically only enough for 30 miles; there is no loss of time steaming up; there are no sparks and smoke to dirty the cars and start fires; only one man is needed to run the train, replacing both engineer and fireman; and the heating costs nothing, as the water which cools the motor is used for this purpose. The initial expense of maintenance has been much higher than is now confidently expected, as the 30 motors put on simultaneously were found to need minor modifications, and the instruction of the drivers proved costly. As the traffic has so increased that they now have two trailers (138 seats altogether) to a train and need more power, they have decided to substitute 40 h.p. motors for those of 30 h.p. now in use. By using small wheels and setting the floor low, the air resistance is greatly lessened. The smaller motors are calculated for a speed of 20-23 miles per hour, the larger for 33-36. The light rails (about 50 lbs.) and frequent unprotected grade crossings make higher speeds undesirable. There is no vibration at the higher speed, and the brakes, applied at a speed of 36 miles per hour, stop the car within 65-85 yards. The 30-h.p. cars make 1,800-2,400 train-miles per month, the 70-h.p. 3,000-3,300. The best proof of their capacity was given by the trip of the car exhibited at Milan, under its own power, all the way from Arad, via Buda-Pesth, Vienna, Simmering, Laibach, Cormons and Venice, nearly 1,000 miles, in 36½ hours, without any difficulty, in spite of several heavy grades. Benzine was taken on at Buda-Pesth, Vienna, Laibach and Cormons; the average consumption of benzine was 1.84 lb. per train-mile. Two escape valves broke, one near Wiener-Neustadt (repaired in five minutes at the station), the other after reaching Laibach. The schedule speed of 32-34 miles per hour was maintained.



Double Catenary Line Construction for 11,000-Volt Alternating Current; New York, New Haven & Hartford.

Benzoelectric Rail Motor Cars in Hungary.

L'Ingegneria Ferroviaria of Nov. 1 prints full details regarding the benzoelectric rail motor cars in use in Hungary. One exhibited at Milan by the Arad-Csanád Ry. is planned for use on secondary lines, and contains two first class compartments (accommodating 12 persons), one second class (seating 24), a closet and a small baggage compartment. The driver's booth and motor are in front. The truck has two axles, one driven by a four-cylinder De Dion-Bouton benzine motor driving a shaft with which a dynamo is also connected. The dimensions are:

Length (including buffers)	42 ft. 8 in.
Width	10 " 2½ "
Height	11 " 1 "
Distance between axles	29 " 6 "

Table of Expense for Benzoelectric Motors.

	Motor 30 H.P.	Motor 70 H.P.	Steam motor coach. 35 H.P.
	1.5	2.0	(coal) 8.34
Combustibles: Benzine, lbs. per mile			
Expense of service (in cts. per mile):	2.49	3.3	(coal) 2.15
Heating material: Benzine	.47	.62	.19
Oiling	.06	.06	.05
Other materials	1.25	1.35	1.34
Personnel			
Total, expenses, material and labor	4.26	5.30	4.46
Cost of maintenance (wages and materials)	1.31	1.59	1.36
Total expense	5.57	6.89	5.82

GENERAL NEWS SECTION

NOTES.

The Mobile & Ohio has put train auditors on its through passenger trains.

The Pennsylvania Railroad has issued revised instructions to employees in regard to what must be done when any person is killed on the railroad premises.

Both houses of the Indiana legislature have passed a bill requiring all freight trains of 50 cars or less to have a crew of five men, and trains of over 50 cars six men.

The Delaware & Hudson Company at Albany this week confessed judgment in the suits instituted against it by the United States for thirty-three violations of the Safety Appliance Law.

Shippers of apples in Central New York, at a meeting in Rochester last Saturday, declared that thousands of dollars are being lost because of the inability of the New York Central to furnish cars to ship apples before they rot.

The Georgia Railroad has made an increase of 8 per cent. in the wages of machinists, boilermakers and blacksmiths. Men in other departments, who are now on strike, assert that this action is taken by the company for the purpose of forestalling a sympathetic strike.

The Northwestern Lumbermen's Association, at its recent annual meeting in Minneapolis, provided for the establishment of a car service department. A competent man will be secured to devote his attention to tracing cars, locating delayed shipments and otherwise promoting the interests of shippers in the association.

On February 6 the Baldwin Locomotive Works finished their 30,000th locomotive. In 1870, after about 37 years of operation, 2,000 locomotives had been built, and at that time it was the ambition of the management to increase the output to an average of one engine a day. At present the output is about nine a day.

The General Manager of the Pennsylvania Railroad has made a settlement with the locomotive engineers of the company concerning a petition which they had presented in regard to wages, but the announcement gives no information as to the basis on which the settlement was made. It is said that a settlement has also been made with the conductors; but negotiations with brakemen are still pending.

The London & South-Western semi-annual dividend on the common stock for the second half of 1906 has been reduced from the regular 4 per cent. to 3½ per cent., because of the expense of satisfying claims for injuries and deaths in the Salisbury derailment last July. There has been set aside $250,000 to meet these claims, and of this amount about $63,000 has, so far, been distributed. Eight claims for deaths and ten for injuries are still unsettled.

On Monday morning last the Chicago & North-Western delivered in Chicago 1,288 cars of live stock, the largest number ever brought to that city in a single day by one road. About three-quarters of these cars came from Iowa and Nebraska, and were hauled an average of 400 miles at 25 to 30 miles an hour. All of the 35 trains arrived before 5:30 a. m., and the last car was unloaded before 10:30 a. m. The average temperature in Iowa on the day before (Sunday) was about 10 degrees above zero.

The legislature of Alabama has passed a bill limiting passenger fares throughout the state to 2½ cents a mile, and there is no doubt that Governor Comer will sign it. The prevailing rate on most of the lines of the state now is 3 cents a mile. A two-cent law passed in Arkansas, to go into effect April 11, was signed by the Governor on February 11. In Iowa the legislature has passed a bill, in West Virginia a two-cent law has been passed by the legislature and approved by the Governor, and Missouri is likely to have a similar law.

A press despatch from Chicago says that the Chicago, Burlington & Quincy, in its negotiations with the Government for the contract for carrying the through mails between Chicago and the Missouri river, has offered a reduction of about 7 per cent. on the rate heretofore in force, which is that prescribed by law. The reduction is equal to the cost of transferring the through Eastern mails to and from the Lake Shore station in Chicago and was necessary to keep the new contract from going to the Rock Island, which has direct connection with the Lake Shore.

The yard brakemen and conductors in and around New York City who, on December 23, accepted an increase in their wages of four cents an hour, after demanding five cents, and who left to arbitration the question of the one cent in dispute, have lost their case; Judge Gray, of Delaware, who was chosen umpire, has decided in favor of the companies. The roads interested were the Baltimore & Ohio, the Central of New Jersey, the Delaware, Lackawanna & Western, the Erie and the Lehigh Valley. It was said at the time that the New York Central and the Pennsylvania granted the demands of their men.

New Home of the New York Railroad Club.

Beginning Friday evening, February 15, 1907, all meetings of the New York Railroad Club will be held in the new building of the Engineering Societies, 29 West Thirty-ninth street, between Fifth and Sixth avenues. The new quarters will afford members every convenience. On the ground floor and connected with a large foyer are rooms convenient for business appointments, consultations and dinner engagements. The coat room on the second floor is so arranged that quick service will at all times be assured. The auditorium on the fifth floor, in which the meetings will be held, has a seating capacity of 500. Connected with it is a conversation and social room, with a lunch room and caterer's serving room in its rear. At the top of the building there is a fine reference library to which members will have access on meeting nights. The annual electrical night of the club will occur on Friday, March 15, 1907.

Sale of the Ward Line to C. W. Morse.

C. W. Morse has bought $2,000,000 of the $2,500,000 capital stock of the New York & Cuba Mail Steamship Company, known as the Ward Line, for $600 a share, and is offering that price for the remainder. The line has 18 steamers which ply between New York and Havana and Cienfuegos, Cuba, and Tampico and Vera Cruz, Mex. A new company with $20,000,000 capital stock and $10,000,000 or $12,000,000 5 per cent., 10-year bonds is to be formed to take it over.

Control of the Boston & Philadelphia Steamship Co. has been acquired by unknown interests acting through Kidder, Peabody & Co., Boston. The company has $1,500,000 outstanding capital stock and operates seven steamers between Boston, Providence, Fall River and Philadelphia.

Electric Trains on the New Haven and the Harlem.

The New York Central announces that electric trains will begin running on the Harlem division February 17 and that the northern terminus of the electric runs for the present will be at Mount Vernon station, which is about a half mile north of the yard at Wakefield, where the electric trains and engines are stored.

The New Haven road expects to begin running electric trains between New York and New Rochelle by March 1. New Rochelle is about four miles from the junction with the New York Central at Woodlawn.

Interior Communications of Iceland.

Considerable improvements in the means of communication in and with Iceland have been made. A railroad connecting Reykjavik with the coast has been surveyed and the details of construction worked out. It will have a length of 46 miles. On October 3 of the current year Iceland was connected with Europe by a cable. The telephone exchange at Reykjavik has 200 subscribers, and although the yearly subscription is only $9.60 it has declared a 10 per cent. dividend. Three Danish transportation companies keep up intercourse with the island, one of them making eight trips around the entire coast every year. On some of the larger fyords smaller steamers ply regularly. In recent years wagon roads have been built and streams bridged so that wagons can be used where formerly pack animals were the rule.

A Maine View of the Rate Law.

Benjamin F. Chadbourne, Maine Railroad Commissioner, is quoted as follows regarding the Rate Law:

In this state the railroads have always been generous with every enterprise that ever came into Maine, and interested in the development of the state. We have had so little rebating, discrimination and extortion by the railroads of Maine that we did not feel the need of any help from outside sources. But I maintain that the rate bill will give Maine shippers no favor or right they could not have obtained under the former system; no adjustment of questioned charges they could not have secured through appeal to the railroad management. On the whole, the rates have been fair, and both consumer and producer were content.

So far as Maine is concerned, the only effect of the new Rate Law thus far noticed is in the shutting off of interstate passes. Railroad men now shy at a pass as a 2-year-old colt would shy at a white sheet hanging on a line. I believe that there should not

be established an Interstate Commerce Commission regulation of railroad affairs without a requirement of conditions or qualifications.

The organic law should state definitely what qualifications the members of the commission should have, so as to get men of the widest experience that should fit them for the work. For seven men to sit down and undertake to fix rates and govern the operation of 240,000 miles of railroad is an undertaking that, to my mind, seems a hindrance rather than a help to this big country of ours.

Nine-tenths of the Maine freight patrons of the railroads are conservative business men who would suffer what they believed to be a wrong rather than to go to the bother and expense of seeking adjustment through a board at Washington.

State Railroad Legislation.

The manager of a railroad, the mileage of which traverses or touches nine western states, summarizes the state legislation affecting the property as follows:

"Missouri—Bill before legislature to reduce freight rates 12 to 15 per cent. Likely to be passed; railroads will fight.

"Kansas—Bill before legislature to reduce freight rates 10 per cent. Situation doubtful. We recently reduced rates 10 per cent. to comply with railroad commission's demand. New commission now in power wants another cut.

"Iowa—Governor Cummings recommended freight reduction on pretext of discriminations. Iowa is lower than any other western state and lower than it should be, and has been so.

"Illinois—Railroad commission talks of reduction in carload rates in line with our 20 per cent. reduction in less than carload class rates last year. Guess we will have to cut some more.

"South Dakota—Some reductions in class rates demanded by railroad commission. Depends on what happens in other states.

"Minnesota—All lines reduced class rates and are now holding up by court injunction commission's reduction in commodity rates aggregating 20 per cent.

"Nebraska—Agitation for creation of a railroad commission and a general reduction in freight rates. Some concessions likely.

"Indiana—Rate reduction proposed by railroad commission; two-cent fare law inevitable.

"Wisconsin—Two-cent fare bill and agitation generally.

"In every state named there is a two-cent fare bill pending or threatened, and in most of them agitation for reciprocal demurrage is taking shape in legislative documents or will. Increased control by the state is the order of the day.

"Wisconsin, Illinois and Minnesota are holding the railroads to strict account in the matter of capitalization. Some states would interfere in our relations with employees.

"No matter which way we turn 'it is handed to us.' The government proposes to reduce our postal revenue. The Illinois railroad commission has gone so far as to tell us what we should charge for switching in Chicago.

"If rates are to go lower service must be reduced. It is time to ask if the railroads are not being pushed too far.

"There have been some bad wrecks lately for the following reasons:

"1. Overtaxed facilities.

"2. Overworked employees.

"3. Large percentage of green men in service.

"4. Demoralization of rank and file by labor agitation incident to wage advances.

"5. Neglect of regular duties by officials under investigation or defending companies against attacks.

"6. The wrecks themselves—nothing so unnerves men of the rail as a series of bad wrecks.

"To get back to the original argument, we have more business than we can carry, but if our gross increases are more than wiped away by increased cost of operation what is the use of being a railroad manager? And if rates must go still lower why should capital extend or upbuild our mileage? Think it over."—*Wall Street Journal.*

Tie Preservation by Crude Oil.

The Atchison, Topeka & Santa Fe has been experimenting with California crude oil in the treatment of ties, with results so satisfactory that it has now been decided by the management to use this treatment altogether for ties hereafter. The following, by E. O. Faulkner, Manager of the Tie and Timber Department of the road, gives briefly the history of the experiment:

"The statement has been made on more than one occasion by the timber experts that in order to produce decay two conditions must be present at the same time, namely, heat and moisture, from a combination of which spring the organisms producing decay. It seemed to us that if we could, by taking thoroughly air-seasoned wood, in which condition the cells or pores would be comparatively empty, and block them up with some hard substance, this should stop the moisture getting into the wood, and thereby prevent decay. There is one special kind of California crude oil of very low gravity, which has about 75 per cent. asphaltum base and the balance light oils, the greater part of which vaporize on being heated. In the fall of 1901 we took a few New Mexico, Arizona and Texas pine ties, thoroughly seasoned, and treated them with this oil, heated to 180 deg. F., and forced in under a pressure of 150 lbs. to the square inch, whereby the different ties took up from 4 gals. minimum to 8 gals. maximum. We placed them in the early spring of 1902 in our experimental track on the Gulf, Colorado & Santa Fe Ry. between Cleveland and Pelican, where an untreated loblolly tie will not last over two years, or an untreated long leaf tie much over three years. In November last when the Santa Fe officers were making their annual inspection, they personally examined these ties and found that at the end of four years and nine months the oil-treated ties were perfectly sound; and on one being sawed through the middle and under the rail base it was just as sound in the interior as though it had only been a month in the track. Also the spike was in as good condition as the day driven and seemed to hold much better than in untreated ties. Since then we have bored into and examined more of them, and they all showed up very well, so that our people have determined on adopting this treatment for ties, while continuing with creosote for bridge timber and piling. This oil at ordinary temperatures is like molasses, but when heated it becomes perfectly fluid, so that we have no difficulty in getting all the penetration necessary, and by applying a light vacuum at the close it seems to seal the pores so that after the ties are taken out of the cylinder they can be handled without any difficulty, and very little of the oil seems to run out. Of those in the Texas track there has sufficient oil come out of the outside of the tie so that it practically makes a thin asphalt covering."

The company will soon begin the erection of a new preserving plant at Belen, N. Mex. It will be a two-cylinder plant of the same capacity as the plant built last year at Somerville, Tex., except the material yard, which will have about half the capacity. The buildings will be of reinforced concrete, as at Somerville, and the plant designed to work any of the preserving processes, but especially the Rueping. Only Arizona and New Mexico mountain pine will be treated, using creosote for the piling and bridge timber and California crude oil for the ties.

The Western Railway Club Library.

The D. L. Barnes Library of the Western Railway Club was the personal library of Mr. D. L. Barnes, the well-known Chicago engineer, whose brilliant career was cut short by death in 1896. His will bequeathed the engineering library he had accumulated to the Western Railway Club "as a nucleus to form a library of its own." For the purpose of accepting and owning the property thus bequeathed the club was incorporated. For many years before his death Mr. Barnes was the Chicago editor of the *Railroad Gazette*, in addition to his consulting engineering work, and for a number of years after it became club property this paper housed the library free of charge in its Chicago office, then at 1750 The Monadnock.

The library grew steadily by accessions from members and friends of the club and the yearly binding of technical periodicals, and finally reached a point where it appeared desirable to install it in quarters of its own. These quarters were secured in the Old Colony Building, adjoining the office of the Secretary of the club. In order to furnish the room suitably, a fund was subscribed by club members, mostly among the railroad supply men, and new book cases and other necessary furniture bought. These have been installed and the club is now the possessor of a valuable technical library, comfortably and attractively housed, to which the members have access for reference purposes at all times. In the possession of such a library the Western Railway Club is unique among its fellow clubs.

The library is not self-sustaining, however, and is largely dependent on the interest and generosity of members and friends for accessions. Works on railroad and engineering subjects must be added continuously to keep such a library up to date. Publishers of such works who care to present copies to the Western Railway Club Library are sure of their coming to the notice of a considerable body of technical readers. The library feature of the Western Railway Club is entitled to all possible encouragement and deserves the cordial support of all of its members.

Valuation of Wisconsin Street Railways.

The physical valuation of the Milwaukee Street Railway properties, including both city and interurban mileage, is now being determined for the Wisconsin State Board of Assessment and the Railroad Commission of Wisconsin. The valuation staff has been drawn in part from the corps hitherto engaged in the valuation of steam roads in the state of Wisconsin and in part from the Arnold Company, of Chicago, which recently had charge of the valuation of the street railway properties of Chicago. Prof. W. D. Pence, M. Am. Soc. C. E., engineer for the two state commissions, has charge of the valuation, and with him are associated Mr. Bion J. Arnold, M. Inst. E. E., President of the Arnold Company, consulting engineer; Mr. C. M. Larson, chief roadway inspector; Prof. John G. D. Mack, M. Am. Soc. M. E., chief mechanical inspector, and Mr. George Weston, chief electrical inspector.

TRADE CATALOGUES.

Acetylene Car Lighting.—The Commercial Acetylene Co., New York, has issued a large new catalogue of railroad car lighting apparatus of the "safety" storage system, employing cylinders packed with asbestos bricks saturated with acetone. A number of different applications of the system for lighting cars, locomotive headlights, signals, yachts, lighthouses and marine buoys are shown in the front pages, and on the following pages are illustrated the lamps, fixtures and apparatus made especially for this system of lighting.

Air-Cooled Electric Tools.—Catalogue No. 21 of the Chicago Pneumatic Tool Co., Chicago, covers the large line of electric drills, grinders, hoists, drilling stands, etc., made by that company. The devices are carefully illustrated and described, with tables of sizes presenting the essential characteristics, where necessary. General instructions for the care of electric drills are given in the back. The book is printed on plate paper in two colors, with excellent engravings, and is a nice piece of work.

Roofing.—An attractive catalogue just issued by The Philip Carey Mfg. Co., Cincinnati, Ohio, gives "evidence and proof as to the best roofing for modern buildings." The composition and construction of the roofing are explained and its durability and other advantages set forth. Also information regarding its application and care of the roof afterward is given. The book is well printed and illustrated, with special cover design.

The Obermayer Bulletin.—The January-February number of this little magazine on foundry information, published by The S. Obermayer Co., Cincinnati, Ohio, contains, as special articles, continuations of the three series on "Cupola Practice," "The Coke Question in the Foundry," and "The Right Way to Run a Foundry" respectively, and also "The Human Canary" and "Plumbago for Foundry Use."

Wheel-Truing Brake-Shoes.—The Wheel Truing Brake-Shoe Co., Detroit, Mich., has prepared a folder giving 20 reasons why its brake-shoes should be used. The 20 are set forth in as many paragraphs, the initial letters to which form the words "wheel-truing brake-shoe."

Lubricating Oil Storage.—A small folder sent by S. F. Bowser & Co., Ft. Wayne, Ind., shows views of their various styles of adjustable measure lubricating oil outfits, describes briefly their uses and gives ten reasons for using these outfits.

Manufacturing and Business.

Newton locomotive arch bricks, made by the Newton Fire Brick Co., Albany, N. Y., are specified for the 100 Atlantic Coast Line engines recently ordered.

Robt. M. Burns & Co., Chicago, have sold 24 tank cars to the Cornplanter Refining Company, and 10 tank cars to the Sunflower State Refining Company.

The Sullivan Machinery Co., Chicago, has opened a branch office in Birmingham, Ala., at 12 South Twentieth street. Rock drills and their parts, and other machinery, are carried in stock.

The Allis-Chalmers Company recently shipped east a carload of air-brakes for foreign shipment. The company makes the Christensen brake, the exclusive manufacturing rights of which it controls.

R. M. Turner, eastern representative of the American Steam Gage & Valve Manufacturing Company, Boston, Mass., has been appointed Manager of the publicity department. C. H. Mosher succeeds Mr. Turner.

Augustus Dowdell, Railway Representative of Valentine & Co., varnish and paint makers, New York, died on February 10 at his home in Philadelphia. Mr. Dowdell had been in the railroad department of this company for the past 12 years; previous to that he had been with the Gould Coupler Company.

The American Car & Equipment Co., Chicago, has sold to the Bucyrus Co., South Milwaukee, Wis., two gondola cars; to the Blodgett Co., Ltd., Jackson, Miss., twenty-five 40-ft. flat cars of 60,000 lbs. capacity and fifty 80,000-lb. coal cars, and to the W. I. Swain Co., Kansas City, Mo., one private car and one combination baggage and sleeping car.

The branch managers and department managers of the H. W. Johns-Manville Co. recently held their annual convention at the headquarters of the company, 100 William street, New York. Representatives from the several branches and factories were present. The convention ended with a banquet at the Waldorf-Astoria on Friday evening, February 1.

The Secretary of the American Street and Interurban Railway Association has announced the removal of its headquarters on February 12 from 60 Wall street to the Engineering Societies building, 29 West Thirty-ninth street, New York. The association will have larger offices than heretofore, and it is believed that the plan of having the headquarters of all the national engineering and allied societies in one building will greatly promote the general interests and welfare of these associations.

A new branch of the H. W. Johns-Manville Co., New York, has just been opened at 214 Main street, Buffalo. This branch consists of a large retail store, offices and warerooms, and will be under the management of George A. Schmidt, who has been in charge of a special department of the W. A. Case & Sons Manufacturing Co., Buffalo, until recently the Buffalo agents of the H. W. Johns-Manville Co. B. F. Boscoe has been appointed Assistant Manager of the new branch, with office in Rochester.

The Webb C. Ball Co., Cleveland, Ohio, has bought the Kingmoore Block on Euclid avenue just east of Ninth street to provide a new location for the retail department of its watch business. The building is three stories high, has 89 ft. frontage on Euclid avenue, and is 135 ft. deep. It will be considerably enlarged, several new stories being contemplated; also quarters will be built adjoining the present building to accommodate the manufacturing department of the retail store and the wholesale watch department.

Iron and Steel.

W. R. Grace & Co., of New York, are in the market for 18,000 tons of bridge material for export to Bolivia.

The Hudson Companies are in the market for 600 tons of open hearth rails for use in the tunnels under the North river. J. G. White & Co. are negotiating for rails for 17 miles of railroad in Manila.

Bids are wanted by the Council City & Solomon River, 5 Nassau street, New York, for delivery during June and July at the road's present terminal at the mouth of the Solomon river, Seward Peninsular, Alaska, for 10,500 tons of 60-lb. rails, and for fish plates and bolts; also for 270,000 ties and for some other material.

Contracts are reported let to the American Bridge Co. by the Kansas City, Mexico & Orient for a considerable amount of bridge material. The Bessemer & Lake Erie, it is said, has bought 140,000 steel ties. The Syracuse Rapid Transit, and the Richmond Railway & Light Co., of Staten Island, have bought about 9,000 ties.

The Norfolk & Western has bought from the McClintic-Marshall Construction Co. 1,500 tons of structural steel, making a total of 4,500 tons ordered by this road. The Standard Steel Car Co. has given the McClintic-Marshall Construction Co. the contract to put up a steel building 110 ft. x 483 ft., requiring 600 tons of steel, and for an extension to its wheel works at Butler, Pa., requiring about 400 tons of steel.

OBITUARY NOTICES.

Alfred Walter, President of the Seaboard Air Line, died in New York City on February 12 after several weeks illness. Mr. Walter was born in Brooklyn, N. Y., in 1851, and graduated from the Rensselaer Polytechnic Institute in 1872. He at once began railroad work as a rodman in an engineering corps on the Allegheny Valley. He worked up through the engineering departments of this road and other Pennsylvania lines until he was made Assistant Engineer of the Northern Central in 1878. Three years later he was transferred to the motive power department of the Pennsylvania as Assistant Engineer, and in 1882 was appointed Superintendent of the Sunbury division of that road and of the Shamokin division of the Northern Central. In 1889 he was appointed General Superintendent of the Baltimore & Ohio lines east of the Ohio river, and three years later was made General Manager of the Erie division of the New York, Lake Erie & Western, now the Erie. In 1894 he was elected President of the Delaware, Susquehanna & Schuylkill. From 1897 to 1902 he was President of the Lehigh Valley; during this period he had to make a constant up hill fight in trying to operate the road to its greatest advantage, which meant continual opposition to the policy of certain financial interests. After leaving the Lehigh Valley, Mr. Walter was for some years out of railroad work, spending most of the time traveling abroad. In July, 1905, he was appointed Chairman of the Board of the South & Western, and early in the next year was elected President of the Seaboard Air Line.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Western Railway Club.

At the February meeting, which will be held on Tuesday evening, the 19th inst., at the Auditorium Hotel, Chicago, a paper on "The Anatomy of a Railroad Motor and Control Equipment" will

be presented by James Lyman, Western Manager, Engineering Department, General Electric Co. It will be illustrated by stereopticon views.

Joint Meeting of the International and Steam Boiler Makers' Associations.

A joint convention of the International Railway Master Boiler Makers' Association, of which J. T. Goodwin, of the Richmond Works of the American Locomotive Company, is Secretary, and the Master Steam Boiler Makers' Association, of which George M. Clark, 1377 Maplewood avenue, Chicago, is Secretary, will be held on May 21, 22 and 23 at the Hollenden Hotel, Cleveland, Ohio.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Atlanta, Birmingham & Atlantic.—H. H. Milam has been appointed Treasurer.

Chicago, Burlington & Quincy.—L. F. Moore, Freight Claim Agent, having been transferred to other duties, the freight claim department has been transferred from the traffic to the auditing department, and will be in charge of C. D. Bird, Auditor of Freight Accounts.

Georgia, Florida & Alabama.—J. O. Hatch, Secretary and Treasurer, has been elected Vice-President.

Pennsylvania Company.—G. L. Peck, General Manager of the Pennsylvania Lines West, has been elected also a Director of the Pennsylvania Company and of the Pittsburg, Cincinnati, Chicago & St. Louis, succeeding C. E. Pugh, resigned.

Pittsburg, Cincinnati, Chicago & St. Louis.—See Pennsylvania Company.

Operating Officers.

Atlantic Coast Line.—O. H. Page, who was recently appointed Superintendent of Transportation of the Third division, with office at Jacksonville, Fla., was born in North Carolina in 1877. After a common school education, he began railroad work in 1890 as a messenger boy on the Cape Fear & Yadkin Valley, now part of the Atlantic Coast Line. He was made assistant operator and then operator at Fayetteville, N. C., and later worked in various positions until 1899, when the Atlantic Coast Line acquired the road. He then went into the despatcher's office of the Atlantic Coast Line at Wilmington, Del., and in a few months was made assistant to the chief clerk in the office of the Superintendent of Transportation at that place. The next year he was appointed special and traveling car agent, and in 1902 was made chief clerk to the Superintendent of Transportation of the First division. In 1903 he was appointed chief clerk to the General Superintendent of Transportation, and in the early part of 1905 was promoted to be Acting Superintendent of Transportation of the First division. In September of that year he was appointed Superintendent of the Fayetteville district, where he remained until his recent appointment.

Cincinnati, New Orleans & Texas Pacific.—H. M. Waite, Superintendent at Somerset, Ky., has resigned to go to the Seaboard Air Line.

Illinois Central.—Eugene Dailey, who was recently appointed Superintendent at Freeport, Ill., was born at Bloomingdale, Ill., in 1862. After a public school education, he began railroad work in 1878 on the Illinois Central as a messenger boy at Ackley, Iowa; he was made telegraph operator two years later, and in 1881 was appointed train despatcher at Fort Dodge, Iowa. From 1885 to 1898 he was chief train despatcher at Waterloo, Iowa, and Dubuque, and was then appointed Trainmaster at Waterloo. In 1901 he was transferred to Freeport with the same title, where he remained until his recent promotion.

International & Great Northern.—Homer Eads, Assistant General Freight Agent at San Antonio, Tex., has been appointed Superintendent at that place. See International & Great Northern under Traffic Officers.

Pennsylvania Eastern.—C. R. French has been appointed Acting General Manager, succeeding J. G. Ruth, resigned.

Pennsylvania Lines West.—See Pennsylvania Company under Operating Officers.

Southern.—C. S. Lake, Superintendent of the Washington division, has been appointed Superintendent of the Danville division, with office at Greensboro, N. C., succeeding W. S. Andrews, resigned to go to the Cincinnati, New Orleans & Texas Pacific. G. V. Peyton succeeds Mr. Lake, with office at Alexandria, Va.

Traffic Officers.

Chicago, Burlington & Quincy.—See Chicago, Burlington & Quincy under Executive, Financial and Legal officers.

Erie.—H. D. Pheatt has been appointed to the new office of General Agent at Milwaukee, Wis.

Grand Trunk.—F. P. Dwyer, General Western Passenger Agent, has been appointed General Agent of the passenger department at New York.

Illinois Central.—Charles C. Cameron, who was recently appointed General Freight Agent of all the lines of this company, was born in 1869 at St. Louis, Mo. After a public school education, he began railroad work on the Wabash, St. Louis & Pacific, now part of the Wabash. He worked in various positions on this road, on the Atchison, Topeka & Santa Fe, the Missouri Pacific and the St. Louis Southwestern until 1899, when he went to the Illinois Central as Assistant General Freight Agent at Louisville, Ky. In 1903 he was appointed General Freight Agent of southern lines, with office at Memphis, Tenn., where he remained until his recent promotion.

International & Great Northern.—M. H. Trice, Assistant Superintendent at Mart, Tex., has been appointed Assistant General Freight Agent at San Antonio, Tex., succeeding Homer Eads, transferred. See International & Great Northern under Operating Officers.

Lake Shore & Michigan Southern.—F. L. Talcott, Commercial Agent at Buffalo, has been appointed to the new office of General Eastern Freight Agent, with office at that place.

Missouri, Kansas & Texas.—J. R. Ford, General Agent at Mexico City, Mex., has resigned to go into other business.

Missouri Pacific.—J. B. Trimble has been appointed General Agent at Pueblo, Colo., succeeding C. A. Waterman, resigned.

New York Central & Hudson River.—W. H. Northrup, General Agent at Williamsport, has been transferred to Watertown, N. Y. C. Hartigan has been transferred to Buffalo, succeeding W. R. Randolph, who has been appointed General Agent at Albany, succeeding A. E. Brainard. Mr. Brainard is transferred to Williamsport.

Northern Pacific.—J. E. Spurling has been appointed General Agent of the freight department at Billings, Mont., in charge of the territory west of Bismarck and east of Livingston.

Southern Pacific.—H. E. Lounsberry, District Freight Agent, has been appointed General Agent at Portland, Ore., succeeding Archibald MacCorquodale, transferred to the Oregon Railroad & Navigation.

Engineering and Rolling Stock Officers.

Chicago Great Western.—T. H. Bacon, Assistant Chief Engineer at St. Paul, Minn., has resigned to go to another company.

Kansas City Southern.—R. M. Galbraith has been appointed Superintendent of Machinery, with office at Pittsburg, Kan., succeeding F. Mertsheimer, resigned.

Mexican Central.—R. H. Rutherford, Master Mechanic of the Torreon division, has been appointed Master Mechanic of the Aguascalientes division, with office at Aguascalientes, Mex. O. R. Hale succeeds Mr. Rutherford, with office at Torreon, Coahuila, Mex.

Missouri Pacific.—M. J. McGraw, Master Mechanic at St. Louis, Mo., has been appointed Master Mechanic at Sedalia, Mo., succeeding S. M. Dolan, resigned to go into other business. T. F. Carbery succeeds Mr. McGraw. R. G. Long has been appointed Master Mechanic at Fort Scott, Kan., succeeding W. C. Walsh, resigned.

New York, New Haven & Hartford.—A. E. Mitchell, formerly Superintendent of Motive Power of the Lehigh Valley, has been appointed Engineer of Tests of the N. Y., N. H. & H., succeeding L. S. Storrs.

Northern Pacific.—H. E. Stevens has been appointed Bridge Engineer, with office at St. Paul, Minn.

LOCOMOTIVE BUILDING.

The Colorado Midland is reported to be about to buy six locomotives.

The Carnegie Steel Company is reported in the market for two locomotives.

The Erie has ordered 35 heavy freight locomotives for May and June delivery.

The Rio Grande, Sierra Madre & Pacific will shortly be in the market for locomotives.

The Cananea, Yaqui River & Pacific will shortly be in the market for locomotives.

The Illinois Central is reported to have ordered about 50 locomotives from the American Locomotive Co.

The Seaboard Air Line is considering the purchase of 30 freight, 15 passenger and five switching locomotives.

The El Paso & Southwestern is reported to have ordered six locomotives from the American Locomotive Co.

The Sierra Madre Land & Lumber Co. will shortly be in the market for locomotives for its Mexican property.

The Des Moines, Iowa Falls & Northern has ordered three mogul locomotives from the Baldwin Locomotive Works.

The Cuba Company, 80 Broadway, New York, will shortly be in the market for locomotives for its plantation railroads in Cuba.

The Tehuantepec National is expected to be in the market shortly for locomotives. The contracts will be placed through the New York offices, 32 Broadway.

The Chicago, Milwaukee & St. Paul, as reported in the *Railroad Gazette* of January 25, has ordered 50 Prairie (2-6-2) locomotives from the American Locomotive Co.

La Louisa Sugar Plantation Co. will shortly be in the market for locomotives for its plantation in the Santa Clara district, Cuba. E. H. Blackstone, Pittsburg, is President.

The Kansas City, Mexico & Orient, as reported in the *Railroad Gazette* of January 4, has ordered 20 Alfree-Hubbell type simple mogul (2-6-0) type locomotives from the American Locomotive Co. The specifications for these locomotives are similar to those published in our issue of January 4, with the exception of the width of the firebox, which is 54 in. instead of 40 in.

CAR BUILDING.

The Kansas City, Mexico & Orient is figuring on 400 box and 200 stock cars.

The Rio Grande, Sierra Madre & Pacific will shortly be in the market for cars.

The Cananea, Yaqui River & Pacific will shortly be in the market for cars.

The Mississippi Central is building 600 flat cars at its Hattiesburg, Miss., shops.

The Atlantic Coast Line, it is reported, is asking bids on 200 box and 50 flat cars.

The Washington, Baltimore & Annapolis Electric will soon order 25 large interurban cars.

The St. Louis, Brownsville & Mexico is reported in the market for about 1,000 freight cars.

The Eureka & Palisade has ordered 15 Hart convertible cars from the Rodger Ballast Car Company.

The Missouri Pacific is reported to have ordered 750 stock cars from the American Car & Foundry Co.

The Doud Stock Car Co., Chicago, will, in the near future, buy material for repairing cars at its own shops.

The Sierra Madre Land & Lumber Company will shortly be in the market for cars for its Mexican property.

The Charleston & Summerville Electric will shortly ask bids on cars through D. E. Baxter & Co., New York.

The Cuba Company, 80 Broadway, New York, will shortly be in the market for cars for its plantation railroads in Cuba.

The Illinois Tunnel Company, Chicago, is reported to have ordered 500 tunnel flat cars from the Bettendorf Axle Company.

The Merchants Despatch Transportation Co., New York, is reported to be buying material for 500 cars to be built at its own shops.

The Yosemite Valley has ordered one observation car, one first class coach and one combination car from the Hicks Locomotive & Car Works.

The Wabash denies having ordered 1,000 box cars from the American Car & Foundry Co., as reported in the *Railroad Gazette* of February 8.

The Hudson Companies deny having ordered 250 steel cars from the Pressed Steel Car Company, as reported in the *Railroad Gazette* of February 8.

The Tehuantepec National is expected to be in the market shortly for cars. The contracts will be placed through the New York offices, 32 Broadway.

La Louisa Sugar Plantation Company will shortly be in the market for cars for its plantation in the Santa Clara district, Cuba. E. H. Blackstone, Pittsburg, is President.

The New Orleans Great Northern has increased its order with the Pressed Steel Car Company by 50 cars, making the total 350 steel underframe flat cars of 80,000 lbs. capacity.

The St. Louis & San Francisco, as reported in the *Railroad Gazette* of February 8, has ordered 3,000 steel underframe box cars of 80,000 lbs. capacity, 1,000 steel underframe gondola cars of 100,000 lbs. capacity, and 500 steel underframe stock cars of 80,000 lbs. capacity from the American Car & Foundry Co. The box cars will be 40 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The gondola cars will be 41 ft. 6 in. long, inside measurements. The stock cars will be 36 ft. long, inside measurements.

The Erie, as reported in our issue of January 18, has ordered 3,000 box cars from the American Car & Foundry Company, and 50 suburban passenger coaches from the Pullman Company; the latter are for July, August and September, 1907, delivery. The coaches will weigh 86,000 lbs. and will measure 59 ft. long, 8 ft. 9½ in. wide and 6 ft. 8¼ in. high, inside measurements, and 66 ft. 1½ in. long, 9 ft. 8 in. wide and 14 ft. 5 in. high, outside measurements. Bodies and underframes will be of wood. The special equipment includes: High-speed air-brakes, canvas roofs and wide vestibules without traps or vestibule doors.

The Atlanta, Birmingham & Atlantic, as reported in our issue of January 2, has ordered 300 drop bottom gondola cars of 80,000 lbs. capacity from the South Atlantic Car Works for March 1, 1907, delivery. These cars will weigh 40,000 lbs. and will measure 39 ft. 6 in. long, 9 ft. 3¼ in. wide and 3 ft. 8 in. high, inside measurements, and 40 ft. long, 9 ft. 8¾ in. wide and 8 ft. high, over all. Bodies and underframes will be of wood. The special equipment includes:

Brakes	Westinghouse
Couplers	R. E. Janney
Draft rigging	Minor tandem
Journal boxes	McCord
Trucks	Andrews side frames

The Missouri & North Arkansas, as reported in the *Railroad Gazette* of February 8, has ordered 100 box cars of 60,000 lbs. capacity from the American Car & Foundry Company, for April delivery. These cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The special equipment is as follows:

Bolsters	Scullin Gallagher
Brake-beams	Monarch
Brake-shoes	Western Railway Equipment Co.
Brakes	Westinghouse
Brasses	Eureka Brass Co.
Couplers	Climax
Door fastenings	Positive
Doors	Security
Draft rigging	Miner
Journal boxes	McCord
Roofs	Murphy
Wheels	St. Louis Car Wheel Co.

The Detroit United, as reported in the *Railroad Gazette* of February 8, has ordered 50 double-truck city cars and 10 interurban cars from the Cincinnati Car Co. The double-truck cars will weigh 37,300 lbs. (equipped), and measure 41 ft. 4 in. long, 8 ft. 4 in. wide and 9 ft. 1 in. high, over all. The interurban cars will be 46 ft. 4 in. long, 8 ft. 6 in. wide and 9 ft. 7 in. high, over all. The special equipment for both is as follows:

Bolsters	Truss type
Couplers	Detroit United Ry. standard
Heating System:	
For double-truck cars	Detroit United Ry. hot air
For interurban cars	Peter Smith hot water
Platforms	Detroit
Trucks (for double-truck cars)	"Standard"
" (for interurban cars)	Baldwin
Vestibules	Detroit
Wheels (for double-truck cars)	Griffin

The Atlantic Coast Line, as reported in our issue of January 16, has ordered 750 steel underframe flat cars of 60,000 lbs. capacity from the Standard Steel Car Co., 1,000 ventilated box cars of 60,000 lbs. capacity from Barney & Smith, and 1,500 ventilated box cars of 60,000 lbs. capacity from the South Baltimore Steel Car & Foundry Co. The flat cars will weigh about 29,000 lbs. and will measure 40 ft. 8½ in. long, 9 ft. 4 in. wide and 4 ft. 1 in. high, over all. The ventilated box cars will weigh 39,000 lbs. and will measure 36 ft. long, 8 ft. 6 in. wide and 7 ft. 5⅛ in. high, inside measurements, and 36 ft. 9½ in. long, 9 ft. 10 in. wide and 13 ft. 9 in. high, over all. Bodies will be of wood and steel, and underframes of steel. The box cars will have National Malleable Casting Company's door fastenings, A. C. L. standard doors and Murphy outside roofs. The special equipment for all cars includes the following:

Bolsters	Truck—structural steel; Body—pressed steel
Brake-beams	Pennsylvania deck
Brake-shoes	Christie
Brakes	Westinghouse
Brasses	Lead lined solid
Couplers	Tower
Draft rigging	Parlow-Westinghouse
Dust guards	Harrison
Journal boxes	Symington
Paint	A. C. L. standard
Springs	A. C. L. standard
Trucks	A. C. L. standard
Vestibule	A. C. L. standard

RAILROAD STRUCTURES.

Binghamton, Ala.—The Binghamton Terminal Co. has authorized an issue of $3,000,000 of bonds to be used in building the new passenger station here.

Calgary, Alb.—It is announced that the Canadian Pacific will put up a passenger station here to cost $200,000.

Enola, Pa.—A contract is reported let by the Pennsylvania to J. N. Bastress of Harrisburg, for putting up a brick machine shop.

Florence, Ala.—The Southern is asking bids for putting up a new freight house to cost about $60,000 to replace the structure destroyed by fire last year.

Jersey City, N. J.—The Pennsylvania Railroad is to make additions to the Jersey City terminal, to cost approximately $300,000. A new building, 120 ft. by 620 ft., will be put up just to the north of the slip now used for the Twenty-third street ferryboats. Pier D, now occupying the space to be taken up by the new building, will be rebuilt for the extension. Sixty feet will be added to the north end of the present lobby in the passenger station to connect it with the new building, which will have a large immigrant waiting room, 160 ft. long and 120 ft. wide. The addition will be two stories high, except at the west end, where there will be three stories for the use of the Adams Express Company. The remainder of the extension will be used for freight.

Lumberton, N. C.—A brick passenger station is being put up here.

Orange, Tex.—A brick passenger station will be built at this place by the Southern Pacific.

Strasburg, Va.—The Norfolk & Western and the Southern are arranging to put up a passenger station for their joint use here.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Alaska Railroads.—It is reported that the Guggenheim interests (American Smelting & Refining Company) have not bought the White Pass & Yukon Railroad, but that they intend to build their own line in Alaska, to connect with their mining properties; also to establish a steamship line between Seattle, Wash., and Skagway.

A favorable report has been made, by the Senate Committee on Territories, on the bill to authorize the Alaska Railroad to build a line from Cordova Bay, Alaska, through copper territory to Eagle. It is thought that the American Smelting & Refining Company is interested in this project.

Arkansas Central.—According to reports work is to be started by C. C. Godman about March 1 on an extension of this road from Paris, Ark., to Dardanelle, 48½ miles.

Atchison, Topeka & Santa Fe.—According to reports from Albuquerque, N. Mex., this company is planning to build a cut off from Rio Puerco to Albuquerque, making that place a junction of the Rio Grande division and the Coast Lines. Such a line will shorten the distance between these places about 20 miles.

Athabaska Railway.—A bill is before the Railway Committee to authorize this company to build a line from Fort Murray, 240 miles north of Edmonton, north to Fort Smith, on the Slave River 250 miles. The company already has a charter for the Edmonton-Fort Murray section of the proposed line.

Atlantic, Northern & Southern.—Incorporation has been granted this company in Iowa with $500,000 capital to build railroads. J. H. Simmons is President; F. M. Nebe, Vice-President; Joseph Stier, Secretary, and E. Marquis, Treasurer, Atlantic, Iowa.

Brooklyn (N. Y.) Roads.—Bids are wanted February 21, by Bridge Commissioner Stevenson for building an elevated connection on the Brooklyn plaza of the Williamsburg Bridge, the work to be completed by August of this year.

Buffalo Creek & Gauley.—Contracts have been let to J. B. Tully, Sutton, W. Va., for building two miles from Gulf, W. Va., to Rockcamp. Additional contracts are soon to be let for building from Rockcamp to Camden, 29 miles. N. D. Janney, Chief Engineer, Clay Courthouse, W. Va.

Central of Georgia.—An officer writes that the Greenville & Newnan, building from Greenville, Ga., via Luthersville to Raymond, 23½ miles, has completed grading, and expects to have track laid for the entire distance this month. W. J. Oliver & Co., Knoxville, Tenn., are the contractors.

Chicago, South Bend & Northern Indiana (Electric).—This company has been incorporated in Indianapolis, Ind., with a capital of $7,500,000. The company has acquired the Northern Indiana Railway, which is to be extended via Michigan City to Chicago; also from Michigan City to Indianapolis. Charles T. Dieterich, of New York, is President; C. M. Murdock, of Lafayette, Ind., Vice-President; A. E. Dieterich, of New York, Treasurer, and S. T. Murdock, of Lafayette, Secretary and General Manager.

Choctaw, Newcastle & Western.—Incorporated in Oklahoma with $5,000,000 capital by J. R. Lebosquet, of Little Rock, Ark.; S. T. Pierson and W. P. Dix, of Shawnee; L. C. Rose and A. W. Underwood, of Chicago, to build a line from Newcastle via Ade and Panes Valley to Lawton, about 200 miles.

Cimarron & North Western.—Incorporated in New Mexico with office at Raton, to build from Cimarron on the St. Louis, Rocky Mountain and Pacific Northwest to Van Bremmer Park, 36 miles. C. N. Blackwell, W. H. Decker and Albert A. Miller are incorporators.

Connecticut Roads (Electric).—Residents of Hartford have organized a company with a capital of $100,000 to build a line from East Windsor Hill to Broad Brook and Hazardville, a total of 11 miles. W. O. Burr, F. S. Carey, C. S. Hills, G. A. Gray, C. C. Cook and D. W. Hewes are incorporators.

Denver, Northwestern & Pacific.—On the extension, which this company is building from Kremmling, Colo., to Steamboat Springs, Utah, grading has been completed for about 60 per cent. Contracts let to Dunphey & Nelson from Kremmling to Azieve, five miles, and Orman & Crook from Azieve to Steamboat Springs, 85 miles.

Florida East Coast.—The first train from the Florida mainland to the Keys, consisting of a locomotive and the private car of Henry M. Flagler, was run on Feb. 8. One or two locomotives have been running on Key Largo several weeks. Largo is by far the largest key, being 23 miles long. With the draw in operation at Jewfish creek further construction will be facilitated.

Grand Trunk Pacific.—During the past year on the National Transcontinental, the part of the line east of Winnipeg, 9,156 miles of surveys were made, including exploratory, preliminary, first location and final location. Of first location there were 1,734 miles, of revised location 618 miles and of final location 358 miles. At the close of the fiscal year contracts were let and work under way on 150 miles from the Quebec bridge west, also on 244 miles from a few miles east of Winnipeg to the approximate point of junction of the Thunder Bay branch of the G. T. P. near Peninsular crossing west, longitude 92 deg., and on the Cap Rouge viaduct a short distance west of the Quebec bridge.

The statement of Collingwood Schrieber, General Consulting Engineer to the Government and Chief Engineer of the Western division of the Grand Trunk Pacific, on the progress made up to September 1, 1906, in surveys, location and construction is as follows:

Preliminary surveys have sufficiently advanced to submit route maps of the line from Winnipeg touching the towns of Saskatoon and Edmonton, and passing through the Yellow Head Pass to a point on the Pacific slope at the junction of the Salmon river with the Fraser river, about 1,247 miles. Of this the government has approved from Winnipeg to a point a short distance east of Edmonton, about 776 miles in all. Edmonton being favorably situated for the establishment of the principal workshops, sorting and distributing yards, cattle yards, warehouses and grain elevators, a large area of land has been bought for these purposes. Plans and profiles of location have been approved by the government from township 12, range 7, section 4, west of the first meridian (Portage la Prairie), to township 53, range 23, west of the fourth meridian (a point about eight miles east of Edmonton), about 720 miles, upon which section work is in progress. On this section the location has been carefully selected with a view to obtaining first class alinement and favorable grades; the curvature is light and the maximum grades against the traffic moving east are 0.40 per 100 and against the traffic going west 0.50 per 100. In securing this alinement and gradients, heavy work has been encountered in the form of high embankments, deep cuttings and large structures at various points, such as at Pine, Mule, Minnawashta, Birdtail and Cut Arm creeks; the little Saskatchewan river; the Touchwood, Eagle and Beaver hills; the Qu'Appelle valley, and at Battle river.

With a road so constructed and, consequently, capable of economical operation, and with the communication to be afforded with the port of Fort William at the head of navigation on Lake Superior, by means of the branch line now being built from a point on the main line east of Winnipeg, the road should be in an excellent position to share with its competitors the increasing traffic of the Northwest and of the grain fields of the prairies. On the Western division from Winnipeg to the Pacific coast the surveys are not at present sufficiently advanced to enable any reliable opinion to be formed as to the character of the alinement and grades to be obtained through the mountain region. However I feel confident that a satisfactory location will be obtained. The prairie country through which the road passes is a fine farming district, the soil being for the most part rich. Many settlers are taking up homesteads along

the route, both north and south of the road. The progress made with the construction has not advanced as rapidly as could be desired. This is due to the impossibility of securing the requisite number of men for a vigorous prosecution of the work. In several instances many teams of horses were standing idle in the stables, owing to inability to secure teamsters to drive them. It is manifest that the supply of laboring men in Canada at the present time is insufficient to meet the demand, and is not within 40 to 50 per cent. of the number of men required to carry out the contracts in hand.

The following is a statement of the approximate quantities of work on the section between Portage ia Prairie and Edmonton, and the amount of work executed thereon up to September 1, 1906:

Character of work	Quantity of work—Total.	Done to Sept. 1, 1906.
Clearing, acres	1,420	1,409
Grubbing, acres	250	97
Earth excavation, cu. yds.	17,700,000	5,091,000
Rock excavation, cu. yds.	797,000	314,700
Culverts, lin. ft.	62,000	17,900
Large trestle bridges, lin. ft.	16,000	4,400
Smaller pile bridges, lin. ft.	11,000	2,060
Steel bridges over large rivers, lin. ft.	5,700	Nil
Telegraph and telephone lines, miles	750	20,000 telegraph poles delivered.
Fencing	1,500	Nil.
Track complete, including ballasting, miles.	816	50,000 tons rails delivered; 160,000 ties delivered; 2 miles track laid.
Station and other buildings	265	Nil.
Cattle-guards and sign boards.	1,500	Nil.
Rip-rap, cu. yds.	20,000	200

The materials for the rest of the culverts, trestles and pile bridges, etc., can be taken out in the winter months, and delivered where it is to be used with much greater facility than in the summer. If nothing interferes track should be laid to Edmonton by the end of next autumn.

GREAT SOUTHERN.—This company, which last year built 30 miles of its line from The Dalles, Ore., to Tygh Valley, 52 miles, will build the remaining 22 miles with its own forces.

GREENSBURG & WESTERN (ELECTRIC).—See West Penn Ry.

GREENVILLE & NEWNAN.—See Central of Georgia.

GURDON & FORT SMITH NORTHERN RAILWAY.—See Missouri Pacific.

GURDON & FORT SMITH RAILROAD.—See Missouri Pacific.

HOBOKEN & MANHATTAN.—See Hudson & Manhattan.

HUDSON & MANHATTAN.—On December 5, 1906, the New York & Jersey (of New York), Hudson & Manhattan (of New York), and Hoboken & Manhattan (of New Jersey) were consolidated into one corporation, known as the Hudson & Manhattan Railroad Company, being a corporation of the states of New York and New Jersey.

Charles M. Jacobs, Chief Engineer, has made a report on the progress of the work on the tunnels. It shows that the tunnels of the Manhattan end now extend from the shaft near the foot of Christopher street nearly to the corner of Christopher street and Ninth avenue; that the two tubes from there to Hoboken are finished except for the operating tracks; that the tubes from Jersey City to Cortlandt and Fulton streets have been bored about three-quarters of the way across, and that the work on the tunnels for the Jersey connections of the under-river tubes is nearly half done. At the beginning of 1906 work on the project was being done from three shafts, while at the present time boring is done from 19 different points. In 1906 the number of men employed on the tunnels was increased from 1,350 to more than 5,000.

KANAWHA & WEST VIRGINIA.—Surveys are being made by this company for an extension of its road from Pond Gap, W. Va., to Sweet Springs, 140 miles.

LAKE ERIE & PITTSBURG.—Announcement has been made that work is to be started about April 1 on this new Vanderbilt line, building from Cleveland and Lorain to Youngstown, and that contracts for work will be let shortly.

LEWISTON & SOUTHEASTERN (ELECTRIC).—An officer writes that contracts have been let to Schofield & Co., of Philadelphia, for building this company's proposed line from Lewiston, Idaho, south via Westlake to Grangeville, with a branch from Westlake east to Ilo, and thence south to Nezperce, a total of 135 miles. Considerable grading has been finished, but no track has yet been laid. W. P. Wood, Chief Engineer, Lewiston, Idaho.

LONG ISLAND.—The work to be carried out this year by this company includes a second track from Roslyn to Glen Cove, from Flushing to Port Washington and from Flushing to Whitestone Landing; also from Oakdale to Patchogue. Third and fourth track from Winfield to Jamaica, and a double track connection from Glendale Junction on the Montauk division to White Pot on the main line and third track from Hollis to Brushville.

LOUISIANA & ARKANSAS.—An officer writes that contracts have been let to M. Tansey, of Tiago, La., for extending the main line from Tiago south to Pineville, opposite the city of Alexandria, about five miles.

LOUISVILLE & GREAT WESTERN TRACTION.—Surveys have been made by this company, which is controlled by the Louisville & Northern Railway & Lighting Company, from New Albany, Ind., to French Lick, 53 miles, and from New Albany to Corydon an additional 20 miles. Grading is to be begun early in March. J. C. Henderson, New Albany, Chief Engineer.

LOUISIANA & NASHVILLE.—According to reports from Atlanta, Ga., this company is planning to build a 50-mile line connecting Chattanooga, Tenn., with the Atlanta-Knoxville division and Etowah, Tenn.

MANILA & SOUTH WESTERN.—An officer writes that this company, which last year started building its proposed line from Wynn, Ark., northeast to Manila, 65 miles, has discontinued work on account of high water, and will resume building about May 1. D. A. Smith & Sons, of Manila, Ark., are the contractors. R. L. Williford, of Manila, President, and William E. Kerr, Jonesboro, Chief Engineer.

MIDDLETOWN & CECILTON.—This company is building a line from Middletown, Del., via Warwick, Md., to Cecilton, Fredericktown and Georgetown, Md., 12 miles. Contracts let to W. R. Polk, Middletown, Del., for building from the Maryland state line, about nine miles; 7½ miles graded, but no track laid. The company proposes to build a branch from Cecilton to Bayview, seven miles. It has not yet been decided whether gasolene or steam will be used as a motive power. W. R. Polk, General Manager.

MISSOURI PACIFIC.—This company, under the names of the Gurdon & Fort Smith Railroad, and Gurdon & Fort Smith Northern Railway, is building from a point half a mile east of Antoine, Ark., via Amity and Caddo Gap, to a point near Black Springs, 39½ miles. The grading has been finished and track has been laid from near Antoine to a point near Caddo Gap, 30 miles.

Contracts let to R. M. Bushman and to A. M. Hanson, of Springfield, Mo., for a two-mile extension of the Springfield Southwestern into Springfield, Mo.

MOREHEAD & NORTH FORK.—An officer writes that contracts have been given to the Snyder Construction Co. for building the proposed line from Morehead, Ky., to Paragon, ten miles. Sub-contracts have been let to the Rinehart-Dennis Company for building three miles, including a 1,400-ft. tunnel. Grading is completed and three miles of track laid. E. W. Hess, Chief Engineer, Clearfield, Pa.

NAUGATUCK VALLEY (ELECTRIC).—This company, which last year let contracts to C. W. Blakesley & Sons, of New Haven, Conn., to build from Naugatuck, Conn., via Bacon Falls to Seymour, eight miles, has track laid for five miles. The line is expected to be completed the coming summer, when it is to be turned over to the Consolidated Railway Company. Two other lines are being built, one from Waterbury to Woodbury, 13 miles, and the other from Thomaston to Waterbury, six miles. It is expected to complete these lines also during the coming summer.

NEBRASKA, KANSAS & SOUTHWESTERN.—Incorporated in Kansas, with $1,500,000 capital, to build a line from Superior, Nuckols County, Neb., to Moneton County, Kan. A. W. Wilson, H. C. Floyd, J. C. Hopper, C. H. Rassfield and R. D. McKinley, incorporators.

NEW YORK & JERSEY.—See Hudson & Manhattan.

NEW YORK, AUBURN & LANSING (ELECTRIC).—An officer writes that grading work has been finished by the Auburn Construction Co., of Auburn, N. Y., on this company's line from Auburn via Fleming, Scipio, Venice, Genoa and Lansing to Ithaca, 35 miles. Track has been laid from Auburn to Genoa, 20 miles.

OMAHA & NEBRASKA CENTRAL (ELECTRIC).—Local reports state that grading will begin as soon as frost is out of the ground on this proposed line from Omaha, Neb., to Hastings, 200 miles.

PADUCAH SOUTHERN.—Incorporated in Kentucky to build a line to be operated by steam and electric power from Paducah to Hickman, and eventually to East St. Louis, Ill. D. A. Archer is the promoter. B. H. Scott, H. H. Loving, W. A. Martin and B. Weille, of Paducah, are interested.

SACRAMENTO & VALLEJO.—Incorporated in California with $1,000,000 capital to build from Sacramento southwest to Vallejo, 60 miles. W. Knight and B. Pringle, of Sausalito, and William G. Barr, of San Francisco, are interested.

ST. MARY'S & WESTERN ONTARIO.—Bids are wanted by J. G. Macklin, Chief Engineer, St. Mary's, Ont., Feb. 20, for the clearing of right of way, grading, track-laying, bridging, ballasting, fencing and telegraph lines complete for a section of this line between St. Mary's and Embro, Ont. Rails, ties and fastenings will be supplied by the company.

SASKATCHEWAN VALLEY & HUDSON'S BAY.—A bill is before the Railway Committee to authorize the incorporation of this company,

which proposes to build a line from Edmonton, Alb., to Prince Albert, and thence to Fort Churchill on Hudson's Bay, 1,500 miles.

Seward Peninsular.—An officer writes that this company, organized last year to build a line from Nome, Alaska, to Kaugarok, 125 miles, is building from Nome to Lanes Landing, 69 miles. C. L. Morris, of Nome, is the contractor. The company proposes also to extend from Lanes Landing to Mines, 30 miles.

South Carolina Public Service Corporation.—This company has been incorporated in Georgia with $500,000 capital to build from Charleston, Ga., to Columbia, with extensions to Spartansburg and Charlotte, through Lexington, Saluda, Greenwood, Union and Newberry; also to build from Augusta via Aiken to Orangeburg. The company has projected a total of 525 miles of new lines. J. J. Timmes, President; C. R. Van Etten, Vice-President; J. P. Bonney, Secretary and Treasurer, all of New York. J. C. Lott, R. H. Jennings and J. A. Craig, of Orangeburg, and L. M. Pinckney, of Charleston, are interested.

South Wilmington & Southern.—Incorporated in Illinois with $25,000 capital and office at Chicago, to build a line from South Wilmington in Grundy County, south to Wilson, Livingston County. A. L. Sweet, W. Farmer, R. H. Gruschow, C. A. Sweet and T. A. Lemmon are directors and incorporators.

Springfield Southwestern.—See Missouri Pacific.

Toronto, Niagara & Western.—This company is planning to build a high speed electric line from Niagara Falls., Ont., to Toronto, over the right of way of the Toronto & Niagara Power Company, 90 miles; also to extend later to Brantford, Woodstock, Ingersoll, London, Paris and other points.

Waupaca & Green Bay.—Incorporated in Wisconsin with $100,000 capital to build from Waupaca northeast to Scandinavia, 11 miles. A. G. Nelson, A. M. Renney, W. B. Johnson, J. Gordon and A. A. Aggerbeck are interested.

West Point Railway (Electric).—Under the name of the Greensburg & Western, application will be made in Pennsylvania to built from Greensburg, Pa., west to Irwin, about 12 miles.

Yosemite Valley.—This company is building with its own men an extension from the present end of its track in California to the Yosemite National Park, 30 miles. Surveys also being made from Junction to Wanona, an additional 32 miles. N. C. Ray, Chief Engineer, Merced, California.

Youngstown & Ohio River (Electric).—This company, which is building from Salem, Ohio, via Washingtonville, Leetonia, Lisbon and West Point to East Liverpool, has let contracts for the first 16 miles from Washingtonville to West Point. Grading finished from Lisbon to Leetonia, eight miles. The work includes about 7,000 ft. of trestle. George L. Wells, Salem, Ohio, Chief Engineer.

RAILROAD CORPORATION NEWS.

Bay Shore Terminal (Electric).—This property has been sold to the Norfolk & Ocean View, which is presumably owned by the Norfolk & Portsmouth Traction. The latter company operates 155 miles of road in and about Norfolk, Va., and is controlled by E. B. Smith & Co., of Philadelphia. The Bay Shore Terminal was sold under foreclosure on May 3, 1906, to E. B. Smith & Co. for $765,000, but the sale has been contested in the courts until a recent decision was made allowing the sale as above.

Boston & Maine.—Gross earnings for the six months ended December 31, 1906, were $21,422,180, an increase of $1,042,298. Operating expenses show a still larger increase; they include $850,000 spent on new block signals and rolling stock, which is $270,000 more than was spent on this account during the corresponding period of 1905. The net earnings were $5,615,966, a decrease of $310,767.

Buffalo & Susquehanna.—This company, it is said, is planning the issue of $10,000,000 5 per cent. short term notes to pay for its recent extension to Blasdell, N. Y. (Feb. 8, p. 196.)

Canadian Pacific.—This company has sold in London something less than $7,500,000 4 per cent. non-cumulative preferred stock, making about $45,350,000 now outstanding. The charter of the company provides that the preferred stock shall never exceed one-half of the common stock; there is now $121,000,000 of the latter outstanding. The additional preferred stock was sold at 101½, which is the equivalent of 98⅜ in New York. The money will be held in the treasury until needed, as the company only sold the stock because of the high price bid for it.

Chartiers Railway.—A circular has been sent to stockholders of this company offering to exchange three shares of common stock of the Pittsburg, Cincinnati, Chicago & St. Louis, $100 par value, for each share of stock of the Chartiers Railway, par value $50. The Chartiers Railway is 23 miles long, running from Carnegie, Pa., to Washington, Pa. It is leased to the Pittsburg, Cincinnati, Chicago & St. Louis, and a majority of its $645,300 stock is owned by the Pennsylvania Company. Its stock pays 10 per cent. dividends, and the Pittsburg, Cincinnati, Chicago & St. Louis common pays 4 per cent.

Chicago Great Western.—This company is planning to sell $3,000,000 additional cumulative 4 per cent. debenture stock in London, the proceeds to pay for double tracking. There is now outstanding $26,127,000 debenture stock, being part of an authorized issue of $30,000,000.

Cleveland, Cincinnati, Chicago & St. Louis.—It is reported that plans are under way for an issue of not more than $10,000,000 notes. Three New York Central lines, the New York Central & Hudson River, the Lake Shore & Michigan Southern and the Michigan Central, recently issued, together, $50,000,000 three-year 5 per cent. notes.

Delaware & Hudson.—See Quebec, Montreal & Southern.

Evansville & Southern Indiana Traction.—This company has filed a mortgage securing an issue of $4,000,000 5 per cent. 30 year bonds; part of the proceeds are to be used to redeem bonds of the Evansville Electric, and the Evansville, Princeton & Vincennes, recently acquired. (Jan. 25, p. 129.)

Great Northern.—The approximate gross earnings for the month of January, 1907, were $2,546,526, a decrease of $1,101,135; this falling off in earnings was due to the exceptionally heavy snowfalls and high winds which have interfered with traffic.

Minneapolis, St. Paul & Sault Ste. Marie.—The severe storms in the northwest greatly affected the January earnings of this road. Gross earnings for the four weeks ended January 31 were $615,200, a decrease of $232,049, or 27 per cent. Gross earnings for the last week in January and the first week in February decreased 37 per cent.; the figures for the latter week are incomplete on account of snow blockade.

New York Central Lines.—Gross earnings for the month of January were as follows:

New York Central & Hudson River	$7,412,494	Inc.	$226,726
Lake Shore & Michigan Southern	3,464,616	Inc.	56,450
Lake Erie & Western	413,503	Dec.	42,682
Chicago, Indiana & Southern	245,428	Inc.	50,679
New York, Chicago & St. Louis	816,297	Dec.	51,178
Michigan Central	2,278,826	Inc.	199,085
Cleveland, Cincinnati, Chicago & St. Louis	1,828,801	Dec.	35,251
Peoria & Eastern	241,766	Dec.	20,861
Cincinnati Northern	74,190	Inc.	3,327
Pittsburg & Lake Erie	1,092,148	Dec.	23,536
Rutland	194,895	Dec.	2,961
Total	$18,062,974	Inc.	$359,818

New York, New Haven & Hartford.—Gross earnings for the three months ended December 31, 1906, were $14,027,310, an increase of $481,240; net earnings $5,050,309, an increase of $40,510.

Norfolk & Ocean View (Electric).—See Bay Shore Terminal.

Norfolk & Portsmouth Traction.—See Bay Shore Terminal.

Northern Central.—It is announced that the proposed merger of this road with the Pennsylvania, which controls it, has been abandoned. A shareholders committee was appointed three years ago to consider plans for a merger, the shareholders having at that time authorized a perpetual lease to or merger with the larger company. The committee has recommended that the directors be asked to make the next semi-annual dividend 5 per cent. on the $17,193,400 outstanding capital stock, and to continue this rate as long as the net income warrants such a disbursement. The annual rate has been 8 per cent. since 1901. A stock dividend of 12½ per cent. was declared last December.

Pennsylvania.—At the annual meeting of the stockholders on March 12, when they are to be asked to authorize $100,000,000 additional capital stock and $100,000,000 bonds, they will also be asked to give the Board of Directors authority to issue from time to time either stock or bonds as the occasion arises. (Jan. 18, p. 96.)

This company has leased from the recently organized Pennsylvania General Freight Equipment Trust 21,878 cars, being those ordered for 1906 delivery. Their cost was about $25,000,000. (Jan. 25, p. 130.)

See Northern Central; also Chartiers Railway.

Pittsburg, Cincinnati, Chicago & St. Louis.—See Chartiers Railway.

Quebec, Montreal & Southern.—This company, which is the holding company for the Delaware & Hudson's properties in Canada, has borrowed through the United States Mortgage & Trust Company $6,000,000 for one year at interest a little under 6 per cent. This loan is guaranteed by the D. & H. Of the proceeds, $1,750,000 is to pay for equipment already ordered, and the remainder is for construction.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS. Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We refer in our editorial columns only to such matters as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

CONTENTS

EDITORIAL:

New Haven and Pennsylvania Note Issues 229
Union Pacific Steel Box Cars 229
Courtesy as an Asset 229
The New York Central Wreck 230
The Atlantic City Conventions 230
Some Phases of Car Shortage 230
A Railroad Accident Investigation Bureau 231
New Publications 232

ILLUSTRATED:

Successive Experiments and Improvements on Locomotives of the Pennsylvania 235
Sleeping Cars on Illinois Traction Lines 242
Alfred Walter 247
Turbine Steamship Governor Cobb 248
All-Steel 50-Ton Box Car for the Union Pacific 250
The Grand Central Terminal in 1906 and in 1911 252

CONTRIBUTIONS:

The Profitable Weight and Speed of Freight Trains 242
The New American Semaphore Code 243

MISCELLANEOUS:

Car Famines: Their Causes and Remedy 234
The Telegraph Block System in England 241
President Finley to His Traffic Men 243
Privilege to Shippers and Car Shortage 244
Final Report of the Pennsylvania Railroad Special Investigating Committee 245
Rail Motor Car Experiments in Hungary 248
Foreign Railroad Notes
Electrification Considered in Bavaria
The Ricken Tunnel 242
Hungarian Freight Blockade
German Railroad Temperance 244

GENERAL NEWS SECTION

Notes 253
Trade Catalogues 254
Obituary 255
Meetings and Announcements 255
Elections and Appointments 255
Locomotive Building 256
Car Building 257
Railroad Structures 258
Railroad Construction 258
Railroad Corporation News 259

VOL. XLII., No. 8. FRIDAY, FEBRUARY 22, 1907.

The past week has seen two important new note issues. First the New York, New Haven & Hartford sold an issue of $29,000,000 15-year 4 per cent. notes in the markets of Europe, and on Tuesday the Pennsylvania Railroad came out with the announcement that it had sold an issue of $60,000,000 3-year 5 per cent. notes to Kuhn, Loeb & Co. The New Haven loan marks the second important case of successful financing by an American railroad abroad, the first being, of course, the placing of a loan of nearly $50,000,000 by the Pennsylvania Company last year. It is also of interest as showing the present necessities of the New Haven system, which, during four weeks of December and January, also placed $26,000,000 short-time notes in this country. The Pennsylvania borrowing is supposed to represent all the new capital which will be raised by that road during the year. This, in spite of the fact that it is not intended to use any of the $200,000,000 stock or bonds which the stockholders have, as a precaution for the future, been asked to authorize at the annual meeting on March 12. It is announced that the proceeds of the $60,000,000 notes will meet all the requirements of the company for construction, including the New York terminal and other expenditures, and also $50,000,000 Pennsylvania Company 18-month notes maturing November 1. It is probable, however that the proceeds of the new issue will be used for immediate construction requirements, leaving the refunding of the November notes to be taken care of by the proceeds from the sale of the Baltimore & Ohio, Norfolk & Western and Chesapeake & Ohio stock holdings of the Pennsylvania last fall. These funds, it appears, instead of being paid in cash at that time, are being received in time payments, which by November will be sufficient to take care of the then maturing Pennsylvania Company notes. Some such arrangement is certainly more than probable, for after providing for the $50,000,000 November notes there would be only $10,000,000 new funds available from the new issue, and this amount, even with a cutting down of new expenditures, would never be sufficient to meet the company's requirements for the year.

The box car of the Union Pacific, which is described elsewhere in this issue, is the extreme development of the steel car. It seems strange that the experiment of building a box car with a steel body has not been tried before, for it is only a short step from the high side steel gondola to the box car. Perhaps the reason why the experiment has not been tried, is the important fact that it has not seemed worth while to carry the steel construction above the underframe. It is claimed that the box car described weighs 37,800 lbs., or about 12 per cent. less than the standard box car with steel underframe used on the Harriman lines. The two cars have substantially the same dimensions, the difference in cubic capacity being only 50 cubic feet. This saving of weight is accomplished largely by using only one center sill and designing the side frames as efficient plate girders of considerable depth. The body framing of a wooden box car has always been more or less of a failure as a truss to carry that part of the load between bolsters. The combination of green timber and imperfect fitting usually results in a side frame which carries little or none of the load after a few months of service, but in the steel box car, the side frames having all the members rigidly attached to each other, do support a great part of the load which would otherwise be carried by the longitudinal sills. The saving of 12 per cent. in weight is an important factor but it would seem to have been carried too far in some respects. The use of side and end sheets of No. 11 B. W. G. (less than ⅛ in. thick) may prove to be doubtful economy. Such plates have perhaps a little more strength than the wooden siding commonly used, but certainly not sufficient strength to resist puncture and tearing to say nothing of minor bending in any sort of a collision or derailment. It will cost more to put on a new plate than it would to put on a few siding boards. Steel gondola and hopper cars seldom have side sheets less than $^{7}/_{16}$ in. thick, and more commonly ¼ in. to $^{5}/_{16}$ in. Such plates can withstand a good many hard knocks without damage, and it would seem to be better designing to have provided the ends of the car at least with heavy plates, just as the vulnerable parts of a battleship are protected with heavy armor.

The ideal relations between a railroad and its patrons are admirably summed up in the address of President Finley, of the Southern, to representatives of the traffic department of that road at a recent meeting held to make clear the policy of the management in this regard. This address is summarized in another

column. There is no place where, at the moment, the importance of a favorable public opinion to successful railroad operation is being more clearly brought home to railroad officers than in the South, where severe attacks against railroads are being made in almost all of the legislatures. It is the freight and passenger agents, as Mr. Finley says, not the general officers of a road, who come in contact with the public. They have the opportunity either to satisfy the public by fair, frank treatment or to give start to a dissatisfaction which later develops into bitter prejudice by actions which seem arbitrary and tyrannical because their reason is not understood. Whether a company shall be popular or unpopular depends in large measure on the treatment which the public receives at the hands of its representatives. People as a rule are fair-minded, and when fully informed can be relied on to deal justly with railroads. The prejudices, as in all departments of life, generally come from misunderstandings. If the two parties to the controversy could discuss it quietly and courteously, each would understand the position of the other, and most of the hostility of the public to railroads would be removed; therefore even the man who makes impossible or unreasonable demands should not be dismissed with a curt refusal, for he may not know that what he asks is either impossible or unreasonable. If he gets nothing more than a sharp answer he realizes only his helplessness as against the railroad, and comes to look upon the company as an enemy to his prosperity instead of, as it really is, a partner in his success or failure. These are no new truths, but the disregard of them is, probably more than all other considerations put together, responsible for the popular hostility to railroads which exists all over the country to-day. It is too late now to prevent this feeling; it is here, but its hurtful effects on railroads may be lessened and the hostility itself eventually removed by the sort of treatment of the public which Mr. Finley urges on his traffic men. His instructions might well be taken to heart by all railroad men, particularly in the operating and traffic departments, who come in any way in contact with the general public.

On Saturday evening, Feb. 16, the New York Central & Hudson River train No. 25 X, a White Plains local express, scheduled to leave the Grand Central Station, New York, at 6.12, was derailed near Williamsbridge, 10 miles from the Grand Central. The train consisted of two electric locomotives with one smoking car, one combination car and three coaches. The combination car and three coaches were thrown on their sides and dragged in that position something like a car length. Eighteen passengers were killed at the time and three died up to the following Monday night at the hospital, making a total of 21 so far killed. Four others are in the hospital in a dangerous condition, and 140 others were injured. The reason given for hauling this train with two electric motors instead of one is that the contact shoes on the right-hand side of one motor and the contact shoes on the left-hand side of the other motor had been removed, so that to insure continuous contact the two motors were used. The motors are 37 ft. long, measured over the buffers; they have a leading radial truck, eight drivers coupled, and a trailing radial truck. The rigid wheel base is 13 ft. long; the total wheel base is 27 ft.; the weight is about 190,000 lbs. The cause of the derailment is not yet definitely known, but it seems to be beyond question that the trouble began with the trailing radial truck of the leading locomotive. When the train stopped, the leading truck of this locomotive and the coupled wheels were in their place on rails, uninjured, while the trailing truck was broken and standing astride the right-hand rail. At the point where trouble began the curvature was 3 deg. and the elevation of the outer rail was 4½ in. All the evidence so far obtained indicates that the speed was about 50 miles an hour, and so far no evidence has been developed to controvert this. The general dimensions and weight of the high-speed steam locomotives used for many years in similar service on the New York Central are as follows: Over all, length, 36½ ft.; weight, 200,000 lbs. The center of gravity of the electric locomotives is lower than that of the steam locomotives. The derailment was due to a violent spreading of the track under such stress that the spikes were sheared smoothly on a level with the surface of the tie-plates. The track was of the strongest type of construction, with 100-lb. rail, tie-plates, 16 to 18 ties to each 30 ft., bedded in rock ballast. The fact that the spikes were sheared is, so far as it goes, proof that the track was strong, and that the elevation of the outer rail was sufficient to resist a turning movement. The summary up to the date of this writing is simply the location of the trouble at the trailing truck of the leading locomotive and the development from that point of such severe stresses as to spread the rails and leave the following cars to their fate.

It appeared, last June, in reviewing the attendance and exhibits at the conventions of the Master Car Builders' and American Railway Master Mechanics' Associations, that Atlantic City lacked being an ideal meeting place for two reasons—difficulty of concentration outside the meeting hall for private discussions and lack of proper shelter for exhibits. Propositions made to the joint committee for the 1907 conventions made it desirable to return this year to Atlantic City; but the arrangements have been so modified as to meet the objections, at least in part. A large hotel has been designated as headquarters and the evening functions will be held in or near that place. The exhibits will again be placed on the Steel Pier but will be better protected from the elements. The plan for their protection, however, has met with some objection from supplymen, largely because of a misunderstanding of the arrangements. Prior to this year a uniform assessment entitled exhibitors to as much space as they required. Many exhibitors found it necessary to go to the place of meeting from a week to a month before the opening day in order to contract for and superintend the building of their booths. At best, the prices paid for the work were not reasonable; but those who left the matter until the eleventh hour were literally robbed. As every exhibitor had his own idea as to how his space should be enclosed and decorated, the result, æsthetically, was what might be expected. This year the same, assessment will be levied and no exhibitor will be restricted to the space he may occupy under that assessment; but a charge of 50 cents a square foot for space occupied will be made to cover the cost of building suitable booths designed in pursuance of a general decorative plan. Special provision has been made for exhibits which cannot well accommodate themselves to the set scheme. The plans, made by the architect, Mr. Bradford L. Gilbert, will give to the exhibits an effect of stability, and the displays outside of the buildings on the Pier will be well protected from rain and fog. The booths will be finished ready for installation of exhibits at least ten days before the first convention opens. The exhibitor will be relieved of much time and care and of all liability to overcharge. The effect will be pleasing to the eye. For these reasons the idea is good; nevertheless, some exhibitors who own substantial structures used at previous conventions will be making an additional contribution for Art's sake.

Car shortage, its causes and its remedies was recently discussed before the Iowa Railway Club. The two papers on this subject read at the meeting are published in this week's issue of the *Railroad Gazette*. One was written by a conductor on the Chicago Great Western, a man who it is fair to assume knows actual operating conditions on at least this one of the Iowa roads from intimate personal experience. He comes out flatly with the novel opinion that instead of there being a car shortage, the through lines have too many cars; the shortage is not in cars, but in terminal facilities and motive power. As showing the first of these lacks he calls attention to the fact that the tonnage handled in the city of Chicago has increased 85 per cent. in the past 10 years, while facilities for handling this business have increased less than 30 per cent. His views on the second point—a shortage of power—is specially interesting as representing the frank opinion which it is usually so hard to have placed on record of a man directly employed in the train service. He believes that the desire to carry heavy trainloads is one of the causes of car shortage. Freight trains are overloaded, giving them a tonnage that they can just manage to get over the road, so that it often takes these heavy trains a week or ten days to get over a 500-mile run. This last point suggests a real reform which, we believe, could be made on certain roads during periods of traffic congestion. At such times of heavy traffic, instead of sending out the heaviest possible trains, it would seem to be the most economical system to lighten the loads and increase the speed so as to make a faster average movement over the road.* An illustration of the success of this system was furnished by the writer of this paper from his personal experience. His paper covered what may be called the operating causes of car shortage and traffic congestion; the other speaker, the Manager of the Illinois & Iowa Car Service Association, dealt more particularly with the traffic causes. It is evident from his remarks that he has had some bitter experiences with trying to enforce demurrage rules, for instance, in the case of shippers or consignees with a pull, also that in his position at the

*See contributions on this subject.

head of a car service association he realizes the serious effects of privileges to railroad patrons on the supply and movement of cars. He sums up briefly the ways in which the shipper, the carrier, the middleman and the receiver are at fault. The conclusion to be drawn from this summary is that although there are criticisms which can be made of the railroad's handling of traffic, by far the most important part of the blame rests on the railroad's patrons who profit by the various privileges which, in times of competitive stress, have been granted to them. His remedy is, in a word, to have railroads act solely as transportation companies. This by doing away with or charging high for reconsignment and other similar privileges and a general agreement by all the railroads on a demurrage rate high enough to prevent delays to cars. He also points out that while it is to the general public's interest to load and unload all cars promptly, it is generally not to the interests of the particular shipper or consignee to do the same. But it is to the interest of all the railroads, both collectively and individually, to have prompt handling of cars. He, therefore, advocates a general agreement among the roads for doing away with these special privileges to patrons which make the railroad a warehousing rather than a transportation company. In this analysis of the traffic causes of car shortage and congestion we believe that a very important opportunity for reform is pointed out. Special privileges to shippers are, in general, a survival of the period of bitter and unrestrained competition for business. With the passing of this sort of competition, and particularly in view of the fact that the railroads are unable to handle the traffic offered them, these special privileges should be done away with by general agreement. Such abolition would, no doubt, injure temporarily certain businesses which have been depending on them, but the change must necessarily come sooner or later, and a time of general prosperity and great volume of traffic, like the present, furnishes both the opportunity and justification for a reform.

A RAILROAD ACCIDENT INVESTIGATION BUREAU.

News of a killing railroad disaster comes by telephone and telegraph to five authorities—the railroad staff; the coroner; the district attorney; the state railroad commission; and the newspapers. While the railroad officers and men are caring for the hurt and dead, clearing the wreck, rebuilding the line, and searching for the cause, the four higher authorities are competing in independent investigations. The evidence is not collated, it is separated. The coroner arrests suspects, seizes broken parts and holds them as "exhibits," halts the officers in charge of removals, and is apparently within the law in enforcing any order. The representatives of the district attorney and the commission are also lawfully entitled to get and keep, if they can, evidence for their own consideration. The newspaper men need no legal enactment for support in their work. They are not to be gainsaid. The result is a skirmish; it is often a scramble. The railroad officers' investigation is methodical, and judicial in form, but between those in charge of train movement, of track and of rolling stock, there is the human temptation to shift responsibility. They work in a storm of criticism, facing punishment, knowing that their findings will not be accepted by lurid critics who see them as criminals trying their own cases. It is disorderly. The railroad company investigations must always be made for railroad purposes, but the four other conflicting authorities are doing harm. An unassailable verdict is a judicial undertaking.

The establishment by congressional action of a bureau for investigating and making public the causes of important train accidents seems to be inevitable, and, if it is wisely planned and officered, should be not only inevitable but beneficent. To prevent erratic action there is needed a full knowledge of the working of similar departments in other countries, combined with the experience and judgment of railroad officers who have had to do with train handling, and also with the larger subject—the relation of the railroads to the public. The hasty introduction of such a bill as is under consideration by the Interstate Commerce Commission is the worst way and is illogical, although it is clearly within the province of the Commission to take the initiative. The subject may be well worth formal consideration by the American Railway Association, whose wonderful membership includes the ablest and best informed men in all departments of the art of transportation.

The British system is a basis for study. For more than 60 years it has worked successfully. There is a Railway & Canal Commission, which is concerned with maximum rates, and is in a limited way comparable with our Interstate Commerce Commission, but the Railway Department of the Board of Trade is the more active agent of government. In practical working, this Railway Department consists of a Secretary, who is in full charge of four inspectors, all of whom are army engineer officers; of two assistant inspectors, and two sub-inspectors. The Secretary's work consists largely of receiving, collating and reporting the statistical returns by the railroad companies and the inspectors' reports. An inspector's function is two-fold:

(1.) Before there can be opened for public use any new lines of railroad or material alteration or addition to an existing road or station or signaling installation or other safety device, an inspector passes on its adequacy and gives permission. It is theoretically possible to appeal from the decision of an inspector, but it is not done; his decision is accepted as final, unless upon further investigation he modifies or overrules it.

(2.) Accidents, resulting in loss of life or personal injury, and collisions or derailments involving a passenger train are referred to an inspector for investigation. In any serious case, the inspector receiving the assignment goes at once to the scene of the wreck, makes a careful examination of everything he can see, receives from the railroad officers all the information and the assistance that they can give him, summons every employee involved in the accident or who has seen any part of it, and then holds a formal inquiry, examining each witness in turn. After gathering all the information possible, he writes a report, which consists of Description, Evidence and Conclusion. The conclusion is apt to be followed by an appendix giving a list of damages done to road and rolling stock, and photographs, drawings, or other data for reference. The assistant inspectors investigate and report on minor accidents to railroad employees and other persons employed on railroad premises.

The important features of an inspector's report given in his conclusions consist of a clear statement of the cause of the accident and such recommendations as he not infrequently makes to the company for a change in its practice. In form, the company is not ordered, and indeed is not legally compelled to carry out the recommendation of the inspector; nevertheless, the relations of the inspector and the railroad officers are such that we know of no case of lasting disagreement, and this relation is due to two causes: The honesty of purpose and intelligence of a Board of Trade inspectors is beyond question. He is always available for a conference to the end of preventing misunderstandings. Character and ability are absolute essentials for an autocrat, and an industrious officer with such attainments does his good work in the world more swiftly and with less friction than a commission.

An obvious criticism is the restriction of these inspectorships to those who are army engineer officers. It would seem at first sight that railroad officers who have had long experience in handling trains, in maintaining discipline among the employees, and almost daily means of judging the value of safety devices, would be the kind of men to be the most valuable inspectors. This is probably true, but there are difficulties involved in making such selection, and still further difficulties involved in coaxing away from railroad service men of sufficient experience combined with the judicial faculty. Moreover, by so much as the field of selection is enlarged, there is an increase in the chances to appoint men for reasons other than fitness. The personnel of the 35 state railroad commissions in this country, and perhaps in this we may also include the Interstate Commerce Commission, does not indicate that a wide range of possible selection is the wisest method of securing the best qualified officers.

From the nature of his work, the inspector has much leisure time. He has periods of intense application to difficult problems; he does not always succeed in finding the cause of the accident; his term of service is for life or to an age of retirement; he therefore has every incentive to study his business as a science; to learn railroad methods thoroughly; and he has also the time for this work. The writer has never found a British railway officer, who considered the inspector's investigations, decisions and recommendations to be other than a help to him; and this, too, in spite of the fact that the inspector makes mistakes. He may make an error in his finding that a locomotive which has left the track was of a type not safe for the speed at which the company has been accustomed to run it. The company officers may on the other hand believe that the derailment was due to a defect in the permanent way. This does not lead the conservative inspector to make hasty judgment limiting the speed of such locomotives, although his report may be suggestive of such a limitation. No friction between the company and the department results, for the company has ample

opportunity to demonstrate in practice whether or not the type is dangerous, and the inspector is quite as ready to accept the officer's evidence as the officer is to accept recommendations.

We venture the opinion that no American railroad officer, experienced in facing coroner's and other investigations, who will avail himself of the opportunity to attend a Board of Trade Inspector's Inquiry, will fail to be impressed by the advantages of the public investigation by an entirely independent trained judge. In our method, the railroad officer surely wants to find the truth, and his advantage is that he already has a lot of stored information concerning the defects and merits of his track, structures, equipment and men; but information does not imply the capacity to weigh contradictory evidence. A United States District Court Judge, in hearing and deciding a patent infringement suit, with no engineering education or practical experience in mechanics, finds his way through the mazes of the triple valve, interlocking device, track circuit, pneumatic tool and the like—finds the truth and makes it a public record. This public record of the facts obtained by an independent official investigation of the causes of serious accidents, is sure to be of great value to the railroads in their relations to government and to the people.

An act dealing with this subject will become a law, and when it is enforced it may be either a benefit or a hindrance. It is for the railroad officers to decide whether they will either take the initiative in submitting a plan; or in some proper way make their knowledge and results of experience available; or wait for the probably costly results of a law framed by less well informed persons.

NEW PUBLICATIONS.

Reinforced Concrete. By Albert W. Buel and C. S. Hill. Second edition; revised and enlarged. New York: The Engineering News Publishing Co. 499 pages; 6 in. x 9 in.; 144 illustrations. Price, $5.00; cloth.

The first impression formed of this book is of completeness, and the impression is not destroyed by a more careful examination. The two-fold authorship does not mean collaboration, in this case, but that the first part dealing with the methods of calculation and the design of reinforced concrete was written by Mr. Buel, while the second and third parts, dealing with the details of, and methods employed in the construction of various classes of reinforced concrete structures was written by Mr. Hill, so that the volume really consists of two books. This method of construction is, as yet, so young, that absolute certainty in the formulas for strength is impossible, yet enough experimental data are at hand to make a close approximation in what is undertaken. The value of concrete steel as a structural material is to a great extent dependent upon the uniformity of the rate of expansion of the two components and the adhesion of the concrete to the steel. These are worked out with considerable detail, but it appears to be the opinion of the author that it is advisable to use some form of mechanical bond and not depend entirely upon the adhesive strength of the concrete to withstand the tensile stresses. With this brief introduction to the general character of the subject, the second chapter of the first part takes up in great detail the theories of flexure of concrete beams. There is first a resumé of the more important tests that have been made by Kirkaldy, Thacher, Hatt, Miller, Turneaure, Talbot, Harding and Marburg, and here the reader will find the detailed information upon which to base an opinion as to the value of the formulae which follow. In this there is a variation in practice that wavers between the parabolic and straight-line formulas, and it is stated that while the theory of flexure of the straight-line formulae is probably not absolutely true, it has not yet been satisfactorily established by experiment that the parabolic is correct or that it is even on the side of safety. For that reason many specifications and codes require the use of the straight-line formula, though it is acknowledged to be not even approximately correct for ultimate stresses. But it must be borne in mind that few structures are built with the expectation that they will be strained to even an approximation to the breaking strength, so that it does not seem that, for working purposes, a complicated formula, difficult to handle, should be used. The main requisite is that whatever is employed should err on the side of safety. However, it does not seem to the writer "that the time has yet arrived when one set of formulas can be inserted in a book and given to the building professions and trades as the only one meriting consideration." With these limitations in mind the reader will find a complete summary of the work that has been done by the several investigators along these lines, as well as a mathematical consideration of the results obtained. The two following chapters are shorter and deal with the designing of retaining walls, dams, tanks, conduits, chimneys and arches, and the testing of the last.

Part II. is occupied with descriptive matter culled from a wide range of sources, on the various items of reinforced concrete construction. While the descriptions themselves are brief they are very fully illustrated so that there is a valuable collection of examples of the best current practice, and it is needless to enlarge upon the value of such a collection to the designer, regardless of his past experience.

Part III. is equally valuable in the description of the materials and methods used in this form of structure. It takes up the methods of construction used in foundation, building, bridge and conduit work, concluding with a chapter on facing and finishing exposed concrete surfaces. The especial value of this part lies in its suggestiveness, for, though every piece of work of any magnitude demands special preparation and consideration, the knowledge of what has been done before, and has yielded satisfactory results, will always be of great assistance.

The book closes with three appendices giving the details of tests made on reinforced concrete and the methods of mixing Portland cement concretes.

Throughout the whole work there is a constant comparison between American and European practice, and especial insistance is placed upon the advisability of using only Portland cement in concrete-steel construction, though natural cements are sometimes used. In this way the subject seems to be viewed in every possible light, and the final reading of the book confirms the first impression that was formed of its completeness.

Interstate Commerce Acts Indexed and Digested. By Charles S. Hamlin, Corporation Counsel of the Boston Chamber of Commerce. Boston: Little, Brown & Co. 480 pages; 8vo. Price, $3.50.

This is a book primarily arranged for lawyers. Bound in buckram and printed in law book fashion, it puts the various acts to regulate commerce conveniently at hand for a lawyer's library. By this very regularity and accuracy of arrangement it becomes of great value to any who have occasion to refer to the exact provisions of the various commerce laws. The first part of the book is taken up with the text of important laws of the United States relating to the regulation of commerce as officially printed by the Interstate Commerce Commission, these acts being printed in numbered lines with marginal index and comments. There are included the original Interstate Commerce Act of February 4, 1887, and amendments, and the Act of June 29, 1906; the acts in relation to testimony before the Commission; the Acts concerning immunity of witnesses; the Act to Expedite Hearings; the so-called Elkins Act as amended; the Act of August 7, 1888, as to Government aided railroad and telegraph lines; the Safety Appliance Acts, the Resolutions of Investigation of block signal systems, interlocking signals, examination of railroad discriminations and monopolies in coal and oil; the Act of June 1, 1898, as to arbitration between carriers and their employees; the Sherman Anti-Trust Act; the unrepealed provisions of the Wilson Tariff Act as to trusts in import trade; the Act of June 11, 1906, relating to the liability of railroads to their employees, and others. The text of these acts takes up 78 pages. Then follows an index-digest of the six laws which are of special interest and importance to shippers and carriers, followed by a digest of the other less important acts separately. The index-digest takes up one by one the principal words and phrases used in the acts and gives the section, page and line where each reference can be found in the text. This greatly simplifies and expedites reference to any particular subject desired. The fact that the index-digests fill over 400 pages gives an idea of the detailed work involved in the compilation.

Grain Chart. 22 in. x 28 in. Published by R. G. Beker, Frick Building, Pittsburg, Pa. Price, $2.00.

Mr. Beker's grain chart shows in graphic form a mass of data about the production and prices of grain, all over the world, through a series of years. It is compiled from official sources, and is published in convenient form for reference, as a wall map.

CONTRIBUTIONS

The Profitable Weight and Speed of Freight Trains.

Providence, Feb. 12, 1907.

To the Editor of the Railroad Gazette:

Mr. Wild's text, in his interesting and instructive letter of January 29th, is car shortage, followed up by an analysis of train load as related thereto. Almost every cause under the sun can be, and has been held responsible for car shortage or freight congestion. Railroad officers have devoted themselves to a solution of the question for many years. It remained, however, for a "business association—I have forgotten the name—which met in Philadelphia the latter part of December to prescribe a concise and comprehensive remedy after a few minutes' discussion, viz.: Congress to open up all waterways; the railroads to be required to double-track all single-track lines and four-track all double-track lines; enlarge all

terminals sufficiently and procure immediately an ample supply of locomotives and cars. The long railroad experience of Mr. Clark, of the Interstate Commerce Commission, enabled him to more correctly diagnose the situation and express the opinion that the public is as much responsible for car shortage as the railroads—both have a duty to perform and should co-operate.

There is a season when the roads are pushed to the utmost to keep cars moving to meet the demands and necessities of shippers. It is then that the public conveniently permits cars to stand empty awaiting load as long as no penalty is imposed, and unload as leisurely. Where the pernicious car-absorbing four-day free limit is permitted by law, the writer has seen cars—and many of them—consume nine and ten days on a short switching haul for which the total revenue derived by the railroad did not exceed two or three dollars. The full four days were used in loading, a day or two in moving the car to destination and another four days in unloading. During this unfavorable weather season, when cars are in great demand, shippers and teamers will let freight houses fill up to the roof waiting for a favorable day when they can get a little more load on each dray. It would be interesting to know to what extent unloading of l.c.l. freight has been improved in Baltimore and Washington, where the Pennsylvania and Baltimore & Ohio roads do their own teaming—i.e., make "store-door" deliveries.

The roads are to blame for the inadequacy of their freight terminals—and for this a by-gone generation must be held to account. Improvement of freight terminals is usually subordinated to caring for passenger traffic, although a road fully prepared to move its freight trains promptly, getting them on and off sidings quickly and into and out of open, smooth working terminals readily will, in all probability, find its passenger train service well taken care of. The one provides for the other. The engineers of the past are responsible for much of the operating officers' present troubles. In an exceedingly busy freight terminal, a 50-car double-end track has track scales planted as near the center as they can be got. There are two 50 or 60-car single-end tracks, with large retail coal plants capable of unloading 30 to 40 cars of coal daily, at the extreme end of the tracks. A small coal plant, unloading two or three cars a week, is located at the switch end of each track. When the small dealer gets a car placed he immediately drops the hoppers and holds the track several days while the large dealer complains because he cannot unload his coal. The section boss' lament comes to mind: "For it's hell if you don't—and it's hell if you do." The engineer also brilliantly planned an ash-track on an approach to the turn-table where an engine could have its fire cleaned, take water, sand and coal at one time. He placed a track alongside for the one ash-car it would hold. When loaded this car has to be staked on the table and after the table is turned is pulled off. The empty car is then placed on the table and roped into the ash-track. The removal of the load and placing of the empty consumes an hour of a busy yard engine's time. These and other awkward situations do not explain to the casual observer why the yard does not handle the business its corps of yard engines and its track capacity would demand.

It is surprising, at times, to note the loss of car and train service by reason of careless train make-up. Insufficient terminals are often largely responsible for it, particularly at the terminals at which roads receive—and deliver—a large part of their freight. Trains are often started in such a manner as to require an entire breaking up and handling of all cars at every large yard passed—and there may be many of these short distances apart; although some of the cars will probably travel from one end of the line to the other and in sufficient numbers to get one or more train loads at the starting point every 24 hours. Initial starting points should make up freight trains to all stations or distributing points for which enough cars run to make a train every 24 hours. Terminals should be enlarged with that end in view. The paradoxical fact should be remembered that starting cars does not necessarily advance them. They should be started right. It is only necessary to take an actual count of the cars despatched on the "chop suey" method from a heavy initial terminal dividing up the handling required at various points and comparing with the reduced handling and increased movement by holding 24 or 36 hours for straight trains, to get a mathematically exact basis of cost. The investigator will be astonished at the large amount of saving in car service, engine mileage, crew wages and yard work to enable enlarging or revising the initial terminal sufficiently to accomplish this end. One of the large eastern roads completed a classification yard a few years ago and has since added a second separating yard at the same point; both operated by humps. In these yards classifications are made and cars held for any point to which business runs sufficiently heavy to start a train once in 36 hours. This system advances freight and increases car mileage.

The economical and expeditious train load has been looked at from all points and no general agreement seems in sight—probably because local conditions enter into it to such an extent that it is usually a case of "try-out." Mr. Wild deducts from his analysis "that there is more net money in speeds of 15, 20 and 25 miles per hour than in speeds above or below these rates." The exhaustive Northern Pacific tests indicated an economical speed of 14 or 15 miles an hour, which corresponds to a schedule speed of 8.75 miles an hour, with approximately 90 per cent. of the maximum rating of the locomotives. The *Railroad Gazette*, October 24, 1902, reviews some interesting heavy train hauls. The writer handled one of these; an 84-mile run with a train of 104 loaded cars weighing 4,014 tons—said to be the heaviest train handled with one engine that distance. This was a test of an extreme possibility; not an example of good railroad practice. With consideration of traffic and geographical conditions, some general rule for rating locomotives may be applied. Approximately, on a division 100 miles long with a predominating eastbound loaded movement, assume a short distance, say 10 miles, of eastbound maximum ascending grade. It would be economy to load to a maximum tonnage, working the lever "in the corner" on the few miles of ascending grade, out of the total 200 miles run, and "cut back" on the remainder of the trip. Were there about 50 miles of a maximum grade instead of a much shorter distance, it would not be conducive to economical or expeditious handling to load so heavily. The locomotive should then be loaded to a point only that would enable it to maintain a speed of at least 15 miles an hour on the heaviest grades, under ordinary conditions, and working steam expansively. This applies to the handling of the train by the locomotive; there are other questions entering into it.

On western lines, with long distances between junction points and larger distributing centers, the heavy train, with reasonable limitations, is not only economical but advances traffic as it reduces the units the train despatcher has to provide for. In eastern countries, with short distances, crowded terminals and a dense passenger traffic, the reverse may be true. A freight train must be able to quickly get out of the way of passenger or high-class freight trains, as quickly return to the running track or cross from one track to another. If traffic is very dense it may be desirable that all trains maintain a uniform speed. At the terminals it must not exceed the length of the tracks provided to receive it to prevent obstructing following trains.

J. A. DROEGE,
Division Supt., New York, New Haven & Hartford.

The New American Semaphore Code.

London, Nov. 19, 1906.*

TO THE EDITOR OF THE RAILROAD GAZETTE:

The American Railway Signal Association's declaration of independence, published in your issue of October 26, comes as a bolt from the blue, and is a challenge to our British signal tenets, especially as regards the use of distant signals.

There are three fundamental innovations, viz.: (1.) The use of not less than two lights for any high-speed signal. (2.) The abolition of the distant signal as a separate signal, and the use of the caution function of a three-position home, starter or advance signal instead of the danger or "on" function of the abolished "distant." (3.) The use of two lights placed diagonally in relation to a vertical line to denote an automatic block signal. The use of the German raised arm for caution and clear functions is also noteworthy.

There can be little doubt that the raised arm is preferable to the lowered one, because it better ensures the return of the arm to horizontal position by gravity. The use of not less than two lights for a high-speed signal is a distinct improvement, for it not only acts to a certain extent as a safeguard against the danger of an extinguished light, but also the second light enhances the value of both the green and the yellow lights. Any observer will have noticed how much more distinct is the color of a yellow or a green light when seen along with a red one. As shown in the diagram, page 369, position No. 16 of the automatic block signals would be confusing to enginemen. In my opinion the upper arm should be horizontal with a green (?) light.

So much for innovation No. 1. Now for the distant signal question.

On the surface this question may appear to be fairly simple, but like most simple things, it will be seen on close examination to be very complex, and to involve us somewhat in philosophy for a determining of whether to treat the matter objectively or subjectively. Let us consider one or two main points. In the first place we must put ourselves in the place of an engineman. Now, all considerations of distant signals presuppose high speeds. That being the case I wish to show that the distant signal is of more vital importance than the other running signals.

Let us try the test of elimination.

Given a train running at high speed round a curve with conditions imposing a very limited view ahead, and approaching another train standing with red tail light and protected by only a

*The delay in printing this letter, for which the Editor begs to apologize, is due to its having been lost after it reached New York.

distant signal, say 1,200 to 1,500 yards in its rear. If this signal is acted upon there will be little danger of a collision.

Given the same conditions with the exception of a home signal 100 yards in rear of the standing train and no distant signal, a collision would be probable.

It thus appears that the distant signal is of predominant importance and in the horizontal position of the arm it should be spoken of as at "danger" and not at "caution" (although the American Signal Association has recommended the latter) for it is necessary to instil into the minds of the enginemen and others the extreme importance of acting promptly upon the distant signal warning when running at high speed.

This state of mind is not likely to result from the use of the word "caution" in connection with the distant signal, and, in fact, instead of the reading "Proceed Cautiously" it should be "Stop Vigorously" in view of the fact that a fast train may take from 500 to 1,000 yards to stop in after sighting the distant.

It is customary in this country, and I think rightly so, to speak of a distant signal in the horizontal position as at "danger" or "on."

For the above reasons we should object to the half-way position of the home arm to substitute the separate distant arm at danger, for it naturally gives the meaning "proceed cautiously" instead of "stop vigorously" as it should.

When one considers Grantham and other similar accidents it is clear that subtle mental effects must be taken into account.

I have followed with interest the development in America of the yellow signal light. My letter in advocacy of this light in the *Railroad Gazette* of November 23, 1894, was written when the amber light had few friends.

The first suggestion for the use of diagonal signal lights as a distinctive signal, will be found in a communication about the year 1881 to the Institution of Civil Engineers from a well-known signal engineer now resident in New Jersey.

As regards the mechanism required for a three-position signal, it is, of course, readily accomplished by a well-designed power machine.

With the American compensated two-wire connections, or with rod connections, it may be accomplished fairly well, except that the slotting would not be very sure for three positions, if done entirely by rods or wires for a signal 1,500 yards away.

ARTHUR H. JOHNSON,
Telegraph Engr. and Supt., London & South-Western Ry.

Car Famines; Their Causes and Remedy.*

It is not scarcity of cars but abuse of them that causes car famines. Shippers of freight in all sections of the country suffer more or less from a scarcity of cars during the busy season of the year, but the heaviest burden always falls on the small shipper, especially at non-competitive points on the different roads, because his only alternative is to wait until cars can be supplied him. The abuse of the box car is not caused by the traffic department, but by the operating department. It is imperative that the operating management of a railroad furnish sufficient facilities to handle the business secured for them to move by the traffic department, which has not been done. In the city of Chicago the tonnage handled in the past 10 years has increased 85 per cent., and the facilities for handling this business have increased not over 27 per cent. What is the result? Congestion and blockades, causing hundreds and thousands of cars to be held out awaiting an opportunity to deliver their cargo. With sufficient terminal facilities these cars should have been unloaded and returned to the different points along their line, and I will venture to say they could make two or three load carrying trips in the time that under our present congested condition they are held up at some point waiting to be unloaded.

Railroads should build freight and storage yards a few miles out from all large centers, were incoming freight could be held until the actual delivering and unloading yard could handle the freight with quickness and despatch. This would in a great measure relieve car shortage.

In a short time after the yearly grain carrying season begins the cry from the grain shipper is, "More box cars." Why? Because, when all the available cars have been loaded, the usual congestion occurs, and instead of these cars being rushed to the different markets, unloaded and returned for more loading, they simply become storehouses on wheels, lie around the different sidings and terminals, and it is days and even weeks before they reach their ultimate destination.

My opinion has always been that the different trunk lines have too many cars. In addition to the number of cars being actually loaded and unloaded each day, a road should not have more cars on its line than it has power (locomotives) and facilities to move each day. Under this condition congestion is impossible, and a road would always have enough cars to handle its business without complaint of car shortage. Suppose that during a congested condition a road should purchase 3,000 or 5,000 new cars and at once distribute them to the different shippers: this would relieve the situation, say, for 10 or 15 days. Then, when the cars are loaded, there would be so many more cars to add to the already congested condition, and matters would be worse than before the new cars were received.

A carload of freight was recently shipped from a point in Illinois to a town here in Iowa—200 miles. This car was 18 days covering the distance. On tracing it up it was found that the car had not been in bad order, but had simply been lying around terminal points and different sidings on account of a congested condition of the road; and still this road is short of cars.

Another cause of car shortage is improper handling of the earning capacity of a car by operating officials who have a mania for making a showing of tons hauled per train-mile by their trains. While a good showing is creditable, it is one of the causes of car shortage. The trouble is caused by overloading freight trains, giving these trains a tonnage that they can just drag over the road. Take a freight division that a train should cover in 10 hours; these "drag" trains take 20 or 25 hours to get over. An economical dead freight train should cover a 500-mile territory in 40 hours, yet it takes drag trains a week or 10 days to cover the same territory. Under the present system of overloading freight trains, road congestion is caused, which is as bad as yard congestion; and a road that practices this system can be sure that its house and passing tracks will be blocked with cars waiting to be moved, its train and engine crews worn out, and its engines in a condition in which they cannot give even light tonnage a reasonably good movement, because they are so long between terminal points that when they reach a terminal they cannot receive the necessary running repairs, as they are first out, the yard is blocked and it is necessary for them to be called on to relieve the situation.

I once worked under a superintendent on a 100-mile division. During a heavy rush of business he immediately cut down the tonnage on our trains so that we could cover the 100 miles in four or five hours, and on leaving the heaviest freight originating terminal he would say: "Now hurry back, boys, and get some more." The consequence was, the crews and power were always in good shape. We frequently covered the division three times in a day. More freight moved with less expense, and we did not know what road or yard congestion was.

One of the chief causes of car shortage can be attributed to the mechanical department. With few exceptions you can ask any employee of the different lines in this territory what is the condition of their power, and the universal expression is, "Very bad." In all cases of retrenchment and curtailing of expenses the mechanical department is the first to suffer. Good power is the very sinew and backbone of a successfully managed railroad, and this department should be the last to suffer. A locomotive is given a general overhauling, placed in service, and with proper care and running repairs regularly attended to, is expected to cover, say, 100,000 miles before another general overhauling. As soon as placed in service she immediately begins the "straining process," overtaxing her capacity, hauling drag trains, not receiving the necessary running repairs because of shortage of power, and before half the required mileage is made she requires shopping again, which she does not get, but must eke out a miserable existence until the other 50,000 miles is covered, as the policy of economy adopted by the road has only allowed so much money with which to maintain the locomotive for each 100,000 miles run. The road whose power is in poor condition can expect nothing but congestion, and congestion is the only cause of car shortage.

Before 1900 the car shortage problem had not assumed such a serious aspect as it does now. Yet to prove that this shortage should have diminished instead of increased I will quote you a few figures I have compiled from an authoritative source. In 1895 there were 85,227,515,891 tons carried one mile; in 1905 there were 186,463,109,510 tons carried one mile; an increase in 10 years of 118 per cent. From the year 1895 to the year 1906 there were built 1,305,205 freight cars—an increase of about 105 per cent. The carrying capacity of these cars increased 75 per cent., making a total increase of 180 per cent. The increase of freight in 10 years was 118 per cent., and the carrying capacity increased 180 per cent. With our improved terminal facilities, increased double-track mileage, heavier power and various other improvements, conditions should have improved in these 10 years and there should not be a shortage of cars.

The total estimated amount spent in the past year for new rolling stock and motive power was $380,000,000—an increase over last year of about 45 per cent.; but our most sanguine traffic official will not say that his increase of business has been anywhere near this figure. The proper solution of this vexatious question is, Better terminal facilities, increased and better motive power and not so many cars.

*A paper by P. B. Vermillion, Conductor on the Chicago Great Western, read on Jan. 11, before the Iowa Railway Club.

Successive Experiments and Improvements on Locomotives of the Pennsylvania Railroad.

BY C. H. CARUTHERS.

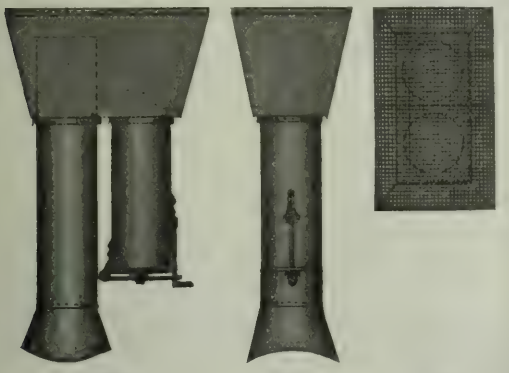
Although the Pennsylvania Railroad has always been considered very conservative in adopting improvements, it has almost from its earliest beginning shown a willingness to submit any reasonable device or suggestion to the only true method of determining its merits or demerits, a thorough test in the regular service of the department most likely to receive benefit from it. These tests not only have the benefit of the skilled office forces of the company, but also that of the practical experience of the large number of able employees who handle the various equipment and plants of the company.

As on most large railroads, the locomotive equipment of the company in its earlier years was of very diversified types, but this diversity was chiefly in form of construction and arrangement of parts, the essential features being the same in nearly all cases.

It will be understood of course that the time of first use or adoption as standard of any device alludes to the Pennsylvania Railroad only, without regard to a possible trial or adoption of the devices at earlier or later periods on other lines.

Probably the first attempt at a radical improvement was the introduction of the Loughridge continuous brake which closely followed the experiments in smoke-consuming previously described in the *Railroad Gazette*.

The older officials and trainmen will remember this brake, which consisted primarily of a transverse shaft carried in movable boxes behind the rear pair of driving wheels, and carrying on one end a friction wheel about sixteen inches in diameter with its periphery grooved to fit the flange of the rear driving wheel against which it could be drawn by a hand lever extending upward through the footplate, while another lever controlled its retention in braking or release positions by means of a pawl and ratchet also fixed upon the shaft and its frame. The braking was effected by means of a chain which united this transverse shaft to a series of chains extending back to the brakes of the tender and following cars. Although an attempt to equalize, or take up, the lost motion of the various parts was made under each car by the use of a swinging frame containing a number of small sheaves, the result obtained was far from satisfactory, and from a high efficiency on the tender and first car, its power gradually diminished until at the fourth or fifth car it had almost dropped to zero. Hence on the local trains where its use was the most severe, the wheels under the tenders and baggage cars required very frequent renewals. While its efficiency was far superior to that of the hand brakes, yet it often



Side (right). *Front.* *Top.*

Smokestack, Winan's "Camel," 1853-1863.

failed on account of the chains breaking when making a sudden stop in time of danger. This was probably owing to the fact that the engineman in his anxiety to avert disaster allowed the friction wheel to remain too long in contact with the driving-wheel, and of course "something had to go." This friction wheel can be seen on the picture of engine 135, directly behind the rear pair of drivers. With all its faults, it was the best brake at that time available, and its use on the passenger trains of the company was continued from 1861 until the adoption of the Westinghouse brake in the latter part of 1869.

This Westinghouse brake had been experimented with for a time on a local train between Pittsburg and Wall (now Pitcairn), and when the National Association of Master Mechanics met in Pittsburg in September, 1869, the train fitted with it was used to carry the members of the body on an excursion to the Altoona shops of the company, and to other points of interest on the division. At that time the Westinghouse brake was of the direct-acting, or "straight air" type and consisted simply of the pump, main reservoir, and three-way cock on the engine; with the train-pipe connected by rubber hose between the cars and attached directly to the brake cylinders. This train pipe was divided into two parts at each end of each car, necessitating the use of two sets of hose connections. This is said to have been done in order to distribute the pressure when an application was made and thus lessen the danger of blowing apart the straight form of couplings used; nevertheless this blowing apart frequently occurred, but as each coupling was provided with an internal checkvalve, the braking power was affected by it but little.

About 1873, the type of coupling in use at present was adopted and the double line of pipe at the coach ends was dispensed with, but the check valve was used in the improved couplings until the introduction of the automatic brake,



Diamond, 1873-'92. *Straight*, 1859-'62, 1870-'81. *Straight*, 1881-1900.

Pennsylvania Smokestacks.

when it was of necessity taken out and angle cocks were placed in the train pipes. The automatic was not generally applied to the company's equipment until some time during 1876, and was so arranged as to enable straight air to be used when desired. The few freight engines at that time provided with air brakes had straight air, and therefore when an emergency required the use of any of these engines in passenger service, straight air only could be used on the train. A fourway cock in connection with the triple valve enabled this change to be quickly made. When the handle of this cock stood line and line with the trainpipe, automatic air was in use; when it stood vertically, pointing downward, straight air was operative, and an intermediate position cut the air out from the car on which the cock was placed in such position. In 1887, the improved quick action automatic was applied and straight air abandoned, a straightway cock between the triple-valve and the trainpipe replacing the former four-way cock. The later improvements and adoption of the high speed automatic, etc., are of so recent a date and are so familiar to all railroad men as to require no especial mention in this article. Of course, the primal introduction of the automatic brake and its continued improvement from time to time soon showed the necessity of a better means of controlling it and regulating its supply of air, and the present type of engineman's valve and the pressure regulator were designed to replace the three-way cock and simple little relief-valve of straight air days. In short the company adopted all improvements of the brake almost as rapidly as they came out.

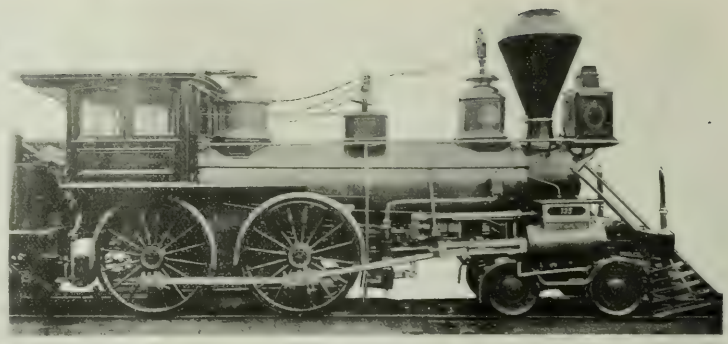
The air signal was first applied about 1881 or 1882. In 1887, as a result of a serious accident on another line which was attributed to some unauthorized person tampering with the emergency cord in a parlor car, a circular was sent out to every employee in the passenger train service of the company, asking whether such instances had at any time come to their notice on the trains in their care, their personal opinions as to the merits of the cord, and whether they thought it wise to retain it, or to replace it by a cock with a projecting handle at one end of each coach, as is customary on some lines. The replies were almost unanimously in favor of the retention of the cord, and it has remained ever since.

Brakes on driving wheels were not used until one or two years after the adoption of the Westinghouse brake. The first used a system of connected levers between the shoes, but these were soon followed by the toggle-joint type still found on many of the company's older engines. In 1892 and 1893 the American and allied types of driver-brakes were applied to many new engines and have been the standard ever since.

An interesting experiment in the use of a limelight for the headlight was made in 1866, and its seeming success caused it to be afterwards applied to many of the passenger engines, but at the end of about one year's service it was taken off, one reason assigned for this being difficulty in preventing too great concentration of the rays of light in a single narrow line. The half-tone of engine No. 135 also shows this arrangement, and the necessary reservoir can be seen in front of the smoke arch. In 1883 the size of the headlight reflectors was reduced to sixteen inches, but the

square case has always remained a standard, except on a few special engines where the circular form has been used. Thus far the company has not given the electric headlight much, if any, attention, and there does not appear to be any desire among the enginemen for its introduction.

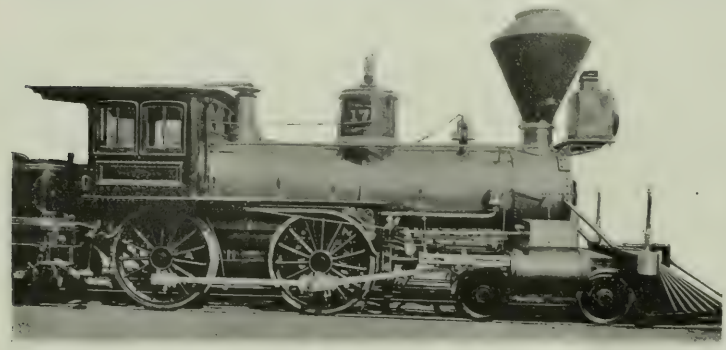
The cowcatchers of the engines from the opening of the road were usually moulded on graceful lines and extended considerably in front of the bumper. Until 1867 all were of iron with transverse slats, except on a few Norris engines built in 1858, 1862 and 1863. These were of vertical wooden bars, but were soon replaced with others of iron. In 1867 those of wood with bars placed vertically, were adopted for passenger engines, and have remained as standard for that service ever since. Within the last five years the form of the cowcatchers on both passenger and freight engines has been materially changed, and the standard now extends but slightly beyond the line of the bumper, of course greatly increasing the pitch. At one time hickory brooms were attached to the bumpers, one on each side, immediately behind the cowcatcher, with their lower ends set close to the rail, in order to sweep away snow or other light obstructions. These have not been used for many years.



Number 135 (Leopard)—Built by M. W. Baldwin & Co., 1857.

Showing reservoir for lime light used in headlight in 1866, and friction wheel to operate Loughridge continuous chain brake.

Until 1859, the smokestacks were all of a large balloon type on practically the well-known French & Baird lines of those days. The only exception to this was in the case of eleven Ross Winans "Camel" engines which retained the peculiar design placed upon them by Mr. Winans at his shops. In 1858 the straight stack with a neat cast-iron cap was introduced in connection with the experiments in smoke-consumption referred to, and until 1862 was applied to all new engines and also to many of the old ones, but as it was entirely open, many large coals were thrown out and frequent fires in buildings along the line resulted. This induced Mr. John P. Laird, then Master Mechanic at Altoona, to design a stack which was a sort of compromise between the large balloon with its full netting, etc., and the straight open stack with no spark arresting device whatever. This Laird stack thereafter became the standard for all passenger engines and was used on many freight engines, although between 1862 and 1866 there appeared to be a "renaissance" of the old balloon type, and many were again used on freight engines during those years. After that time the Laird stack was applied to all engines except those especially built for shifting purposes. These used a stack similar to that of the anthracite coal-burning freight engines of the Reading Railroad. In 1870, James Smith designed a type of spark-arrester, for use in connection with straight stacks of the pattern referred to as applied to the smoke-consumers from 1859 to 1862, which proved very successful, and during the following two years was applied to a large number of both freight and passenger engines, but the amount of fire still thrown out was found to give some trouble, and in 1873 Diamond stacks began to replace the Smith stacks on freight engines, and were also applied experimentally to some of those in the passenger service. Here, however, the fine dirt thrown from the Diamond stack proved very annoying to passengers, and the Smith stack once more resumed its place in that branch of service, but not until one supreme test of the two stacks had been made. This test was conducted on the Pittsburg division on engine 654, which ran a heavy express train each way daily between Altoona and Pittsburg. It was in charge of two enginemen, who, of course, ran it on alternate days. After the first two days of this experiment, the Smith stack was removed and a Diamond of the Jewett type which had been claimed to have produced excellent results on the Pittsburg, Columbus, Cincinnati & St. Louis Railway (as it was then called), was substituted for the Smith, and was used during the next two days. Thus the test was continued for at least one month, and resulted in a sweeping victory for the Smith stack, which met no further competitor in the passenger service until the coming in of extension fronts in 1881, and even with these, the ornate exterior form of the stack was retained until 1885, when the first of the plain straight stacks put in an appearance.

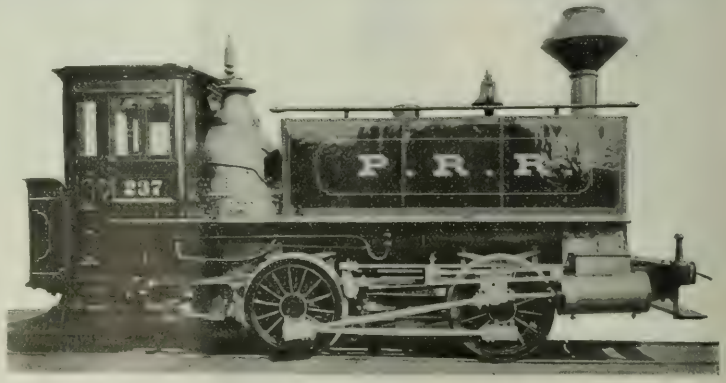


Number 173.

Showing sandbox encircling dome. Boiler from state engine Nebraska. When the Pennsylvania bought the state improvements in 1857, the Nebraska was a Baldwin engine with 4 drivers, 60 inch, and 17 in. x 24 in. cylinders set at a steep pitch. Rebuilt at Altoona, 1866. All except boiler is new.

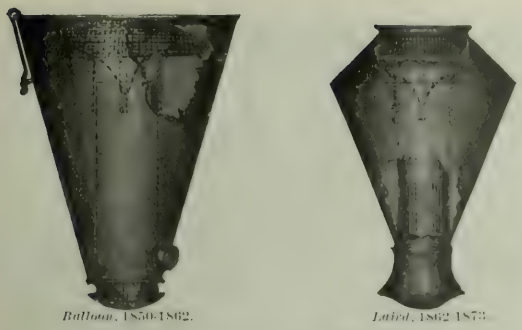
The extension front was not placed on all freight engines until after 1885, and only on passenger engines using soft coal, until 1882. In that year it was also applied to the hard coal burners. Since its introduction this feature has undergone some modifications to adapt it to the different classes of engines, and a pipe, which at first extended from the lower part of the boiler to the cinder-space and was fitted with a globe valve to enable water to be turned into the cinders when cleaning out or in case of their taking fire, has been discarded; probably because it frequently became so clogged with sediment as to be unserviceable.

Bells on Pennsylvania engines have been placed in almost every possible position between the stack and cab, and two attempts have



Number 237.

Built on boiler of old Westmoreland, 198, bought from the state in 1857.



Baldwin, 1850-1862. *Laird, 1862-1873.*

Pennsylvania Smokestacks.

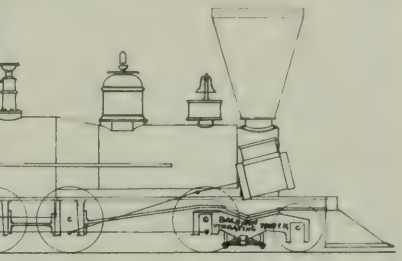
been made to substitute large gongs for them. Thirty-three of the first freight engines, including the "Camel" pushers referred to, were built without bells and ran thus for several years, the Camels until 1862.

In 1860 Mr. Laird rebuilt a passenger engine with the sand-boxes under the running board as in English practice, and it was followed by several others, both freight and passenger, from both Altoona and Baldwin's, on the same lines. After two or three years' service this arrangement was found to be unsatisfactory on account of the sand used in this country packing in the boxes and refusing to flow, hence by 1867 the sandboxes of these engines again occupied positions on top of the boilers. In 1881 the high-speed class K engines came out with the sandboxes under the running board, and this practice was followed on all new passenger engines built thereafter until 1893, when it was again abandoned. Since that time all sandboxes have been placed on the top of the boiler and those under the running board have been removed. In 1900 a semi-circular, or crescent-shaped sandbox fitting closely to the front of the dome and concealed by a combined casing which gave the appearance of but a single part to both dome and sand-box, was applied to a number of passenger engines and is still retained upon them. The sand pipes on these engines are concealed under the boiler casing, and this practice was followed for a time on later engines with sandboxes in the usual position, but latterly these pipes have been placed on the outside of the casing.

In 1889 the first engines were built at Altoona with domes having no mountings, the pop-valves and whistle occupying a small cover directly over the roof-sheet, as in English practice.

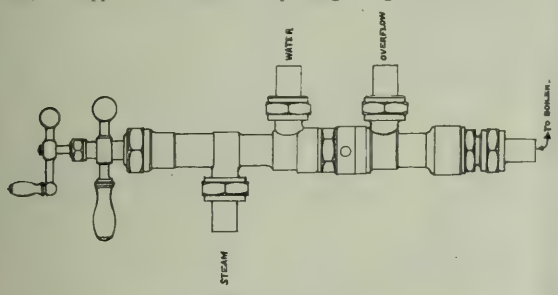
Link motion was finally adopted as the standard valve-gear in 1861.

Injectors were first applied to the engines in 1861. These were of the Giffard type and were placed under the foot-plate with the check-valve on the rear wall of the firebox casing, just above the mud-ring. This location caused leaks, and in a short time all these check-valves were removed to a point well forward on the side of the boiler barrel. At first but one injector was used on each engine, with no other means of supplying water to the boiler. Even old engines which received injectors had the pumps taken off. The delicate character of these early injectors produced frequent failure of working, and engines were often hauled in "dead" on this account. Hence two injectors were put on subsequent engines, or sometimes one injector and one "squirt," but although improved types were introduced, the trouble with them continued, and late in 1864 the standard of equipment became one injector on the left side of the engine and one pump on the right side, which arrangement prevailed until 1878, after which the pumps were gradually removed and two Sellers injectors of the 1876 type, or their equivalent, to each engine, has been the practice since. Between 1863 and 1865, a number of the engines of both freight and passenger service, had only the Sellers non-adjustable "squirt" as a means of supplying the boilers with water, and but one of these to the engine, yet they appeared to have no more trouble than engines using the adjustable type. Check-valves placed in the cab were tried on some shifting engines in 1882, but for some reason were found to be unsatisfactory. In 1885 internal check-valves were adopted and have been used on all equipment since.



Number 45, as Remodeled at Altoona in 1864.

30-in. wheels replacing first pair of drivers. Vibrating truck containing these 30 in. wheels and first second pair of drivers moved ahead.

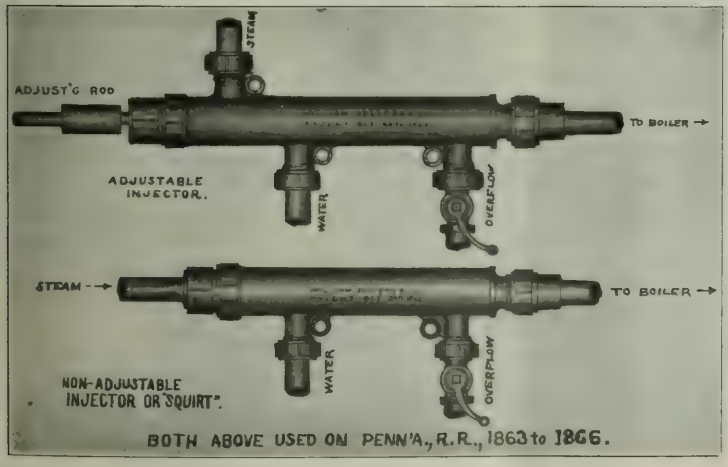


Giffard's Injector.

As used on the Pennsylvania, 1861-1863.



Number 98; Altoona, 1864.



Pennsylvania Injectors.

"Pop" valves were first applied in 1867, and until 1885 the practice was to have one pop-valve and one spring-balance lever safety-valve on each engine, but since the date mentioned all the spring-balance valves have been removed and replaced by pop-valves. Previous to 1867 two spring-balance valves only, were used, usually placed on the dome cover, although on some of the older engines but one occupied this place and the other was on a column some distance from the first.

Tallow-cups were first placed in the cabs in 1861, and bridges were first used in 1875.

Sight-feed lubricators were not generally adopted until after 1883.

Solid end parallel rods were adopted for all classes of passenger engines in 1883, and for freight engines in 1885. They had, however, been in use on the class K fast express type from July, 1881. Belpaire fireboxes were first used on freight engines in 1885, and on passenger engines in 1889.

Although the two-wheel truck has undergone considerable change since its introduction on the road in 1862, the four-wheel trucks have been of the Bissell type since early in the fifties. The only change in them of note was placing the equalizing bars between the frame and knee brace instead above the frame after 1865; and from 1868 until 1878 mounting the center-plate on an independent frame hung from the main truck frame by four staggered eye-bolts in such a way as to afford a slight lateral motion in rounding curves and thus reduce the shock. About the time that nearly all of the engines with four-wheel trucks had been fitted with this device, some one came forward and substantiated his claim to a patent upon it and demanded what was thought to be an excessive royalty for its use, whereupon oaken blocks were at once placed between this auxiliary frame and the main frame to practically render the trucks rigid, and as rapidly thereafter as possible, they were all changed to the ordinary rigid type still in use.

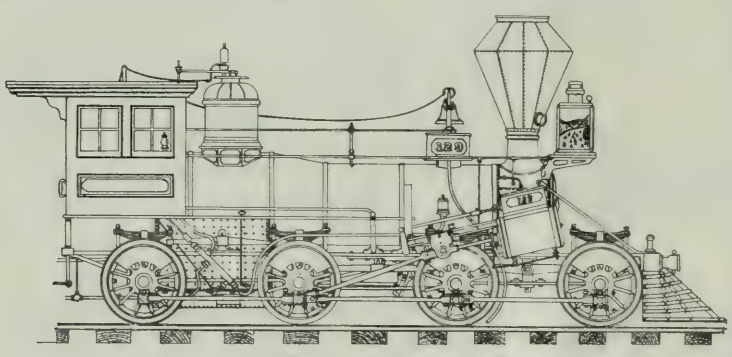
Tenders arranged for taking water from troughs while running, have been in use since the latter part of the sixties, and since 1896 this device has also been applied to the tenders of many of the freight engines.

Probably the most numerous experiments in remodeling locomotives which has ever been made by any railway, in proportion to the number in service, were made by the Pennsylvania Railroad Company between 1861 and 1866. Many of these experiments were dangerously near the class of "freaks." In 1862 the Ross Winans



Number 131 (Seneca) as Rebuilt at Altoona in 1862.

Originally a Ross Winan's "camel," built in 1856. The cab, boiler, barrel, dome, throttle, smokebox, cylinders, steam chests, parallel rods and side rods are original. All else is new.



Number 129—After Remodeling at Altoona in 1864.

camel, Seneca, No. 131, which had been built in 1856, was remodeled at Altoona. The boiler barrel, smoke-arch, dome, Winans throttle, original cab with canvas curtains instead of windows, cylinders, steam-chests, and solid-end parallel rods. All else was new. The firebox had considerably less slope in its roof and crown sheets, and the new frames were of the standard bar type of the period and carried back to a transverse bar at the rear of the firebox as on other classes of engines. A leading truck with a single pair of wheels was introduced, and the three pairs of driving wheels were so spaced that in connection with the truck the engine was practically a mogul. It ran in this rebuilt form until the latter part of 1870, when a broken main driving-axle damaged it considerably and it was cut-up; in line with the policy adopted to so dispose of all old types of engines requiring extensive repairs.

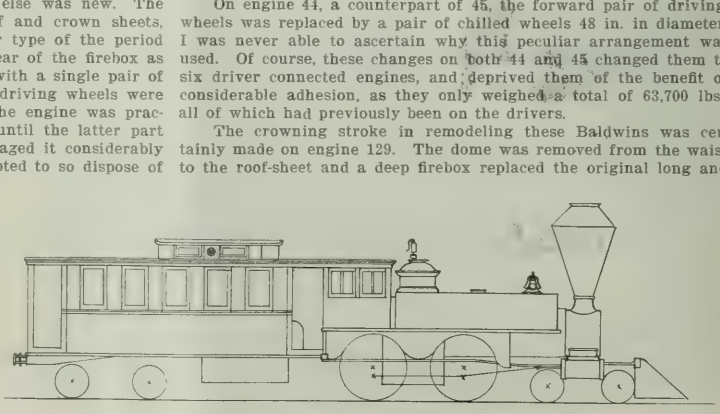
The remaining ten camels were all later rebuilt with similar frames and running gear, but the boilers were made flush-top with cabs of ordinary type placed over them at the firebox end, as in long-firebox engines of to-day. All but one of the ten received new cylinders with saddles, and all, like the Seneca, received link-motion, but the Winans dome and safety-valves were retained on the entire lot, being placed on the roof-sheets and covered with jackets of Russia iron. In fact, on most of these ten, nothing remained of the original engines except these domes and throttles and the three rings of the boiler barrels.

Eight Baldwin eight-wheel connected engines on the road at the time of these experiments in rebuilding, seemed to afford a special field for inventive genius. No. 98 was rebuilt at Altoona with the eight drivers placed closely together between the cylinders and fire-box, with a leading truck, having a single pair of wheels, in front of the smoke-box, the whole forming a very fair prototype of the later consolidation engines. A huge saddle tank covered the boiler, and a large coal-bunker was located behind the cab. For some reason Mr. Laird soon removed the second pair of drivers from their original position, to one under the coal-bunker. Thus arranged, the forward part of the engine resembled a mogul. As the leading truck had but little provision for rounding curves, and the re-arrangement of the driving wheels evidently offered no better solution of the trouble, the 98 is said to have been "splendid on a straight line, but a terror on curves," and to have spent almost as large a part of its existence on the ties as on the rails. Notwithstanding all this, official records published in 1868 mention engine 97 as of same design. Although frequently through Altoona shops and roundhouses, and over the road, in those days, I never saw the 97 after its rebuilding in this way.

Engine 45 was another of practically the same design as the preceding two, previous to their remodeling, although somewhat smaller and having but 18 in. x 20 in. cylinders and 42 in. driving-wheels instead of 19 in. x 22 in. cylinders and 44 in. driving-wheels as on the other two. In this engine Mr. Laird satisfied himself with substituting a pair of 30 in. wheels for the forward pair of driving-wheels, but retained the Baldwin vibrating truck, merely adapting its front end to the new conditions, by lengthening it slightly and lowering the pedestals. He also moved this truck about sixteen inches forward.

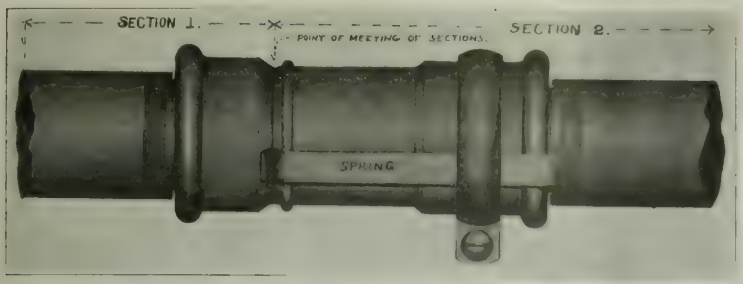
On engine 44, a counterpart of 45, the forward pair of driving-wheels was replaced by a pair of chilled wheels 48 in. in diameter. I was never able to ascertain why this peculiar arrangement was used. Of course, these changes on both 44 and 45 changed them to six driver connected engines, and deprived them of the benefit of considerable adhesion, as they only weighed a total of 63,700 lbs., all of which had previously been on the drivers.

The crowning stroke in remodeling these Baldwins was certainly made on engine 129. The dome was removed from the waist to the roof-sheet and a deep firebox replaced the original long and



No. 217 with Passenger Car Rigidly Attached—Altoona, 1864.

Car was afterward detached and ran independently with 251; sister engine to 277.



First Hose Coupler Used on Westinghouse Airbrake, 1869-1873.

shallow one. New frames were also made, and the eight pairs of driving-wheels were retained, but spread as far apart as the length of the engine would permit. The front pair was fitly designated, as it was placed at the extreme front end of the frame, between the bumper and the smoke-arch. The rear pair was under the foot-plate, directly behind the firebox, and the other two pairs occupied positions about uniformly distant from the rear and forward pairs, and from each other. This engine is said to have equalled the 98 in taking short cuts at curves.

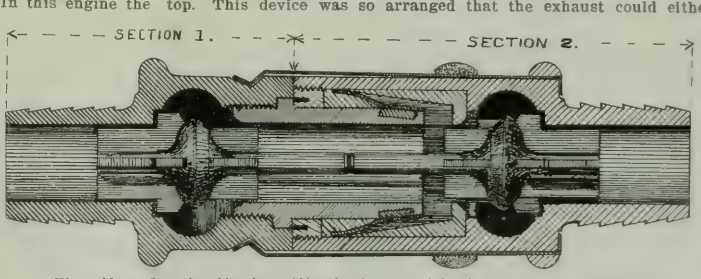
About the same time several small Baldwin passenger engines with semi-circular fireboxes and "haystack" domes, received new fireboxes of rectangular form, but used the old domes on the new roof-sheets. An old Norris engine of similar type which had been lying at Altoona for a long time as the result of a boiler explosion, was rebuilt as a saddle-tank shifter with the eccentrics on one axle, and the main pins on the wheels of the other. In this engine the exterior of the semi-circular firebox was retained with its surmounting haystack dome. Probably the next experiment was made with engine 256, a comparatively new Baldwin ten-wheeler. Instead of a separate tender, the engine frames were pieced at the rear to a length of about 12 ft., terminating in a bumper to which was attached a cowcatcher and a cast-iron drawhead. This extension of the frames had two pedestals in which the boxes for an additional pair of driving-wheels were placed, and these wheels were connected to the pair in front of them by parallel rods in the usual manner. A tender about 10 ft. long and 4 ft. high, with compartments for coal and water, was placed on the top of this extended frame. This engine possessed many of the objectionable features of the 129 and 98, with little to offset them, and after a brief trial it was relieved of its "improvements," restored to its "good old way," and rendered ten or twelve succeeding years of efficient service.

After this, a small Baldwin saddle-tank passenger engine had its frames extended and a small passenger car about the length of a standard four-wheel cabin-car was built on this frame for the use of officials of the road. This arrangement was also short-lived, and the car was then detached and placed on a truck similar to that used under cabin cars, and for several years thereafter served as a special car for Robert Pitcairn, Esq., superintendent of the Pittsburg division, being used in connection with his special engine of the same type as that to which the car had previously formed a part.

With the rebuilding of four passenger, and a number of freight locomotives as moguls, the craze for improvements rested for a time, probably on account of the adoption of fixed standards for engines for freight, passenger or yard service.

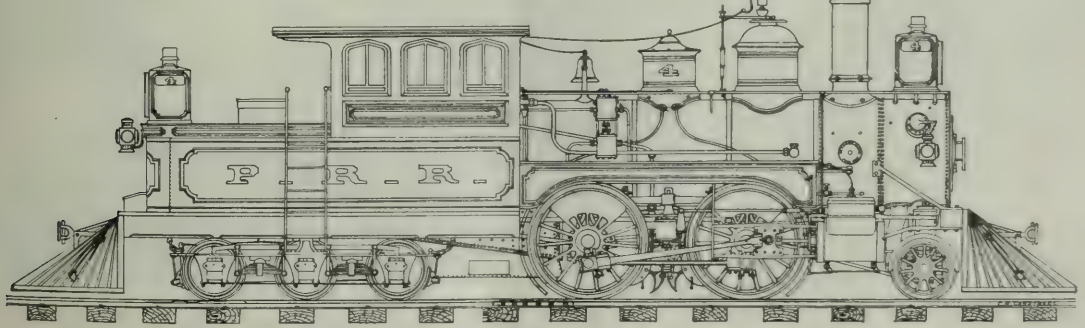
The peculiar conditions attending the use of a locomotive in Pittsburg, Pa., to haul freight trains from the Duquesne freight station at the "Point," or intersection of the Monongahela and Allegheny rivers, to the beginning of the elevated track at the Union Station, a distance of over one mile along Liberty street, one of the busiest thoroughfares in that or any other city, led Mr. Colin in 1874 to prepare an engine especially for this service. In conformity to an ordinance of the city, coke must be used as fuel; steam must be prevented, as far as possible, from blowing off; and the speed must not exceed four miles per hour. The rails were of a pattern which enabled vehicles to traverse or leave them with ease, but were not so well adapted to the performance of the locomotive, and were often covered with a black, greasy mud which rendered it difficult to obtain adhesion, or prevent slipping and its consequent annoyance to the business men in their offices, or frightening horses on the street.

To overcome some of these difficulties, of this street service, engine 258, a sister engine to 256, was selected. Its tender was dispensed with, and instead a coal-bunker was built on an extension of the frame at the rear end, and a large saddle-tank covered the boiler between the cab and the smoke-arch. A pipe was attached to the top of the Baldwin "exhaust-pot," as the peculiar nozzles of these engines were called, and carried out through the left side of the smoke-arch and thence into the water-tank at its top. This device was so arranged that the exhaust could either be turned into the pipe leading to the tank or into the stack in the usual manner, as desired, by means of a reach-rod and shaft, the latter entering the smoke-arch on the right side. Mufflers had not yet come into use on safety-valves, so the 258 was provided with a pipe extending from the back boiler-head into the water tank, and fitted with a globe valve which could be opened when the engine approached the blowing-off point, allowing the steam to pass into the tank. Otherwise no changes were made in the engine except that the designer supposed its maximum weight of 94,300 lbs. would give it such an amount of adhesion that sandboxes would be unnecessary and therefore omitted them, but this idea was found to be incorrect, and the engine was then supplied with these very necessary fixtures. No means for escape of any surplus exhaust steam from the tank was provided except through a safety-valve on its top. This, however, proved inefficient, and when working



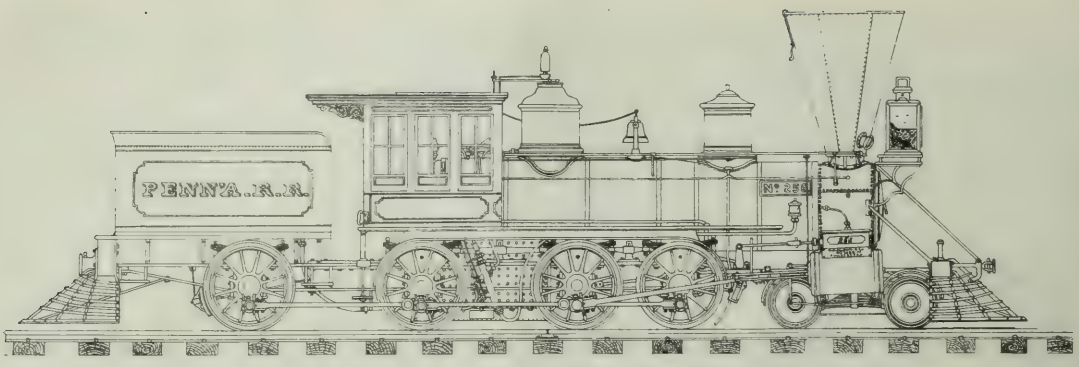
First Hose Coupler Used on Westinghouse Airbrake, P. R. R., 1869-1873

Close spaced diagonal lines on one half of coupling. Wide spaced on other half of coupler.



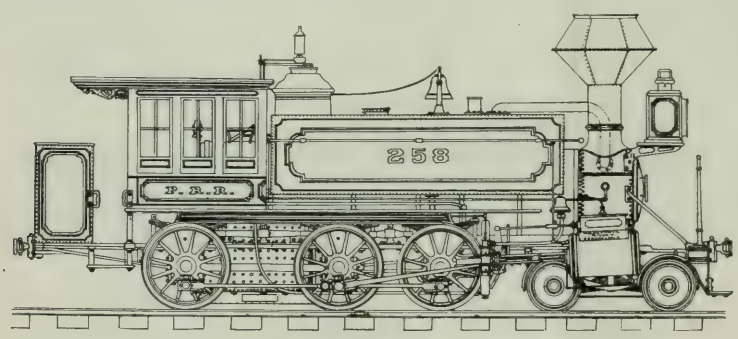
Number 4.

Built at Altoona, 1851, for suburban traffic.



Number 256—Tender on Extension of Engine Frame with Drivers Underneath, 1865.

with the exhaust turned into the tank, the engine was enveloped in a cloud of steam which escaped through the imperfect riveting of the seams, and around the joint of the cover, or manhole. An injector on one side and a pump on the other constituted the "water-works," but the high temperature imparted to the water rendered the former almost useless, and sometimes interfered with the favorable working of the pump. The conditions of the street, even with sanded rails, caused so much slipping that the coke fire languished and steam went down unless the exhaust was used direct. The experiment, so far as this street service in Pittsburg was concerned, proved a failure, and the engine was taken to eastern yards, where the requirements were less exacting. It continued in service for several years without impressing the Mogul Power Department with the desirability of perpetuating the type in later engines.



Number 258.
Arranged to condense exhaust when used in city streets. 1874.

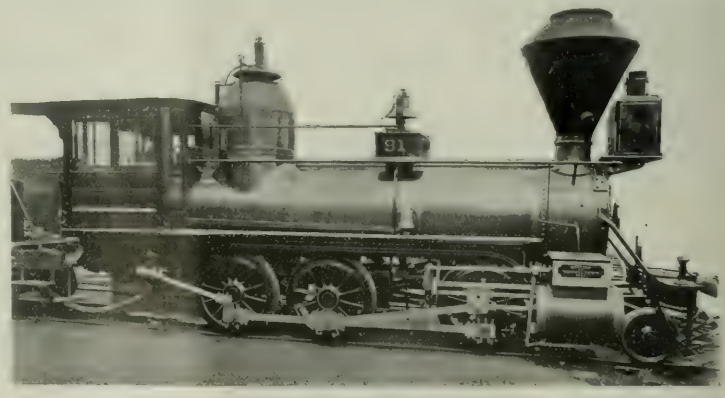
Probably the only other experiments which were confined to the first engines in each case built to carry out the ideas of the designers, were five in number. The first of these was "high speed" passenger engine No. 2, built at Altoona in 1880. It weighed 90,800 lbs.; had 19 in. x 24 in. cylinders; 68 in. drivers and a firebox 119 in. long and 39 in. wide, inside. Alligator guides, driving-boxes of gun-metal without wedges, slab frames from the rear of the front driving-box knees to the transverse frame behind the firebox, and the boiler center at slightly higher elevation than was then followed on most American engines, were distinguishing features of No. 2. Otherwise it bore a very close resemblance to the 62 in. and 68 in. "C," and "CA," anthracite engines, at that time hauling the express trains on the New York division. No. 2 was known as Class K, although it differed greatly from the magnificent 78 in. wheel engines of that class which came out one year later and rendered such excellent service until within the last seven years. It was soon found to be over-cylindered, and the diameter was reduced by bushings to 17 in. The engine was taken off the road in 1898.

The second of these experiments was No. 4, a double ender built at Altoona in 1881 for suburban traffic. Its weight was 124,100 lbs.; cylinders, 17 in. x 24 in.; drivers (four in number), 62 in.; dia., and firebox, 35½ in. x 86 in. The drivers were between the cylinders and firebox; a truck with a single pair of wheels, and framing as on consolidation engines, was in front of the cylinders, and a six-wheel Bissell truck was behind the firebox, under the rear part of the engine frame, which carried the tender. This tender was of the wing type, with its wings on each side of the firebox, and the cab was placed on the top, giving the engine somewhat the appearance of having been telescoped in a wreck. Access to the cab could only be had by climbing vertical steel ladders attached to the sides of the water cistern. The boiler was of "Altoona" type with sloping crown and roof sheets, and the dome was on the first ring of the barrel, close to the stack. The English reversing screw was used instead of a lever. No. 4 ran on local trains until 1891, when it was taken to Altoona, where it stood in the shop yard for about one year, after which it was scrapped.

In 1889 the "Pennsylvania," No. 1320, a Webb compound built in Manchester, England, by Beyer, Peacock & Co., on exactly the lines of the standard compound express locomotives of the London & North-Western Railway of England, was placed on the road, and after trials on the various divisions was finally put in service regularly on the New York division, where it remained until 1897, when it was cut up.

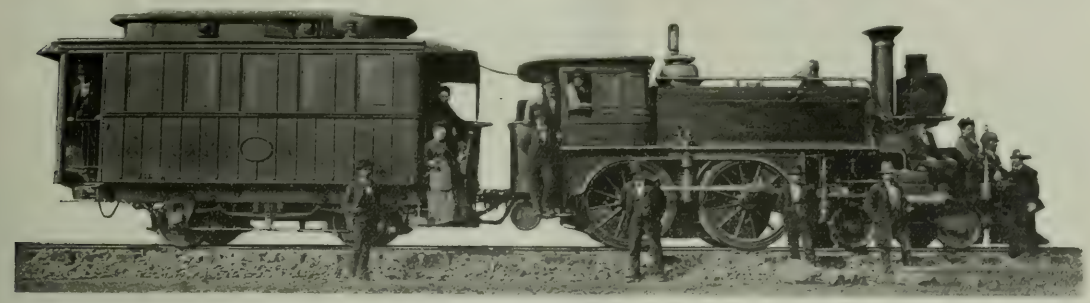
This English compound had the Joy valve gear. The driving-wheels were 75 in. in diameter, without parallel rods, and the high pressure cylinders were 14 in. x 24 in., exhausting into the single low-pressure cylinder 30 in. x 20 in. The greatest trouble experienced with it arose from difficulty in starting quickly owing to only the rear pair of drivers being available until a sufficient amount of exhaust steam had accumulated to act upon the low-pressure cylinder which actuated the forward pair.

In 1901 a compound engine was built at Altoona for passenger



Number 91 (Originally Logan).
Rebuilt Ross Winans "camel." Dome, throttle and relief valves and their springs are original. Exploded its boiler in 1876.

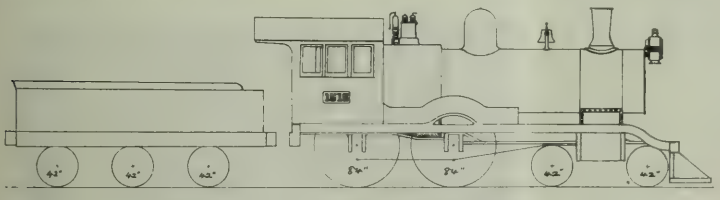
service and after a trial of several months on the mountain, it was taken to the New York division and thereafter ran the Pennsylvania Limited between Jersey City and Philadelphia until 1904, when it was taken off the road and utilized to furnish power to steam pumps on the Meadows. Like most of the compounds, it made considerable shop time during its service on the Limited. A striking comment on its work when running was the reply made to the writer by an official of the company a few years ago. The Limited had side-wiped the engine of a work train whose crew, through some blunder, had puled out of a siding at the time it was due to pass, and as a result both engines were overturned. Supposing, of course, that 1515 was drawing the Limited at the time. I asked where it had been taken, and was informed that it had been in the shop on the day of the accident, and that if it had been running there would have been no collision, as it would certainly have been behind time sufficiently, at least, to have allowed the other engine to have got out of its way!



Number 251 with Private Car Used by Superintendent of Pittsburg Division Until 1877.

Built at Altoona, 1864, and was at that time rigidly attached to an extension of the frame of No. 247. At that time it had a standard passenger car truck under it at the point where the double washer appears, near rear platform. It gave trouble on curves, and was afterwards placed on a stand ard cabin car truck, as shown.

This engine had a high pressure cylinder of 19½ in. diameter, and a low pressure of 31 in. The stroke was 28 in.; diameter of drivers, 84 in.; total weight, 145,500 lbs.; piston valves on sides of cylinders under smoke-arch and directly connected to the links. The finish was strictly English, even to the wheel covers, and the tender was of six-wheel type. No. 1515 was not the first Pennsylvania engine to use piston valves, one of a peculiar design having been tried on a Baldwin freight engine in the early '80s. As the old cylinders were retained, the inventor made a special steam-chest somewhat wider and deeper than that used with the slide-valve.



Number 1515, Compound, Altoona, 1892.

This special chest contained three cylindrical divisions side by side lengthwise, and these divisions contained three piston valves, the stems of which were connected on the outside of their glands to a cross-bar attached to the regular valve-rod. The exhaust nozzles were fitted with check-valves to enable the engine to be reversed without drawing cinders into the valves and causing injury. This latter feature was found to be objectionable, and the inventor fearing trouble from cinders entering the valves if the checks were not retained, only continued his experiments for a short time. The valves, I believe, gave fair satisfaction. These two engines and several Baldwin compounds comprised the only piston valves used on the main line until 1904. Since that time they have been introduced in considerable numbers, both on freight and passenger engines of several classes. Whether intentionally or only by a coincidence, their use now appears to be entirely in connection with the Walschaert link.

In 1900 an experiment was made with three new passenger engines which was not repeated, and after three years' service these engines were transferred to the Long Island Railroad, probably from a similar motive to that which actuated a good old sister of the Methodist Church in the days when that denomination opposed the wearing of jewelry. In an experience meeting this sister is said to have told how she had indulged in these forbidden things, but finding they were leading her to the Evil One, gave them to her younger sister and had since given them no consideration! These three engines had boilers of the Wootten type and, of course, had the cabs set well forward on the boiler. The frames, running gears, etc., were of Atlantic type, and practically the same as the later class E engines, except that the trailing wheels were 56 in. in diameter instead of 50 in., and were considerably closer to the rear drivers. The cylinders were 20½ in. x 28 in., and the driving-wheels were 80 in. in diameter. The weight in running order was 173,450 lbs. The tenders were of water-bottom, six-wheel type, and strictly English in every outline.

Other types of compound engines beside the 1320 and 1515 were tried at various times between 1889 and 1902, but all were afterward either sold or changed to simple engines. Some were of two-cylinder type, and several were of the Vauclain four-cylinder type.

The de Glehn four-cylinder compound Atlantic engine No. 2512, built at Belfort, France, by the Société Alsasienne de Constructions Mecaniques, in 1904; followed in 1905 by two four-cylinder compounds from the Baldwin works and the American Locomotive Company, respectively, and a simple prairie type from the latter company, complete the experimental engines worthy of passing mention. These four engines can scarcely be said to have yet passed the experimental stage, especially in the case of the de Glehn, which was not placed in regular service until after the close of the St. Louis Exposition. It met with a serious accident a few months later which necessitated sending to France for a number of new parts to replace those broken or seriously damaged, and this caused the engine to stand idle for several months.

Countless other inventions covering almost every part of a locomotive, have been tried at various times, but generally proved so unsatisfactory that they were abandoned after very brief trials.

The most radical change is the recent application of the Walschaert link to several hundred locomotives to both passenger and freight service, and from its special adaptability to the classes of engines using it, and the satisfaction of both officials and employees with its mechanical features and its performance, it is likely to be the standard for at least all engines except perhaps the old eight-wheel type, and is especially adapted to any type requiring curved eccentric rods or intermediate connecting-bars if the Stephenson link were used.

The Telegraph Block System in England.

Readers who are weighing the relative merits of the telegraph block system as compared with the controlled manual or the automatic, will be interested in the following succinct description, by Mr. Henry Johnson, of the most common English practice.

On most English railroads other than single-track lines block signaling is carried out by what is known as the block telegraph. Specially designed block signaling instruments are provided in the signal cabins. In case of a double track Signalman B. has an instrument for working to and from A and another instrument for working to and from C. Each instrument consists essentially of the following, viz.: In cabin B, for instance, for operations between A and B: 1. A visual indicator showing the state of the block section from B to A. 2. A visual indicator repeating the position of the indicator at A which shows the state of the other track from A to B. 3. An electric switch for operating the indicator at A. 4. A single stroke bell for receiving code bell signals which must

accompany all changes in the visual block indicators and must be acknowledged. 5. A bell key for operating the block bell at A.

An exactly similar set is used for block working between B and C, and each part is distinctly labeled to show to which section it applies, and in which direction. There are about ten designs of block telegraph, some requiring three wires and some only one; but they all conform to the above named essentials. The wires are grounded at the cabin except in neighborhoods of electric traction.

The usual form of blocking is the "affirmative," the block indicator working to three positions, viz.: 1. "Line Closed." 2. "Line Clear." 3. "Line Blocked." With this arrangement Signalman B, never sends a train forward to C without first asking C to accept the train. But with some of the short headway in suburban traffic the "positive" method is employed, when the block indicators work to only two positions, viz.: "Line blocked" and "line clear." The "line closed" position is left out to save time, and Signalman B sends train forward without preliminary question, depending on the assurance of line-clear which was received from C after the passage of the last preceding train. He has this assurance not only from his block record sheet, as would be the case in telegraph block signaling in America, but also from his visual indicator, which indicates "line clear," and has continually so indicated since the arrival of the last preceding train at C. Considerable importance is with good cause attached to the visual indicator portion of the block instrument.

A small portion only of the railroad systems in Great Britain and Ireland use what is known as the "lock and block" or "controlled manual" system of blocking, and nearly all of these are of the Sykes design. This has for many years included the locking of the facing points on a route after the home signal has been placed in the proceed position and until the engine has reached a treadle in advance. Electrical junction locking is also largely applied in this system and trailing points are locked by the act of accepting a train (plunging) from the operator in the rear. Experiments were tried in track circuits by Sykes as early as 1870 on the Chatham & Dover Railway. He applied that system at the Crystal Palace Station about the year 1876, using one cell of Daniel battery and a one ohm relay. Track circuiting was, however, abandoned for many years owing to the then impossible task of persuading the various railroad companies to bond the wheels of their cars. Wheels with wooden centers were and are still the standard.

All passenger single-track lines other than those worked by one engine only are operated on either the staff or the tablet systems. The operation of a single-track railroad on the "controlled manual" system, or "lock and block," has often been proposed in the United Kingdom, but has met with absolutely no support.

Foreign Railroad Notes.

The Prussian railroad estimates call for provision for an addition of 10,583 to the regular force of employees.

Railroad construction has continued in Russia in spite of its troubles, and in the first half of 1906, 1,020 miles of new road were opened.

The Bavarian government is making a survey of the available water powers in the country, with a view to utilizing them for generating electricity for working the state railroads.

The Ricken tunnel in eastern Switzerland, which will be very nearly five miles long, had been excavated for seven-eighths of its length at the end of 1906. Coal has been met in the tunnel, but not enough to be worth working.

On the 28,617 miles of railroad in British India in 1905, 452,058 men were employed, an average of 15.8 per mile of railroad. Of this army of employees only 6,535 were Europeans; but there were 9,175 of mixed blood—Eurasians, so called.

The freight blockade in Hungary called out a discussion in Parliament, during which the responsible Minister said that it was first of all due to an unforeseen sudden increase of 22 per cent. in freight shipments, next to extraordinary snowfalls, and finally to prevailing illness which disabled an unusually large number of enginemen. The station yards are not sufficient for the traffic, and the rolling stock, though unusually large additions have been made, is also insufficient. Altogether, the story fits Dakota about as well as Hungary.

Sleeping Cars on Illinois Traction Lines.

The Holland sleeping car for electric railroads was described in this paper at the time that the first two cars were being built (*Railroad Gazette*, Aug. 14, 1903), and the statement was made that they would be operated over certain of the traction lines between Indianapolis and Ohio points. They were in this service for a time, but later were withdrawn, and last fall the two cars, with all the Holland Sleeping Car Co.'s patent rights for America, were acquired by the Walter A. Zelnicker Supply Company, St. Louis, Mo. The two sleeping cars were later sold to the Illinois Traction System, and were taken into their shops at Bloomington for a complete overhauling and refitting. They were placed in service on the first of this month between Bloomington and St. Louis, via Decatur and Springfield. In exterior appearance they are like the usual large interurban electric car. The interior, however, is novel, as appears from the views shown herewith.



Interior of Holland Car for Day Travel.

To give again, briefly, the scheme on which this car is designed: In the day time it is used as a parlor car. The chairs are spaced alternately 3 ft. 6½ in. and 3 ft. 3½ in., the narrow



Section Made Up with Front Partition Removed.

spacing being between the chairs turned back to back when the berths are made up. To make up the berths the inner arm of each chair is dropped down to a horizontal position to fill the space between chair and car side, and the seat cushions are pulled forward, resting on supporting rods fitting in sockets in the front panel of the chair. The outside chair arms are removed completely, being used to fill the remaining space between chairs and wall, the backs are pulled down, and the head rolls dropped forward to provide pockets for clothes. The upper berth mechanism is quite similar to the Pullman arrangement, and bedding, etc., is carried in the pocket under the roof. Compartments under the chairs hold the pillows, and the blankets and linen are kept in closets at the end of the car. The completion or screening off of the compartment is accomplished by means of flexible wooden screens, made on the principle of a roll-top desk, which disappear beneath the floor in the day time. They slide in removable posts which fit in sockets in the floor and are supported at the top by the special ornamental open grille extending down from the roof of the car. A berth is large enough for a single person only, is extra long—6 ft. 8 in.—and the compartment is large enough to provide a space between berth and front screens approximately 14 in. wide, for



Interior of Car with Part of Berth Made Up.

dressing and undressing. Other facilities provided are quite as complete as in a standard Pullman.

The cars are 57 ft. long over all and weigh 50 tons. They are equipped with 150 h.p. of motors. The service competes with the Chicago & Alton and the results will be watched with interest.

President Finley to His Traffic Men.

The representatives of the freight and passenger departments of the Southern Railway were addressed as follows at Atlanta on February 13 by W. W. Finley, President of the road:

Your duties bring you into personal and daily contact with the people along the lines of the Southern Railway, and I as one who has filled positions which some of you are now filling, propose to speak to you briefly of the relations of freight and passenger agents to the public. Your duties are of a two-fold nature. You owe duties to the railroad company by which you are employed and you owe duties to the public. These double duties do not in any way result in conflict or divided allegiance, for he serves the railroad best who serves the public best.

The general officers of a railroad have, unfortunately, too few opportunities for meeting and talking with the people who are dependent upon the road for transportation services. The man having business relations with the road, as a rule, comes into personal contact with the local representatives of the traffic and operating departments. The policies of the railroad are formulated and mapped out by the general officers, but the application of these policies to specific transactions must be entrusted in the main to men in the field. It follows, then, that you have in a substantial sense the reputation of the Southern Railway for fair and just dealing in your hands. Whether the company shall be popular or unpopular depends in large measure on your attitude toward the public and on your treatment of those doing business with the road. It is of supreme importance, therefore, that you, who daily come into intimate personal contact with the public, should bear in mind constantly that it is the unvarying policy of the company to be just and fair to all alike—to the small shipper and the occasional traveler as well as to the large shipper and the regular traveler; that you should be perfectly frank in all business dealings; that you should always be considerate and patient, and that you should do all in your power to make the services of the road satisfactory to those for whom they are performed.

All classes of the public should be treated with consideration and be given every possible and reasonable accommodation. Even the man who makes impossible or unreasonable demands should not be dismissed with a curt refusal. He may not know that what he asks is either impossible or unreasonable, and a few words of frank explanation pointing out to him why his wishes cannot be complied with may send him away a friend of the road instead of a faultfinder. While everything possible should be done for the accommodation of those doing business with the road, care should be exercised not to promise the impossible in the way of facilities or services. When failure to fulfil such a promise follows, the man who made it may be able to shift responsibility to the operating or some other department or officer, but the damage done to the reputation of the road cannot be easily remedied. Questions that seem to you to be trivial may be considered of much importance by the persons asking them and they should be answered with patience and courtesy.

The efficiency of the service as a whole depends on the efficiency of each individual official and employee. Every agent and employee should study his duties in detail and should understand thoroughly just what he is to do in any contingency that may arise. He should then neglect no detail of his duties, however unimportant it may seem to him, for no matter how carefully and minutely duties may be prescribed by the general officers, the neglect of some apparently minor detail may lead to serious or possibly to disastrous results. Of even more importance than a careful observance of duties prescribed by the company is obedience to law. Many of the relations between the railroads and the public are now regulated by federal and state statutes, and every official and employee of the Southern Railway must understand that its business affairs are to be conducted at all times in strict accordance with the laws of the land. No transaction or practice that is forbidden by the laws can be permitted, and there must be no evasion of any kind.

As representatives of the Southern Railway, you should bear in mind at all times the basic fact that the interests of the railroad and of those served by it are identical and that they are inseparably interwoven. The railroad can prosper only as a result of the prosperity of communities by which the demand for transportation is increased, and the prosperity of the South can continue and can be brought to the highest possible level only through adequate and efficient transportation facilities. At the present time, when every effort is being made to supply additional facilities and more efficient services, nothing is more important than that the truth of this proposition should be realized by men in all lines of business. When once this identity of interests is thoroughly understood, the railroads of the South and the people will be brought together in more harmonious co-operation for the development of the natural resources of the South and for the expansion of all lines of industry. The men in the freight and passenger departments are in a position to do much to bring about this mutual good understanding and this harmonious co-operation for the upbuilding of the territory traversed by the lines of the company. Your careful attention to the wants of the people and your considerate treatment of everyone having business with the road will serve as a constant object lesson of its interest in the individuals and communities along its lines.

My personal experience convinces me that the people as a rule are fair-minded and when fully informed can be relied on to deal justly with the transportation interests. I feel sure that it is only necessary to direct your attention to the importance of your relations to the public, and that we shall have your loyal support in carrying out what is the policy of the company—the building up of a thoroughly efficient transportation system on the solid basis of harmonious relations with the people along its lines.

There is another point to which I desire to call your especial attention. The management of the Southern Railway has been confided to us as a high and sacred trust. This trust is not confined to the President, the general officers or the Board of Directors. It applies with equal obligation, in his sphere of action, to the humblest employee as it does to the highest. Each has his duty to perform and, in the performance of that duty, he represents the railroad and is engaged in the performance of a trust in respect to it. The brakeman cannot perform the President's duty, nor can the President perform the brakeman's duty. Each must do faithfully his own duty, and only in the honest and faithful performance of duty by all can there come a proper measure of success.

The railroad and the public are entitled to the very best that is in our employees, from the highest to the lowest. They are both entitled to demand that there shall be no lukewarm or limited service, but that the heart of our employees shall be in their work. All of us have voluntarily undertaken a duty in respect to this property and the railroad and the public should receive from each of us full and faithful performance. I wish to build up among all our employees a spirit of interest and co-operation—a spirit in which each man will recognize that he is identified with the road and will earnestly and honestly work for its welfare. Only in this way can we successfully administer the trust which has been confided to us.

Privileges to Shippers and Car Shortage.*

The purpose of the Interstate Commerce Act is to place all shippers on an absolute equality. Nothing in it prevents carriers from making arrangements with shippers, so long as all terms and conditions are without undue preference or advantage to particular persons, commodities or localities. This same purpose has been the animating factor in the organization and administration of car service or demurrage bureaus. The impossibility of instituting reforms in car handling through individual initiative has never been, by the public, sufficiently appreciated. The tyranny exercised by certain powerful, grasping and unscrupulous shippers over railroads and their employees has been akin to that swayed by political bosses. "Show us favoritism or get off the earth," they say with a villain's smile, and there are too many men who desire to stay on the earth. When the general public join in a hue and cry against a demurrage bureau, they are opposing an institution that has stood for their interests and fought for equality and justice between man and man, for a generation and more.

The fact that cars travel on an average only 24 miles a day, or one mile an hour, is a vigorous and humiliating indictment of present conditions, and the people responsible for them. Justice and public interest require a clear recognition of all the facts. That there is wastefulness of transportation facilities somewhere is apparent. Let us frankly inquire where the blame rests for existing traffic conditions. Did the railroad managers fail to anticipate the enormous increase in traffic of the past few years and make the necessary extraordinary preparations to handle it satisfactory? Candidly, I think they did. Now with this open confession, which is good for the soul, let me do a little more confessing for the shippers. Before the Interstate Commerce Commission a few weeks ago I testified as to conditions as I found them. They were summarized under the following eight headings:

(1) *Shipper's Deficiencies.*

(*a*) Loading too many goods that are not sold.
(*b*) Ordering more cars than are currently needed.
(*c*) Assembling shipments in cars.

(2) *Carriers' Deficiencies.*

(*a*) Insufficient supervision of transportation and switching.†
(*b*) Holding empties for prospective loading.
(*c*) Light loading and setting out of merchandise cars.
(*d*) Unnecessary delay in unloading company material.
(*e*) Inadequate facilities.†

†(*a*) and (*c*) are not true of all roads.

(3) *Middlemen's Deficiencies.*

(*a*) Buying or handling shipments consigned to themselves.
(*b*) Holding cars to the limit while seeking customers and price.
(*c*) Reconsigning once or oftener.

(4) *Receiver's Deficiencies.*

(*a*) Primitive unloading appliances.
(*b*) Inadequate storage facilities.
(*c*) Failure to use available storage facilities.

(5) *Results of these Deficiencies.*

(*a*) Congestion at shipping point, en route and at destination.
(*b*) Industries and consumers are improvident, living from hand to mouth.
(*c*) From 100 to 500 per cent. more switching than necessary.

(6) *Pertinent Facts.*

(*a*) Railroads transport shipments faster than their customers unload them.

(*b*) Many industries and manufacturers have increased their business from two to five times in the last five years, but have not increased their facilities for storage and handling from 200 to 500 per cent.—in many instances not at all.

(*c*) Public storage is scarce, next to none for bulky commodities such as coal, lumber, etc.

(*d*) "Hold" cars and not current business burden terminals.

(*e*) When terminals are full there must be "set outs" elsewhere.

(*f*) Numerous reconsignments en route are time killers and speculators' devices.

(*g*) Railroads are not allowed to be exclusively transportation companies; the shipper with no warehouse assembles his shipment in a car; the middleman with no warehouse, sends the car first to convenient track for inspection, second to "hold" track while he negotiates sale or decides as to disposition, and third to his customer's track or to public delivery, while the customer, with no warehouse, utilizes the contents direct from car often requiring several switchings before it is finally spotted. To say that the receiver unloaded that car within 48 hours after it was placed for unloading is to leave out a large part of the story. The "why" it did not "get there" sooner was because the instructions were so transmitted and the transaction so complicated that it required at least 300 per cent. more switching than if the car had on arrival gone direct to unloading track.

(7) *General Remedy.*

Do business on the European hotel plan—order what you want and pay for what you get.

Let any act of shipper, middleman or receiver which prevents the continuous carriage of a car from shipping point to the point of unloading, be adequately charged for: then industries doing a 10-car business on a 2-car space will enlarge their tracks to avoid paying for the extra switching; then the middleman will find his customer before the goods are shipped to avoid charges for reconsignment: then the shipper will stop loading in anticipation of sales, as the process might prove expensive: then demurrage, when made high enough, will be avoided instead of absorbed and the surplus switching engines—of which there would be many—could then be converted into regular road freight hauling power.

This remedy contemplates immediate relief, leaving the question of more railroads, more cars, more locomotives, etc., to be solved in due time.

(8) *Specific Remedies.*

(*a*) Apply a reconsignment charge of $5.00 a car.
(*b*) Increase the demurrage rate to $3.00 a day.
(*c*) Increase minimums to insure full loading of cars.
(*d*) Make a through car (by car for car exchange or otherwise) and minimize transferring.
(*e*) Assess demurrage against departments on company material.
(*f*) Fix a unit of efficiency and measure railroads accordingly.

The argument is often heard that it is just as much to the public's interest to load and unload cars promptly as for the railroads to furnish and handle them promptly, since they both suffer through unnecessary delays. I concede this to be true as a communistic proposition but not as an individualistic. The interests of the public, as a whole, and of the railroads, as a whole, are subordinated to the selfish interests of the individuals comprising such "wholes." The natural incentives of the individual railroads happen to be the same on this question as the natural incentives of the railroads as a whole, namely, to furnish as many cars as possible and carry them to destination as quickly as possible, since the more cars, the more trips, the more revenue, but this similarity of interests does not hold when applied to the shipper's side, since the selfish interest of the individual shipper is to load and unload cars when it best suits his individual convenience.

A great deal has been said recently about shortage of equipment, without, however, any definition of the word "short" or contemplation of the possible conditions should the "shorts" become long. Car shortages are of two kinds, nominal and actual; nominal when shippers order more cars than they need, and actual when they need more cars than they get. The congestions at San Francisco and regions round about after the earthquake and fire were the result of too many cars being shipped to one point at one time, and while a calamity called forth the cars, the cars produced a second calamity from which the whole Northwest has suffered, for, had these cars moved regularly and normally, they would have been in service eastbound lumber-laden, instead of standing weeks within 100 miles of their westward destination. You may say that such a situation is not likely to occur again. I answer that a market quotation or a bountiful crop are sufficient to produce a San Francisco or a Galveston congestion at any time, provided cars are available in sufficient quantities to be blown with every gust of the commercial winds, and the public do not promptly unload them. It required an enormous increase in the demurrage rate to force public co-operation in lifting San Francisco's congestion, and if this demurrage panacea were rigidly applied to lake ports, the blood or cars in the veins and arteries of our transportation body would freely circulate instead of clogging and causing car shortages.

*A paper read on Jan. 11 before the Iowa Railway Club by Ashley J. Elliott, Manager of the Illinois and Iowa Car Service Association.

There is in Frankfort-on-Main a society which takes note of measures for the comfort and advantage of workmen. This society has recently published a statement of the number of the different kinds of drinks supplied to workmen on their order in 21 different establishments, some of them government and some of them private, in 1902 and 1905, which has been a time of special effort to encourage temperance among railroad men. When we see that in that time there is an increase of 26 per cent. in the number of cups of coffee, 42 per cent. in the glasses of milk and of 483 per cent. in the portions of mineral water, we feel inclined to call upon the W. C. T. U. to sound a pæan; but finding further on that the orders for beer increased 254 per cent., we are not so jubilant. It is, however, gratifying to see that in both years the orders for "soft drinks" greatly exceeded those for beer, 524,472 soft drinks of all kinds having been consumed in 1902, against 70,755 beers, and in 1905, 711,336 soft drinks (chiefly coffee and milk), against 249,983 beers. In the latter years more of either coffee or milk was taken than of beer and more milk than coffee.

Final Report of the Pennsylvania Railroad Special Investigating Committee.

The following is an abstract of the final report, dated February 4, of the special committee of the board of directors of the Pennsylvania Railroad, appointed May 23, 1906, to investigate the charges brought against officers and employees during the Interstate Commerce Commission's investigation of coal and oil traffic in the spring of 1906. The preliminary report was printed in the *Railroad Gazette* of July 6, 1906. The investigation covered the following railroads: Pennsylvania Railroad; Pennsylvania Company; Philadelphia, Baltimore & Washington; Northern Central; West Jersey & Seashore; Pittsburg, Cincinnati, Chicago & St. Louis; Vandalia; Grand Rapids & Indiana; Cleveland, Akron & Columbus; Long Island; Cumberland Valley. The report follows:

The committee called for examination officers of each of the railroad companies as follows: The chief executive or other officer designated by its President, the Real Estate Agent, the Purchasing Agent, the Chief Engineer, and also in the case of the Pennsylvania Railroad, all the Vice-Presidents, the General Manager, the General Superintendent of Transportation, the General Superintendents, the General Superintendent of Motive Power, many of the Division Superintendents, the Comptroller, and many other officers. The executive officers produced copies of the by-laws and organizations, of the subsidiary companies, and explained their general systems of administration. The real estate agents explained the system of real estate purchases, the precautions taken to secure the payment of not more than fair prices, and the methods of caring for properties purchased. The officers of the Engineering Department explained the system of inviting competition, letting contracts, and supervising work under construction; and they also produced schedules of all contracts for construction, with lists of contracts awarded to other than the lowest bidder, and the explanations of such awards. The purchasing agents explained their systems of purchasing, the methods of securing competition, checking deliveries, and insuring the payment of not more than market prices. In each of the companies the system of administration is such that the interest of their shareholders has been carefully guarded.

The operation of a railroad company is a complicated and highly specialized business, for a full knowledge of which years of study and experience are needed. Criticism of railroad administration is, not infrequently, the result of misinformation and misunderstanding; and matters are often the subject of complaint which, if fully understood, would be found to be the unavoidable result of general business conditions existing at the moment.

The years between 1899 and 1907 will be memorable in the history of the Pennsylvania Railroad. In 1899 the company was confronted by a growing traffic, by inadequate receipts from transportation, and by an increased cost of operation, resulting partly from rising prices for material and supplies and from higher wages of labor, and partly from the overtaxing of the then existing facilities for the free movement of traffic. These conditions, if not controlled, would have resulted, not only in a serious reduction in net earnings, but also in a failure on the part of the company to do its full duty to the public. In order to provide adequate facilities for the free movement of traffic, and thereby to lessen the cost, and increase the efficiency, of operation, expenditures upon an unexampled scale had to be made for real estate, for additional lines, tracks, yards, and terminals, and for engines with greater tractive power, and cars of increased capacity, and the money had to be provided for so much of those expenditures as was charged to capital account.

The most important new construction has been the double-tracking of the Western Lines, finished on the Fort Wayne, and in successful progress on the Pan Handle; the extensions, both East and West, of automatic signaling; the construction of branch lines as feeders; the completion of a four-track line between New York and Pittsburg, with the exception of four three-track sections, one of 7 miles between Spruce creek and Tyrone Forge, one of 3½ miles east of Conemaugh, one of 5.5 miles from Manayunk bridge to Newton Hamilton, one of 4 miles from South Fork to Mineral Point, and also with the exception of five two-track sections, one being the Schuylkill river bridge, 0.3 of a mile in length, one being at Conestoga creek for 0.1 of a mile, one of two miles from Donohoe to George, one of two miles at Greensburg, and one of 0.5 of a mile, the Radebaugh tunnel; relieving freight lines, so that eastbound freight does not encounter any grade between the Ohio river and the Atlantic Ocean, in excess of 16 ft. to the mile, excepting a 1 per cent. grade for 24 miles from Conemaugh to Gallitzin; a double-track freight line between New York and Pittsburg, independent of the four-track line, with the exception of 96 miles between Petersburg and Marysville, and of 29 miles between Sheridan and Gallitzin, and of 47 miles between Trenton and Newark; additional lines for freight movement in and around Newark, Philadelphia, Pittsburg, Niles, Hudson to Ravenna, and Covington; the reduction and elimination of grades and curves; the widening and straightening of the lines at necessary points; the removal of grade crossings by raising or lowering highways; elevations of lines through Newark, Elizabeth, New Brunswick, Washington, Pittsburg, Latrobe, Cleveland and Chicago; the new terminals at Washington, comprising elevated lines, tunnels, and a great passenger station, built in conjunction with the Baltimore & Ohio; the construction of tunnels to prevent interference of passenger and freight movement; adequate passenger and freight stations, docks with improved machinery, classification yards, shops, water supply and coaling facilities; the construction of new steel bridges at Columbia, Havre de Grace, and Herr's Island; the substitution of stone for steel bridges, including those over the Susquehanna river at Rockville, and Shocks Mills, that over the Delaware river at Trenton, that over the Raritan river at New Brunswick, and that at Newark, and last, but not least, the tunnels and terminal construction in and near New York, giving to the system adequate terminal facilities in the heart of the metropolis, and convenient interchange of passenger and freight traffic with New England lines.

The committee has thoroughly investigated the system under which many thousand contracts have been made for maintenance of way and for new construction. The committee reports that as effective a competition was secured as is possible in work of such magnitude, carried on during a period when the facilities of the country for construction and for the production of machinery and material have been taxed to the utmost; when the demand for has exceeded the supply of labor, and when it has been difficult to find contractors of the ability and financial responsibility, and possessed of the equipment, necessary for the completion of work on a large scale within any reasonable limit of time. The committee has called before it and examined the principal engineering officers of the several lines, the several contractors who have been, and are, engaged upon the New York tunnels and terminals, and the many contractors who have done, or are doing, the greater part of the work on the Eastern Lines of the Pennsylvania Railroad. In railroad construction economy requires that the work be pushed to completion, in order that the investment made by the purchases of right of way and by payments to the contractors during the progress of the work, may as speedily as possible become income producing. Therefore, only those contractors were asked to bid whose responsibility, capacity, and possession of the essential equipment fitted them for the successful accomplishment of the work. Most of the contracts were awarded upon competition, and to the lowest of several bidders. The committee has investigated every instance in which a contract was awarded without competition, or to other than the lowest bidder. In every such instance the award was made by the concurrent action of more than one responsible executive officer. In every instance where a contract was awarded after competition, and to other than the lowest bidder, the award was so made because the awarding officers found that the lowest bidder either did not have sufficient capital, or was without the necessary equipment, or was overburdened with other work, or was unwilling to agree to complete the contract within the necessary time. In every instance where a contract was awarded to one bidder, and without competition, the award was so made because the awarding officers, in the impartial exercise of a sound discretion, determined it to be to the interest of the railroad company to so award.

Because of charges that have been brought to the attention of the committee, alleging favoritism in the award of contracts to H. S. Kerbaugh, and to H. S. Kerbaugh, Incorporated, the committee specially scrutinized all contracts awarded to Mr. Kerbaugh or to his corporation. Almost every one of those contracts was awarded after competition, and because the Kerbaughs were found to be the lowest bidder. In the few instances where contracts were awarded to them without competition, those awards were made only for the reason that the interests of the railroad company required the completion of the work within the shortest possible time, and because no other contractor was possessed of the capacity and plant adequate to the accomplishment of the work within the necessary time. The committee has had some of the most important work done by the Kerbaugh Company, and without notice to it, re-examined in detail, by W. K. Martin, a competent engineer, new measurements being made without reference to the original plans or cross-sections and by such methods as are employed in preparing careful estimates of probable quantities on a located line, Mr. Martin having, however, the advantage of knowing the actual width of cuts made, the spans of arches built, the sizes of the drains, and other structures, and having had to conjecture only as to the depths of foundations and the weight of iron pipes. Mr. Martin checked the quantities called for by the final estimates and found that the prices paid were, on the average, lower than those paid to other contractors on the balance of the line, and were in themselves reasonable.

It is the judgment of the committee that there has been no favoritism in selection of contractors; that officers have awarded contracts in proper exercise of a reasonable discretion; that work under construction has been carefully supervised; that every reasonable precaution has been taken to insure the faithful performance of contracts; that no officer or employee, of any of the railroad companies

has been, or is now, directly, or indirectly, interested in any contract for construction, and that no officer, or employee of the railroads has directly, or indirectly, received any compensation, or gratuities, from any contractor; and that the officers of the railroad companies have been in all engineering and construction work as faithful as they were skilled.

The Purchasing department is organized under a system which prevents collusion with any seller and makes certain the payment of not more than market prices. The department neither receives nor pays out any cash. All its purchases are competitive, with the exception of those articles whose manufacture is limited, either through the seller's control of patents or because they are specialties, and the non-competitive purchases constitute a small percentage of the total purchases. The department has indexed records covering many years of past and present market prices of all material and supplies which have been, or are likely to be, bought. There is a strictly enforced regulation that "all contracts for supplies covering a term of more than three months, or involving an outlay exceeding $10,000, must be sanctioned by the Second Vice-President, and copies thereof shall be furnished to the General Manager and the Comptroller." Purchases are made only on written requisitions from the officer for whose department the purchase is made. Several officers and employees of the department participate in the making of every contract and the giving of every order. Bids are awarded on consideration of the quality of material offered, the price and delivery point, and the time of delivery; and as between bidders, otherwise equal, their disposition to favor the Pennsylvania Lines in competitive freight business. Every bill, before forwarding for voucher, is submitted to and approved by the officer on whose requisition the purchase is made and by several officers and employees of the Purchasing department. In the Comptroller's department, as preliminary to the issue of a voucher, the calculations on the bill are examined and verified; its total is checked with the contract or order, its terms charged to the several accounts affected, and all payments made by voucher.

Because of charges brought to the attention of the committee the relations of the Standard Supply & Equipment Co. to the Purchasing department have been fully investigated. Mr. Winthrop Sargent, who has successively held the offices of Secretary, President and chairman of the board of that company, was formerly an employee of the railroad in its Motive Power department, but has had no connection with the service of the railroad since July 15, 1886. That company is capitalized at $400,000; has warehouses in Pittsburg, Altoona, Philadelphia and Baltimore; has made sales since January, 1900, amounting yearly to more than $1,750,000, of which about 5 per cent. were sales to the Pennsylvania Railroad and its eastern lines, and about 2½ per cent to the western lines, the remaining 92½ per cent. being sales to other railroads or to other concerns. Six officers of the Pennsylvania System were at various times owners in all of less than 150 shares of the 4,000 shares of the Standard Company's stock purchased for cash at par. All purchases from that company are made on a competitive basis.

It is due to the Purchasing department to say that the committee is satisfied, after full investigation, that that department has been administered with marked ability and with unswerving fidelity to the interests of the shareholders of the Pennsylvania Railroad.

Notwithstanding large and costly increases in freight car equipment, it is the fact that there are now in service on the lines of the Pennsylvania Railroad fewer of its own freight cars than there were some years ago, because under modern transportation conditions freight cars are subject to loading for movement to points upon other lines; because of the inadequacy of the stipulated per diem compensation for the use by roads of cars owned by other roads; because of the inefficiency of the penalty for unreasonable detention of such cars by roads not owning the cars; and because of unreasonable delays by consignees in unloading cars. Within a short time some of the trunk lines have agreed to a moderate increase of that per diem rate, but other railroads have not as yet assented to that modified agreement. Many railroads have not provided themselves with an adequate equipment, because it is cheaper for them to use, in some cases under the rules and in other cases in defiance of the rules, the cars built and paid for by other railroads rather than to build, pay for and use cars of their own.

The construction of additional lines and the increased number and size of the locomotives have made gravely important the subject of an economical supply of water of a quality suited to engine use and adequate for both the present and the future. On the Lines West, the water stations have been changed and enlarged, and it has become necessary to use water softening processes and to build stations therefor at Washington, Middlepoint, Indianapolis Hartsdale, Richmond, Bradford and Unionville. On the Lines East there have been in the past periods of drouth when it was necessary to haul water in large quantities and for long distances, and at all times the supply has been costly and insufficient. To meet and overcome this difficulty, this company has, in the manner and to the extent authorized by the laws applicable to it, promoted the organization of water companies at various points along its lines, and has made advances to such companies of the amounts necessary to enable them to acquire adequate water supplies, and to erect and construct the works and to lay pipe lines necessary for the utilization and delivery of water at various points along the company's lines. It is believed that through this outlay the company will be enabled to acquire an adequate supply for the present and for a long time to come, and at a cost per gallon materially lower than that heretofore paid. No director, officer or employee of the railroad company has, or ever has had, any interest, direct or indirect, in these companies.

The purchase of fuel coal for the engines and shops of a railroad company constitutes a substantial portion of its expenditures. Operating and traffic considerations are important factors in those purchases. The committee has carefully examined into the system on the different lines, of making those purchases, and reports that they have been made not only in the interest of the railroads but without intentional favoritism to any shippers. The system that has been in use on the Pennsylvania Railroad has had its advantages from the standpoint of the prices at which the purchases were made, but some disadvantages in the methods under which orders have been distributed. The committee recommends the subject for consideration as to whether any better system can be adopted.

The committee regrets that through a failure of duty on the part of some officers it was not, as soon as it ought to have been, brought to the attention of the officers charged with the duty of making purchases that the coal supplied from the tipple at Hunker's Station on the Southwest Pennsylvania division was of inferior quality. The officers who have failed in that duty have been reported for proper discipline. So soon as the matter had been brought to the attention of the Motive Power department, the building of a coal wharf at a convenient point was recommended, and when that wharf is in operation, the use of coal from Hunkers will be discontinued.

In the case of lines overburdened with traffic, and especially when the available supply of cars is inadequate, railroad officers are naturally reluctant to add to existing difficulties of movement Nevertheless, 176 sidings for bituminous mines, and 2,303 sidings for other industrial works were put in. A siding requires a construction within the railroad's right of way and a connected construction upon the property of the applicant. Every siding must either directly or indirectly be connected with or pass over a track upon which passengers and freight are moved. Where the traffic is heavy and is moved at high speed the siding must be protected by signals, which are costly, and even then the factor of danger cannot be entirely eliminated. The railroad officers must, therefore, determine in the first place whether or not the danger to life is such as to forbid the construction of a siding. If they determine that that danger is too great to be overcome by any means within reasonable limits of expenditure, they should refuse to grant the application. In the second place, the railroad officers must determine whether the probability of gain in traffic is such as to justify the construction of the siding. If they determine that there is such a probability the practice of the railroad is to approve the construction upon terms that the construction is made by the railroad at its cost, as respects so much of the siding as is within the right of way of the railroad, and at the cost of the applicant as respects so much of the siding as is without the right of way of the railroad. Where the traffic results of the siding are doubtful, it is the practice of the railroad to grant the application if the applicant consents to pay the entire cost of construction both within and without the right of way of the railroad. If the prospects of resultant traffic are reasonably good, but there is a doubt as to the continuing responsibility of the applicant, the connection is made upon terms of the applicant paying the entire cost, with an agreement on the part of the railroad to refund its proportion thereof at an agreed rate per car moved over the siding. In cases where the siding is granted, an agreement in writing is made between the railroad company and the applicant, granting a revocable license for the construction and connection of the siding under the supervision of a proper officer of the railroad company, and providing for termination upon 60 days' notice in writing, without claim for damages for such termination, and subject to the further condition that if the discontinuance of the siding be required by law the siding shall be immediately discontinued. The fact that an application for a siding has been made and refused is no evidence that the application ought to have been granted; but there must be in each instance a consideration of all the circumstances. By the Interstate Commerce Act as amended in 1906 (Section 1) it is declared to be the duty of a railroad, on application by any lateral branch line, or by any shipper tendering interstate traffic, to construct, maintain and operate on reasonable terms a switch connection or private siding, "where such connection is reasonably practicable and can be put in with safety and will furnish sufficient business to justify the construction and maintenance of the same"; and jurisdiction is given to the Interstate Commerce Commission, if the connection be refused, to

hear, investigate and determine "as to the safety and practicability thereof and justification and reasonable compensation therefor." This legislative recognition of a reasonable practicability in operation, and a business justification, as the chief elements for consideration in granting or refusing a siding, would seem to approve the railroad's established policy on this subject.

The committee said in its preliminary report, "The question of the independent, or privately owned, coal cars is not a new question, nor one which admits of an offhand solution. The Pennsylvania Railroad was chartered on the theory that the company would build the line and the shippers would furnish their own means of transportation. The greater portion of the coal tonnage of England is moved to-day in privately owned cars. The use of such cars on the Pennsylvania lines is not peculiar to a few favored shippers. They have been used from the beginning of coal transportation." There has not been, and is not, on the part of the railroad, any discrimination as between shippers in the facilities given for the exercise of that legal right. There were 5,238 individual coke cars, owned by 10 different owners, and 22,301 individual coal cars, owned by 49 different owners, in service in 1906 on the Pennsylvania Railroad, which pays for the use of the cars at the rate of six mills per mile, loaded or empty; charges the regular freight on the carload, and has the option of buying the cars at the actual cost of building cars of like character and quality at the time of the sale, less stipulated allowances for depreciation. The advantage to the owner of individual cars is that he can contract for shipments to the amount of the tonnage of his cars with an assurance of having the cars in which to ship, and this compensates him for the fact that the mileage paid him does not meet his outlay in interest, repairs and depreciation. The advantages to the railroad are that it has the use on favorable terms of cars, for whose construction it does not have to find the capital, and whose interest, repair and depreciation charges it does not have to meet, and which assure to it a greater net revenue than its own cars yield. For the reasons already stated, an equal number of railroad cars will not effectively replace the individual cars. The disadvantages to the railroad are that the shippers, having control of the loading, load their individual cars, in periods of diminished coal demand, to long distance points in order to obtain the maximum receipts from car service; and, in periods of increased coal demand, to short distance points, so as to insure their speedy return, the railroad cars allotted in pro rata distribution being at such time loaded by the shippers for foreign points, which their return is uncertain. The individual cars are also a hindrance to economical and efficient railroad operation. When empty they must be returned to their home sidings, and being moved in trains to the yard nearest to the coal regions, there must be increased switching and yard service in breaking up those trains and classifying the cars. There are also delays to trains on main lines in order to cut out cars for branch lines and sidings. There is much empty mileage in returning the cars to their home sidings. The individual cars also cause suspicions of preferences and lead to unfounded, but vexatious, charges of discrimination. The individual cars also interfere at times with the pro rata distribution, in that when the owner's sidings are filled by his individual cars, the economies of transportation require the railroad cars allotted to him to be distributed among the nearest mines, thus disturbing the pro rata distribution not only in the same region, but also as between regions. While recognizing all these disadvantages, nevertheless the railroad has not as yet seen its way clear to do away with the individual cars; in the first place because of the charter requirements above mentioned; in the second place because whenever the railroad thought that its equipment was catching up with the demands to make it possible to do so, there came a growth of business that more than absorbed its increase; in the third place, because an equal number of company cars will not, during a given period, move the same amount of tonnage and, in the fourth place, because large consumers located at points far distant from the coal fields, the successful operation of whose works are entirely dependent upon a full and regular supply of fuel, must have that supply assured to them, and this seems impossible of accomplishment, except through an assignment of cars, that can only be made certain by an ownership of cars, either by the consumer, or by the operator supplying the fuel.

(To be continued.)



Alfred Walter.

Alfred Walter.

Brief reference to the life and work of Mr. Alfred Walter, late President of the Seaboard Air Line, was made in these columns last week. Mr. Walter has been characterized by a warm personal friend and associate as the last president of a great railroad in this country who was absolutely independent of financiers in his policies and viewpoints, with his interests wholly confined to the transportation problems at hand. This very aloofness from the matters which Wall street holds most important cost him the Presidency of the Lehigh Valley in 1902, as is well known. In the years prior to 1893, the old Lehigh Valley company, fathered by Asa Packer, was a sort of close corporation in the railroad field, having a line in the anthracite regions all middle, without beginning or end, and delivering its coal to other companies to haul to tidewater and to western points. As an accessory to coal mining operations, the old company prospered greatly; then it reached out to Buffalo and to tidewater at New York and became a trunk line, but without fixed policy, good financing or capable management.

When Mr. Walter became President, in 1897, the Lehigh Valley was in what may be described as a neutral condition. It was earning money, but paid no dividends. It had thrown itself into bankruptcy by its Buffalo extension, yet Mr. Walter saw that abundant resources existed, although they had been neglected. His problem was to make use of the facilities then supposed to have been foolishly acquired and develop them so that they would become a source of profit, instead of a drag on the property; to make a trunk line successful by trunk line methods after it had failed by coal road methods. In this he accomplished his purpose, by using all the money the road earned to improve its motive power, track facilities and cars, so that it could take its place among its competitors as a first-class property, with established credit, and with the potentiality of economical operation that goes only with a well built and well equipped railroad. But in so doing, Mr. Walter ignored the demands of banking interests that dividends be paid on the stock; he saw his duty in another quarter, and in the resultant friction he was removed from office. It is fair to say that the present management of the company has adhered to Mr. Walter's betterment policy, already nearing fruition at the time of his removal, and has combined with it a plan of financing that has enabled the shareholders to receive dividends without interruption of the improvement work.

Like Thomson, Roberts, Provost, Cassatt and a long list of prominent executive officers, Mr. Walter was a graduate of the Rensselaer Polytechnic Institute at Troy. He worked his way up from supervisor to Superintendent of the Sunbury division of the Pennsylvania, and was General Superintendent of the Baltimore & Ohio lines east of the Ohio river from 1889 to 1892. When Mr. Felton left the Vice-Presidency of the Erie, where he had been in charge both of traffic and of operation, his company was at a loss to know where to go for an operating officer. Mr. Walter came to the Erie as General Manager in March, 1892, a little over a year

before the company went into the hands of a receiver, and there had his first chance to show his skill in organizing the different departments of a railroad. He improved the roadway until the Erie's tracks were brought to their present standard of excellence, and organized the transportation department in such a way that the suburban traffic could be properly taken care of without neglecting through business. Mr. Walter saw that while the commuter, *per se*, is not apt to be profitable to the company, the business he brings in his wake does pay.

It was the wish of Mr. J. B. Coxe, who died in 1894, that Mr. Walter should succeed him in the management of his coal properties. The inducement was tempting, and from 1894 to 1897 he was less concerned with the work of railroad management, for which he especially cared (although President of the Delaware, Susquehanna & Schuylkill), than with the coal business. The Lehigh Valley presidency became vacant in 1897, and Mr. Walter's work there was outlined earlier in this article, out of its chronological place, because it was desired at once to emphasize the type of railroad man he was.

The enforced retirement from this company in 1902 threw Mr. Walter into great distress. He had for some time been suffering severely from a chronic malady which he had concealed even from his wife and most intimate friends, so great was his desire to do the work at hand, without thought of self. He was a man of much culture and of simple habits of life, and was able to enjoy his travels in Europe at this period, although restless and afflicted by his disease. Returning to this country, he became Chairman of the South & Western in 1905, and President of the Seaboard Air Line in 1906. Mr. Walter was exactly the type of man the Seaboard needed. It had been starved by its financial managers and let run down hill for lack of a strong operating hand to grasp the operating problems, maintain properly out of income and build up facilities to meet traffic needs. Some progress had already been made along these lines during Mr. Walter's short tenure; much remains to be done, and the road is most unfortunate in being deprived of an executive so single-minded.

Rail Motor Car Experiments in Hungary.

The Hungarian State Railroads have been running some light suburban trains for some time with a motor car and one or two trailers. It was questioned whether a light locomotive would not be more economical, with which inferior coal and harder water could be used. Experiments were instituted over three different routes. The result was that the locomotive burned less coal for the same service and generally used less water and cost less for repairs. An absolute conclusion as to the balances of advantage and disadvantages is not yet drawn, but the authorities have ordered that seven locomotives be fitted for this work and the experiments continued.

Turbine Steamship Governor Cobb.

The "Governor Cobb," the first turbine steamship launched in America, is now in service in the Eastern Steamship Company's line between Boston and St. Johns, N. B. The vessel was built by the Delaware River Iron Shipbuilding & Engine Works at Chester, Pa., and the engines by the W. & A. Fletcher Co., Hoboken, N. J. The hull is 300 ft. long over all, on the water line 290 ft. long, 51 ft. beam, 20 ft. 6 in. deep, and draws 14 ft. loaded. It is built of steel with double bottom throughout and is fitted with several watertight bulkheads. The boiler and engine pit is entirely enclosed with steel as far up as the dome deck. The vessel has state-room accommodations for about 200 passengers, and its freight capacity is 500 tons; all freight is carried on the main deck, none being stowed in the hold.

As the accompanying photographs show, the "Governor Cobb" has three screws, driven by Parsons turbines; the center one by a high-pressure turbine and the others by two low-pressure turbines. The high-pressure turbine drives ahead only, while the low-pressure engines are combination ahead and astern. A view of one of the low-pressure turbines with half of the shell removed is shown herewith. The large part of the cylinder is the ahead turbine, while the smaller part, to the left, is the astern turbine. The photograph of the engine room shows the three turbines; each low-pressure engine has a separate surface condenser, circulating pump, air pump and steam pipe connections, so that each may be operated independently.

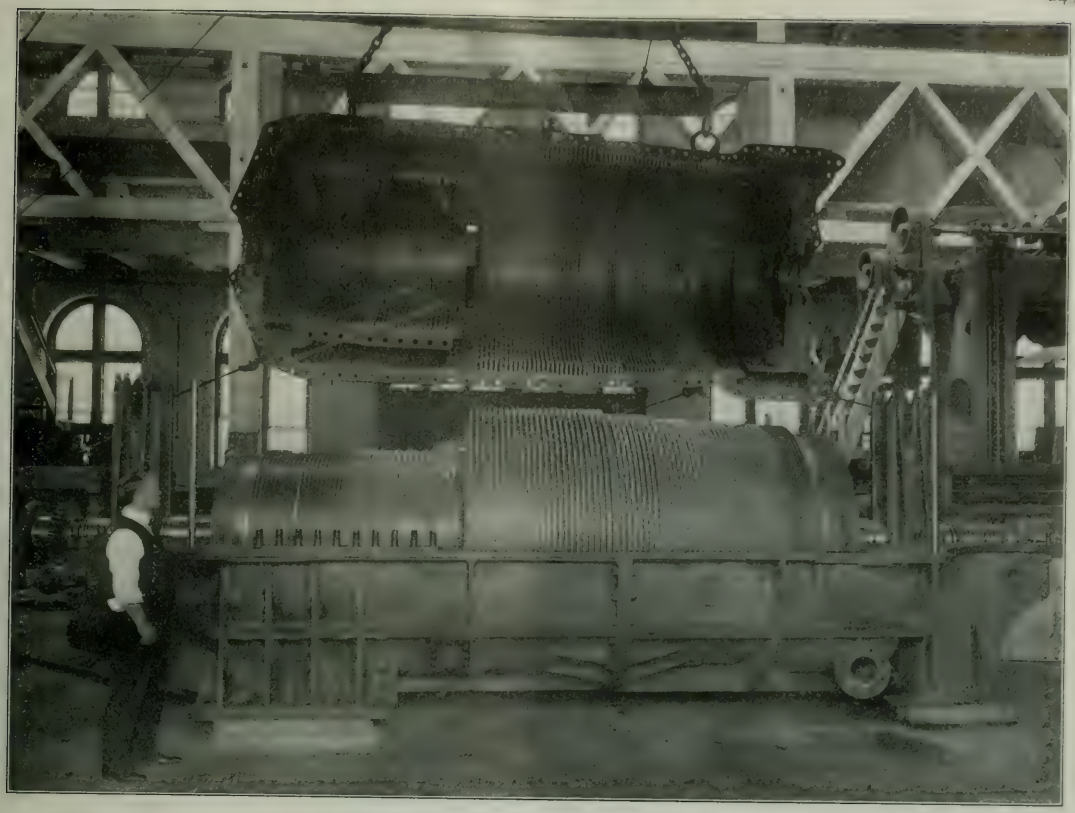


Screw Arrangement.

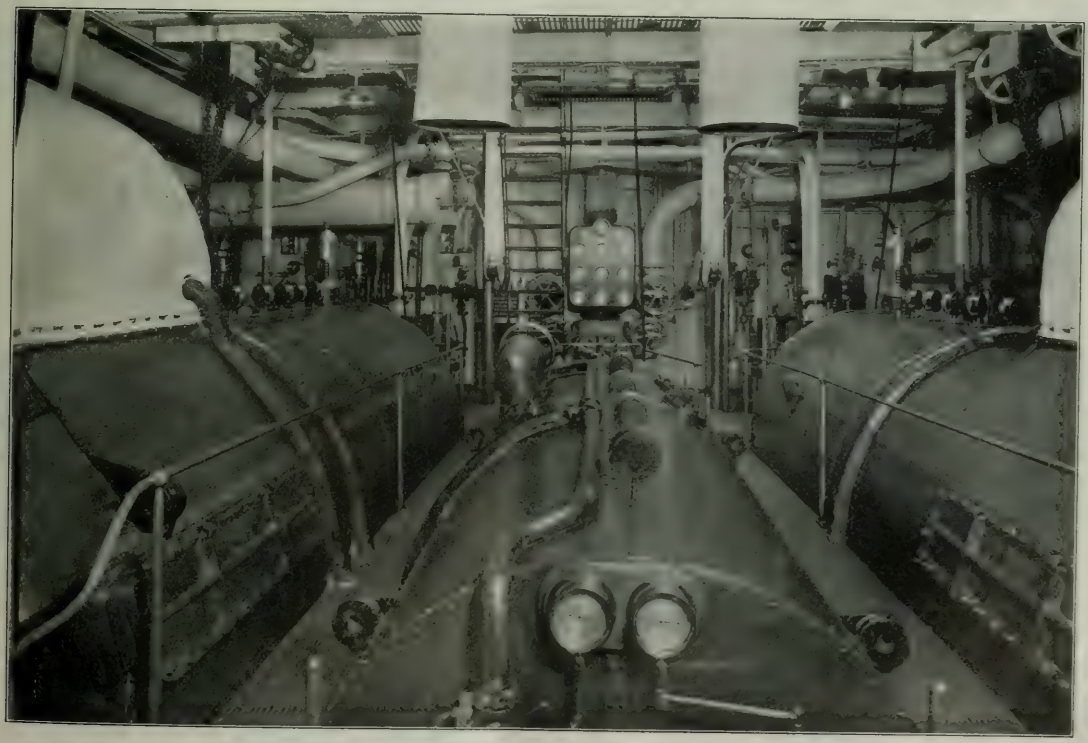
Steam is supplied from six Scotch-type boilers designed for a working steam pressure of 150 lbs. The boat is fitted with steam steering gear, as well as hand gear operated from the pilot-house and auxiliary hand gear on the saloon deck aft. The 20-k.w. generators



Turbine Steamship Governor Cobb.



Low Pressure Turbine with Half of Casing Removed.



Engine Room of Steamship Governor Cobb, Showing the Three Turbines.

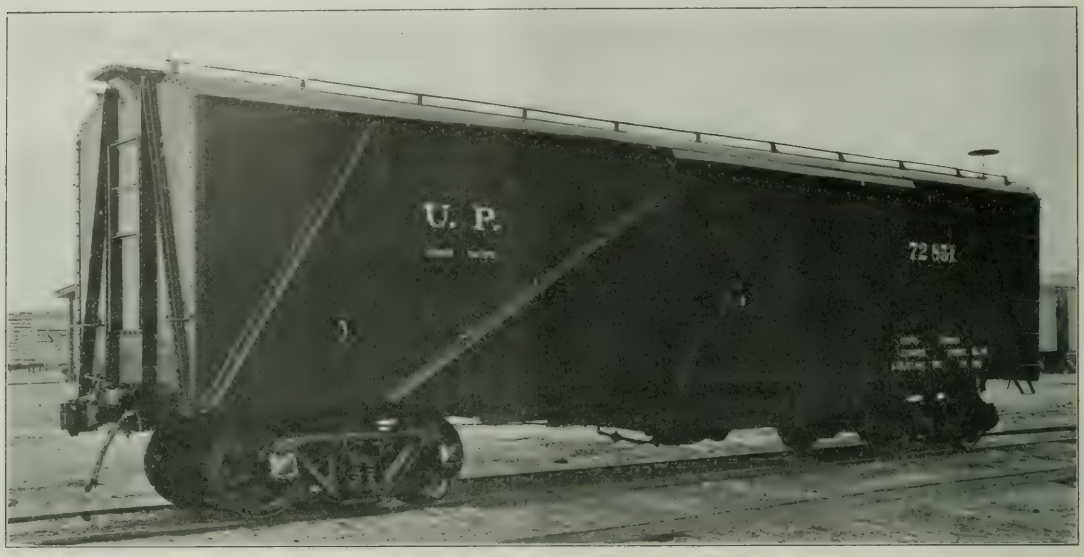
supply current for electric lights and other electric installations.

On the builders' trial trip the "Governor Cobb" developed a speed of 21¾ miles an hour over a measured mile under a steam pressure of 125 lbs., only five of the six boilers being used. On its trip to Boston it averaged over 21 miles an hour for 14 hours and 25 minutes, part of this being in the open ocean when rounding Cape Cod.

All-Steel 50-Ton Box Car for the Union Pacific.

The standard all-steel postal car and day coach designs of the Harriman Lines have been described in the *Railroad Gazette*, June 22 and Oct. 5, 1906, respectively. An all-steel box car has now been designed by W. R. McKeen, Jr., Superintendent of Motive Power and Machinery of the Union Pacific, and two sample cars have been built at the Omaha shops. The first of these has been in service since the first of the year and photographs and drawings of it are presented herewith.

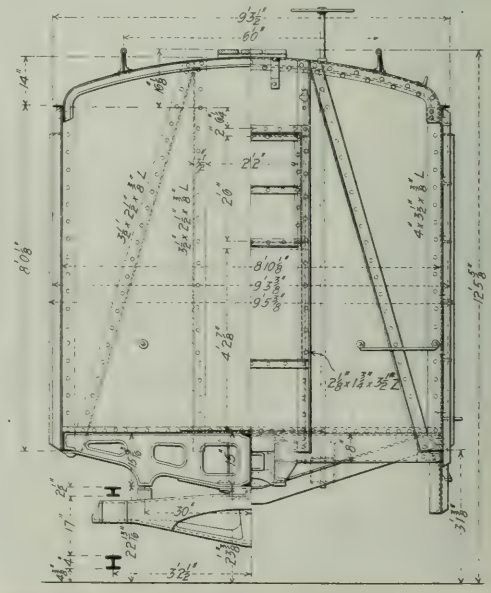
It is a 50-ton car, 40 ft. long inside. The principal features of the design are well shown by the drawings. Variations from wooden or composite box car design in a number of essentials will be observed. There is only one center sill—a 15-in., 42-lb. I-beam—which is cut off 17 in. beyond the center line of the bolsters. To its ends are riveted the draft sills, formed of 12-in. 20-lb. channels. There are no other separate longitudinal sills. Instead of the usual side sill a fish-belly girder construction is provided as a continuous part of the car side by extending the side sheets down to form the web member. The depth under the door opening is 22 in. Instead of the usual inter-post braces a single compression member runs from bolster to door post. It is formed of two angles, the upper one of which is made continuous over the door opening



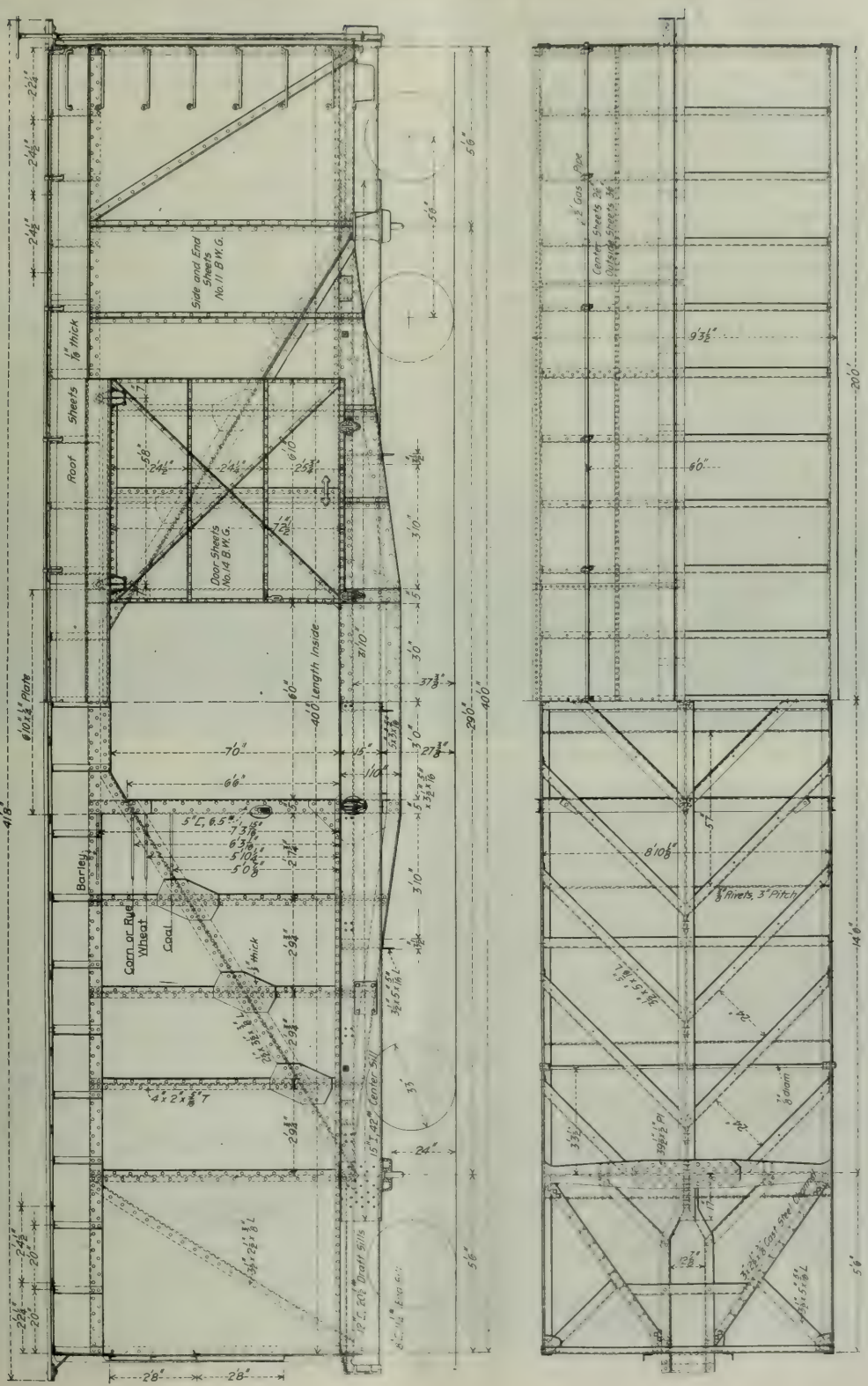
50-Ton All-Steel Standard Box Car; Union Pacific.



End View of Union Pacific Steel Box Car.



Combined Section and End Elevation; Union Pacific Box Car.



Plan and Side Elevation of 50-Ton Standard Steel Box Car; Union Pacific.

to provide the requisite section of metal in this portion of the structure. The side posts are 4-in. x 2-in. x $^{5}/_{16}$-in. T bars, the corner posts 4-in. x 3½-in. x ⅜-in. angles, and the end posts 3½-in. x 2½-in. x ⅜-in. angles. The bottom transverse members are angles, of which there are five. The body bolster is cast-steel, and extending from the outer ends of the latter to the ends of the draft sills are 3-in. x 2½-in. x ⅝-in. cast-steel channels. There is a transverse tie rod ⅞ in. in diameter, 3 ft. 3½ in. back of each bolster, and further transverse stiffness is imparted by the floor angles, 3½ in. x 5 in. x $^{5}/_{16}$ in., which run obliquely from the center sill to the sides, spaced 24 in. apart.

The side and end sheets are No. 11 B. W. G. and the roof sheets are $^{7}/_{16}$ in. thick. They are riveted to 2½-in. x 2-in. x ¼-in. angle carlins spaced 24 in. apart. The floor is No. 10 B. W. G. sheets with one thickness of tar paper between sheets at the joints. Each side door is formed of a single No. 14 B. W. G. sheet riveted to light angles. The end doors slide in a Z-bar frame. The car has Sessions "Type C" friction draft gear, Buckeye cast-steel bolsters and Andrews cast-steel truck side frames.

This car differs slightly in dimensions from the Harriman Lines common standard box car. The latter is 40 ft. long inside, 8 ft. 6 in. wide, 8 ft. high, and has a cubic capacity of 2,720 ft. The steel car has the same inside length, but is 8 ft. 10⅛ in. wide, 7 ft. 10 in. high, and the cubic capacity is 2,770 ft. It weighs considerably less than the common standard car, the figure being 37,800 lbs. as against 42,200 lbs. for the latter.

The Grand Central Terminal in 1906 and in 1911.

The accompanying illustrations show the Grand Central terminal at New York in its present transitory state and in the completed form toward which the improvement work is tending. The fundamental idea, involving operating through trains from stub-end tracks at grade, and local trains around a loop below grade, is doubtless familiar to our readers, and has been fully described in these columns. The picture of the completed terminal shown herewith gives a clear idea of the street arrangements, in accordance with which Park avenue will be carried over the center of the yard on an elevated structure connecting directly with the station. This will relieve Madison and Lexington avenues and Forty-second street of much of the vehicle traffic to and from points north of the station, and thus permit, incidentally, of a better surface car service than is now possible on these congested thoroughfares.



Grand Central Yard, Looking South, November, 1906.



General View of Grand Central Yard and Northerly Approaches When Completed in 1911.

GENERAL NEWS SECTION

NOTES.

The Southern Pacific has ordered from the National Tube Works Company enough 8-in. pipe for a 400-mile oil line to be laid in California.

The Presidents of the Chicago, Milwaukee & St. Paul and the Chicago & North-Western have announced their acceptance of the Wisconsin 2½-cent fare.

According to a press despatch the Southern Pacific lines in Texas are to engage hundreds of Japanese to work on track repairs. Considerable numbers are already employed.

Albert H. Stanley, General Manager of the trolley lines of the Public Service Corporation of New Jersey, has been appointed General Manager of the Underground Electric of London.

The Grand Jury in the United States Circuit Court at New York, this week handed up an indictment against the Great Northern Railway Co. for paying rebates to Lowell M. Palmer, the authorized traffic agent of the American Sugar Refining Co.

The Department of Agriculture has handed to the Department of Justice evidence in a large number of cases of violation of the 36-hour law concerning the transportation of live stock. Among the roads named are the Atchison, the Burlington, the St. Paul, the Rock Island, the Big Four, the Southern Pacific, the Union Pacific, the Northern Pacific, the Lake Shore and the Nickel Plate.

The Central Freight Association, after several days' conference, has decided to abolish about 75 per cent. of the commodity rates and put the commodities in the Official Classification. Just what it will be for each commodity will be decided at meetings to be held during the next two weeks by special committees of the Central Freight Association and the Trunk Line Freight Committee at Chicago.

The railroads have succeeded in presenting so strong a case before the Interstate Commerce Commission in the hearings held this week that the Commission will probably modify the rules for the filing and construction of tariffs. Rule 15, which seems to require a railroad to give a competing line the advantage of a local rate in competing with it for through traffic, will probably be withdrawn.

Attorney-General Bonaparte has instituted suits against fifteen railroad companies to recover penalties for violation of the Safety Appliance Law. The roads are the Alabama Great Southern, Atlantic Coast Line, Central of Georgia, Denver & Rio Grande, Eagles Mere, Erie, International & Great Northern, Missouri, Kansas & Texas, Mobile & Ohio (15 cases), Pennsylvania, St. Louis & San Francisco, Southern Pacific, Texas Mexican, and the Wabash.

Receiver Harmon, of the Cincinnati, Hamilton & Dayton, threatens to sue railroads which borrow his freight cars and do not return them in reasonable time. He proposes either to call upon such roads to account to the court, under whose authority he acts, for the profits which they have made on C., H. & D. cars, or else to sue for damages sustained by him in loss of business by reason of lack of cars, whichever course seems likely to bring the most money.

At a recent hearing before the Interstate Commerce Commission in Chicago that body was asked by certain railroads and by the Chicago Board of Trade to issue a general order authorizing the payment of rebates on account of shipments made before the passage of the revised law. As the revision made little or no change in the law, as regards rebates, except to more clearly define it, and to provide for more certain punishment, this request would seem to be very much like asking the commission to formally approve lawbreaking. The request was denied.

The Delaware, Lackawanna & Western, indicted for giving rebates on sugar, under circumstances similar to those of the New York Central cases, in which the road and the shipper were both convicted, has entered a demurrer, on the ground that the shipments from New York to Buffalo were not interstate. Judge Holt, in the United States Court, at New York, February 15, overruled the demurrer, deciding that, as the line of the road passes through other states, the federal law applies. This is in accordance with the decision of the Supreme Court in the case of Hanley vs. Kansas City Southern, January 5, 1903.

According to a press despatch from New Orleans Capt. Charles W. Oldrieve between January 1 and February 10 walked on the water from Cincinnati to New Orleans, a distance of 1,600 miles. The time was 40 days, lacking 45 minutes, and Captain Oldrieve won a bet of $5,000. Oldrieve left Cincinnati January 1 at noon on a wager that he would walk to New Orleans in 40 days. At the falls above Louisville he was delayed for 24 hours, and this was allowed for. He was in motion only during daylight hours, lying over every night. He was equipped with shoes made of cedar wood, 4 ft. 5 in. long, 5 in. broad and 7 in. deep. In a gasolene boat preceding the water walker were Capt. J. W. Weatherington and Arthur Jones. Mrs. Oldrieve was also in the party.

Cornelius A. Jackson, who was the towerman at Ninth avenue and 53d street, New York, in September, 1905, when a Ninth Avenue Elevated train ran off the track at the curve and one car fell to the street, killing twelve persons and injuring twenty-eight, has been convicted of manslaughter in the second degree, before Judge Foster. A strong recommendation for mercy accompanied the verdict of the jury. On the morning of the wreck Jackson had set the signals for a train which was to take the curve. Then he left the tower, and as a Ninth avenue train came along, which should have taken the straight track, it took the curve too fast and the forward car plunged into the street. The motorman, whom most people believed to be responsible, ran away and has not been caught.

The Sixteen-hour Railroad Employee bill was up in the Lower House of Congress on Monday last, but the substitute proposed by the committee was defeated by the opposition of the Democrats, who were able to prevent the bill from receiving the two-thirds vote necessary under suspension of the rules. This action was taken by the Democrats in the belief that the bill as reported by the committee is a "gold brick." They declare that the House bill is full of loopholes purposely placed in it by the Republicans. It is also understood that Senator LaFollette, having become convinced that the House bill is not what it purports to be, urged his friends in the House to vote against it. This failure of the bill will not prevent it from coming up again. If the bill proposed in the House —called the Esch bill—is passed and the question goes to conference, Senator Dolliver will stand out for the LaFollette bill, which is recognized to be anti-railroad, and Mr. Hepburn will contend for the Esch bill, which is regarded as pro-railroad. Senator Dolliver and Representative Hepburn are both from Iowa. It is said that Senator Dolliver will reflect the views of the President in the conference, and if the President says he favors the LaFollette bill instead of the Esch bill, the Senate may win the conference fight; otherwise, without instructions from one House to the other, the bill may die in conference.

New Dry Dock at San Francisco.

According to press despatches from San Francisco, a large dry dock is to be built by the San Francisco Dry Dock Co. at Hunter's Point, adjacent to the two existing docks of the company. The new dock is to be 1,050 ft. long, big enough to hold any two battleships of the United States Navy.

Wheeling and Lake Erie Improvements.

The Wheeling & Lake Erie has just completed, or has nearly completed, the following work:

At Huron, Ohio, one additional slip 1,400 ft. long, 200 ft. wide, 21 ft. depth of water; four Wellman-Seaver-Morgan ore conveyors with five-ton buckets on each; one ore storage bridge, 10-ton bucket, 280 ft. between inner legs with 80-ft. cantilever arms; one McMyler car dumper for unloading coal, and an extensive rope haulage plant for drilling cars from the car dumper to the ore conveyors and ore storage bridge (this ore storage bridge will serve space for storing 1,500,000 tons of ore). An electric light plant is to be put in for lighting the yards, docks, conveyors and car dumpers. The company will increase the terminal tracks by about 3,000 cars capacity. This includes the 2,000-car yard at South Huron, one mile distant from the docks, where all modern improvements for weighing and classifying cars are being put in.

At South Huron yard a coaling plant is being put in for locomotives, also a water station and a roundhouse.

At Cleveland the company is just finishing a new dock along the Cuyahoga river and a new McMyler car dumper with storage tracks of about 1,000 cars capacity. Facilities there are being increased by replacing a number of wooden structures with steel bridges, notably, over Harrison street, Factory street and the Erie Railroad.

Twenty passing sidings are being put in along the road to hold 80 cars each. During the past year 15,000 tons of 90-lb. rails have been laid, and 5,000 additional tons will be laid soon.

The company is now constructing the Sugar Creek & Northern Railroad, a cut-off line between Bolivar, Ohio, and Orrville, 26 miles, by which six miles in distance is saved and the severest grades

of the main line will be eliminated. On the existing line the grades where helper engine service is now necessary, costing about $100,000 yearly, will be done away with, and as business will probably multiply several times within the next few years, the economies in this connection will be proportionately great.

Grading and bridge work on the Sugar Creek & Northern Railroad is about 90 per cent. completed and eight miles of track laid.

At Brewster the company has in contemplation the construction of a 3,000-car yard and extensive shops, roundhouse and other division terminal facilities. The work on the Brewster yard is now under good headway, and the work of constructing the roundhouse will be started in 30 days.

The connection between the Wabash Railroad and the United States steel plants was completed some months ago and is now being used.

The connection between the Wabash Railroad (West Side Belt) at Clairton with the United States Steel Company's works at that point is about finished and is to be put in operation during the next 30 days.

At Clairton, sidings and other facilities are being provided for the interchange of business at that point.

On the West Side Belt in the city of Pittsburg, three of the old wooden trestles are being replaced with steel viaducts, and other improvements, such as reducing the grades, curvature, etc., will be made. This will improve the existing connection with the Pittsburg & Lake Erie, where interchange facilities of considerable magnitude are being provided. This company will use a small portion of the P. & L. E. for reaching its freight terminals on the South Side and the Monongahela river in Pittsburg, where carload consignments will be handled. The present freight station adjoining the Wabash Terminal building in Pittsburg will then be devoted principally to handling smaller consignments.

Electricity for All Harlem Trains.

The electrification of the Harlem division of the New York Central is now so far completed that no passenger trains are drawn by steam locomotives south of Wakefield, thirteen miles from the New York terminal. Ninety-nine through and local trains on that division are now propelled by electric locomotives or run as motor trains in and out of the Forty-second street terminal.

Twelve new local electric trains are put on between New York and Mount Vernon, just beyond the electric terminal yard at Wakefield. These trains arrive and depart from the new Lexington avenue terminal of the Grand Central Station; there are now, including several Croton locals and Yonkers trains, 152 electrically propelled trains, which will arrive and depart from the new terminal.

Complete Block Signaling.

"On the important railroad lines, detailed train rules and written train orders should be things of the past, and all movements of trains, not only when running on tracks designated for their use, but also when running on tracks assigned to trains running in opposite direction, should be controlled and directed by signals; and the rear ends of trains when running slowly or stopped should be protected by fixed signals, instead of train flagmen." The speaker believed that this would be the method of operation in the near future.

This is from a speech of Joseph Crawford at Washington, as reported in the Proceedings of the Railway Signal Association. Mr. Crawford was for years superintendent of the New York division of the Pennsylvania Railroad.

North Shore Railroad of Cuba.

The North Shore Railroad of Cuba has been incorporated under Cuban laws to build 250 miles of railroad. Building is to be begun May 1. C. D. Gibbons, 106 Wall street, New York, is President, and Frank H. Carr, of Grand Rapids, Mich., who was formerly assistant to the General Manager of the Pere Marquette, is General Manager.

Starting at a point of Mayanaba Bay, just north of Nuevitas, Puerto Principe, the line is to run west through the Cubitas valley to Caibarien, in the province of Santa Clara. The road will be about 10 miles from the north coast. A branch is to be built from Senada south to what are claimed to be rich iron mines south of the Cubitas mountains. On the main line south of the mountains are various small towns, of which Moron is the largest.

At present at Caibarien large vessels cannot load sugar within 18 miles of the shore. Freight must be loaded first on scows, and then unloaded, being handled sometimes two or three times. When the new railroad is in operation, the planter will simply have to deliver his sugar to the car. Large docks will be built on Mayanaba Bay and the ships can come alongside so that the sugar may be loaded from the cars to the vessel's hold.

According to President Gibbons, there are from 100,000,000 to 150,000,000 tons of red hematite iron deposits along the route of the line. This iron has no sulphur or phosphorus and assays some 65 per cent. of metallic iron. From 60,000,000 to 80,000,000 tons are owned by Pilling & Crane, of Philadelphia, the Cuba Mining Co., of Bethlehem, Pa., of which John Fritz is President, and the Nova Scotia Iron & Steel Co. The company will develop on its own account some 14,000 acres of iron deposits, which it is estimated will yield from 50,000,000 to 75,000,000 tons of rich ore.

There are said to be no engineering difficulties to be met in the construction of the line. The Cuban authorities have granted a subsidy of $6,000 per kilometer. Among the Cubans interested in the project are Dr. Lincoln de Zayas, Edward L. Delgado and Alfred Betancourt Mandalay, all of Havana.

TRADE CATALOGUES.

Heisler Geared Locomotive.—The Stearns Co., Erie, Pa., has recently issued a catalogue setting forth the advantages of the Heisler geared locomotive. In it, it is claimed that the locomotives of this class possess many advantages over the standard direct-connected machine for industrial works and places where curves are short, grades heavy and track uneven. Singularly enough, this catalogue contains no description of the engine as a whole, but the text is limited to a discussion of the excellence of its details. The illustrations are, however, so numerous and clear that there is no difficulty in grasping the salient features of the machine. It has a boiler of the usual locomotive type and on either side of this, at about the center of the length, there is bolted an inclined cylinder that drives a longitudinal shaft placed centrally beneath the boiler. These two cylinders are set at right angles to each other so that they have the same starting capability as an ordinary locomotive. This longitudinal shaft is cranked and carries beveled pinions that mesh with gears placed upon the axles of the trucks. The trucks are of the four-wheeled bogie type, with wheels coupled by side rods, so that but one gearing on each truck is required. The shaft is fitted with universal joints in which there is ample allowance for the movement of the trucks on curves. As the ratio of the pinions to the gears is not given the ratio of piston to engine speed cannot be ascertained, but it is about one to two. In a table of the sizes and capacities of these engines, the cylinders are of 10-in. diameter and 10-in. stroke for a machine weighing 17 tons; and, for the largest size, or 52 tons, the cylinders are 16¾-in. diameter and 14-in. stroke. The wheels are 30 in. in diameter for the light and 40 in. for the heavy machine, and the minimum curves that they will pass have radii of 50 ft. and 90 ft., respectively. Between these two, six intermediate sizes are listed. The final claim of the 17 that are set forth regarding the excellence of the machine, is to the effect that the engine is not only symmetrical but every detail is up to the standard in workmanship and design of the most modern and best direct-connected locomotive.

Stationary Engines.—Catalogue No. 206 of the American Blower Co., Detroit, Mich., is on the subject, "Vertical Self-Oiling Steam Engines," a special type of which this company lately developed. The details of the engine are all carefully described and illustrated and its merits and advantages set forth. There are two types, "A" and "E," which are covered separately. On the last pages are shown the engines attached to dynamos, pumps, etc. Two small pamphlets accompany the catalogue; they are "A Different Engine," and "Will 100 Per Cent. on Investment Interest You?", both referring to the engines described in the catalogue.

Turbines.—Bulletin No. 9 of the Kerr Turbine Co., Wellsville, N. Y., describes and illustrates the Kerr steam turbine. This turbine is built on the principle of the Pelton water wheel; jets of steam are directed at a tangent into buckets set on the circumference of a diaphragm, the engine consisting of a series of these diaphragms. The buckets are of the double cup type. Steam turbine-driven blowers are also illustrated and described in the bulletin, and tables of dimensions, weights and capacities are given.

Springs.—A new edition of the catalogue of the Railway Steel-Spring Co., New York, shows representative types of the products of that company. The illustrations are half-tone engravings of excellent quality made from wash drawings, and under each is noted briefly the character of the spring and the important features of its construction. The book is printed in red and black on enameled paper and is neat and pleasing in appearance.

Air and Gas Compressors.—Catalogue H36 of the Ingersoll-Rand Co., New York, is devoted to Class H air and gas compressors. These machines are of the duplex, steam-driven type with sub base. Sizes from 10 h.p. to over 200 h.p. are described, and the machines and their parts are shown in 38 excellent half-tones and line drawings. The operation and efficiency of these engines are fully discussed, and tables of dimensions and capacity are given.

Louisville & Nashville.—This company has published a most attractive pamphlet describing the country traversed by its new short line between Cincinnati and Atlanta, which was opened last month.

The illustrations, which are of stretches of the road, bridges and interesting spots near the line, are particularly good.

High-Speed Drills.—The Cleveland Twist Drill Co., Cleveland, Ohio, makers of drills, reamers, bits, etc., has issued catalogue No. 34, showing high-speed steel drills and sockets. Price lists and dimensions of each type are given. The catalogue also gives a page of hints on the use of these drills.

Thermit Welding.—The Goldschmit Thermit Co., New York, is distributing an illustrated folder describing the process of welding rail joints with thermit. The folder gives the weight of the outfit, materials needed, and the number of men in the welding gang and their duties.

Railway Motors.—Bulletin No. 4,474 of the General Electric Co., New York, illustrates and describes the GE-76 railway motor. This motor is rated at 160 h.p. running under 550 volts pressure. Efficiency curves are given of four types of the motor.

Railroad Shops.—Bulletin No. 21 sent out by D. C. Newman Collins, M. Am. Soc. C. E., Consulting Engineer and Architect, New York, is a small pamphlet illustrated with half a dozen sketch plans and half-tones of railroad shops.

Manufacturing and Business.

The Paris & Orleans Railway, France, has specified Falls hollow staybolt iron for the 20 DeGlehn compound locomotives now being built by the Baldwin Locomotive Works.

The St. Louis Frog & Switch Co., St. Louis, Mo., has completed its plant for the manufacture of frogs, switches, switch-stands and special track work for steam and electric railroads. The plant is at 6500 Easton avenue, on the West Belt of the Terminal Railroad, thereby having connection with all St. Louis railroads.

The Mummert, Wolf & Dixon Co., Hanover, Pa., has lately completed a new modern pattern shop; individual motor drive is used. The company has also erected a new machine shop and are equipping it with new machinery to build their "Plurality Die" bolt cutter, and also a revolving oil-stone for sharpening edged tools.

The Danville Car Co., Danville, Ill., has received a large order for equipment from the Illinois Traction System. The contract includes twenty 34-ft. interurban cars, ten 46-ft. interurban cars, 20 express trailers, 12 new cars for the Danville city lines, and six electric locomotives. The contract amounts to about $200,000.

At the annual election of the East St. Louis Locomotive & Machine Shop Company, East St. Louis, Ill., the following directors were chosen: M. M. Stephens, George W. Allen, C. H. Huff, H. D. Cleveland, Thomas M. Gallagher and G. Gallagher. The officers elected are: M. M. Stephens, President; George W. Allen, Vice-President and Treasurer; C. H. Huff, Vice-President and General Manager; H. D. Cleveland, Secretary.

Iron and Steel.

The Bessemer & Lake Erie is reported to have ordered 120,000 steel ties from the Carnegie Steel Company.

The Kansas City, Mexico & Orient has ordered 40,000 tons of rails from the United States Steel Corporation, delivery to begin in March.

The following orders for rails have been given to the Lackawanna Steel Co.: Manila Railway, 10,000 tons; Bolivia Railway, 6,000 tons; Atlantic Coast Line, 10,000 tons, and Lehigh Valley, 2,000 tons.

The Central of New Jersey recently bought a large amount of steel for bridges from the Fort Pitt Bridge Company, of Sharon, Pa., and the Boston Elevated has given an additional order to the same company for a large amount of bridge steel.

The Pennsylvania has ordered 5,000 tons of fabricated steel for bridges from the Pennsylvania Steel Company and the McClintic-Marshall Construction Company. The New York, New Haven & Hartford is reported to be in the market for about 1,800 tons, and the Erie for 2,500 tons of bridge material.

The New York City Railway (Metropolitan) has recently given contracts for 3,000 tons of rails. Other small orders have been let aggregating about 5,000 tons for electric lines. Negotiations are under way for an aggregate of about 47,000 tons of rails for domestic use, and for export to Alaska, the Philippines and to Japan.

OBITUARY NOTICES.

W. A. Howett, formerly local attorney at Chicago for the Illinois Central, died in St. Louis on February 13. Mr. Howett resigned his position with the Illinois Central July 1, 1905, on account of ill health and had been in a sanitarium since that time. He was 56 years old. Before going to Chicago he represented the Illinois Central locally at Hillsboro, Ill., where he practiced law for a number of years. He was appointed local attorney at Chicago for the road, in charge of trial work, in 1897, and held the position until failing health compelled him to give it up.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies, see advertising page 24.)

Canadian Society of Civil Engineers.

At a meeting of this society Feb. 14, two papers were read: "An Investigation on the Value of the Indentation Test for Steel Rails," by H. K. Dutcher, and the "Victoria Bridge, Crossing Bear River, Annapolis and Digby Counties, Nova Scotia," by J. Lorn Allan.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Colombian Pacific.—E. H. Mason has been elected President and General Manager, with office at Buenaventura, Republic of Colombia, S. A.

Colorado Southern, New Orleans & Pacific.—A. J. Davidson, President of the St. Louis & San Francisco, has been elected also President of the C. S., N. O. & P., succeeding C. C. Cordill. G. A. Clark, General Manager, has been elected Vice-President.

Delaware, Lackawanna & Western.—W. H. Moore, Chairman of the Finance Committee of the Rock Island Company, has been elected a director of the D., L. & W., succeeding Henry Graves, deceased.

Detroit, Toledo & Ironton.—See Mississippi Central.

Illinois, Iowa & Minnesota.—B. H. Harris, Traffic Manager, has been elected also Vice-President.

Mississippi Central.—W. L. Greenhalgh, formerly Assistant Treasurer of the Detroit, Toledo & Ironton, has been appointed Auditor of the Mississippi Central.

Missouri, Kansas & Texas.—C. Haile, Traffic Manager, has been elected Vice-President in charge of traffic, with office at St. Louis, Mo.

Mobile & Ohio.—See New Orleans Terminal.

New Orleans & North Eastern.—See New Orleans Terminal.

New Orleans Terminal.—C. C. Harvey, President of the New Orleans & North Eastern, has been elected also President of the New Orleans Terminal, succeeding L. S. Berg, resigned. A. J. Davidson, President of the St. Louis & San Francisco, has been elected also Vice-President of the New Orleans Terminal. E. L. Russell, Vice-President of the Mobile & Ohio, has been elected also Second Vice-President of the New Orleans Terminal.

New York State Railroad Commission.—George W. Aldridge has been elected Acting Chairman, succeeding Col. G. W. Dunn, resigned.

Rock Island Company.—See Delaware, Lackawanna & Western.

St. Louis & San Francisco.—See Colorado Southern, New Orleans & Pacific; also New Orleans Terminal.

Operating Officers.

Atlantic Coast Line.—Morton Riddle, General Superintendent of the Second division, has been appointed General Superintendent of the Third division, with office at Jacksonville, Fla., succeeding H. A. Ford, assigned to other duties. J. N. Brand, Superintendent of Transportation of the Second division, succeeds Mr. Riddle, with office at Savannah. E. R. Wooten, Superintendent at Richmond, Va., succeeds Mr. Brand. E. Phenneger, Superintendent at Wilmington, N. C., succeeds Mr. Wooten, with office at Richmond, Va. J. C. Murchison succeeds Mr. Phenneger.

Baltimore & Ohio.—L. G. Curtis, Engineer of the Chicago division, has been appointed Assistant Superintendent of that division.

Baltimore & Ohio Southwestern.—See Peoria & Pekin Terminal.

Canadian Pacific.—George Hodge, chief clerk to D. McNicoll, Vice-President, has been appointed Superintendent of Terminals at Montreal.

Chesapeake & Ohio.—The authority of E. P. Goodwin, Superintendent of the Cincinnati division, has been extended over the Kentucky division on account of the ill health of H. C. Boughton.

Chicago & Alton.—W. L. Derr, Superintendent of the Hartford division of the New York, New Haven & Hartford, has been appointed Superintendent of the Chicago & Alton at Bloomington, Ill., succeeding E. Ryder, resigned to go to the Chicago, Indiana & Southern.

International & Great Northern.—E. E. Johnson, agent at Mart, Tex., has been appointed Assistant Superintendent of the Fort Worth division, with office at Mart, succeeding M. H. Trice, promoted.

Mexican Central.—E. E. Styner, General Manager, has resigned.

Missouri, Kansas & Texas.—The office of Trainmaster at Sedalia, Mo., has been abolished, O. F. Fowler having been reappointed chief despatcher at that place.

Missouri Pacific.—J. F. Murphy, Trainmaster at Coffeyville, Kan., has been appointed Superintendent at Wynne, Ark., succeeding H. L. Hungerford, resigned.

New York, New Haven & Hartford.—P. T. Litchfield, chief clerk to the Superintendent of the Plymouth division, has been appointed Assistant Superintendent of that division, with office at Boston, Mass.

See Chicago & Alton.

Peoria & Pekin Terminal.—H. G. Kruse, Trainmaster of the Baltimore & Ohio Southwestern at Washington, Ind., has been appointed Superintendent of the Peoria & Pekin Terminal.

Seaboard Air Line.—T. O. Cole, Car Service Agent, has resigned and the office has been abolished. H. W. Stanley, Superintendent of the Fourth division, has been appointed to the new office of Superintendent of Transportation, with office at Portsmouth, Va. W. A. Witt, Trainmaster at Richmond, Va., succeeds Mr. Stanley, with office at Jacksonville, Fla.

Traffic Officers.

Atlanta & West Point.—J. A. Higgins has been appointed Assistant General Passenger Agent.

Bangor & Aroostook.—Charles Calkins has been appointed General Agent at Stockton Harbor, Me., succeeding G. M. Houghton, promoted.

Canadian Pacific.—J. Halstead has been appointed Assistant General Freight Agent at Calgary, Alb., succeeding H. H. Abbott. W. M. Kirkpatrick has been appointed General Freight Agent at St. John, N. B., succeeding J. N. Sutherland, retired.

Chicago & North-Western.—C. H. Knapp, Assistant General Freight Agent at Chicago, will retire on a pension on March 1. H. C. Cheyney, General Agent at New York, has been appointed Assistant General Freight Agent in charge of local traffic in Wisconsin and Michigan, with office at Chicago. M. J. Golden, traveling agent at Sioux City, Iowa, has been appointed Assistant General Freight Agent in charge of local traffic in Iowa, with office at Chicago. R. M. Johnson, General Agent at Philadelphia, Pa., succeeds Mr. Cheyney at New York. A. L. Armstrong, traveling agent at Cleveland, Ohio, succeeds Mr. Johnson.

National of Mexico.—E. G. Wuerpel has been appointed General Agent at Vera Cruz, succeeding L. R. Gordon, deceased.

Tonopah & Tidewater.—W. M. Jacobsen has been appointed General Agent at Chicago, Ill.

Trinity & Brazos Valley.—D. C. MacWatters, General Passenger Agent, has resigned to go into other business.

Wisconsin & Northern.—Albert Trathen, formerly contracting agent of the Copper Range Railroad, has been appointed General Freight and Passenger Agent of the Wisconsin & Northern, with office at Oshkosh, Wis.

Engineering and Rolling Stock Officers.

Baltimore & Ohio.—See Baltimore & Ohio under Operating Officers.

Bessemer & Lake Erie.—H. H. Harman, Acting Engineer of Bridges, has been appointed Engineer of Bridges, with office at Greenville, Pa.

Erie.—R. B. Watson has been appointed Engineer of Tests, succeeding J. G. Platt, resigned to go to another company.

Georges Creek & Cumberland.—J. Q. Barlow, Chief Engineer of the Western Maryland, has been appointed also Chief Engineer of the Georges Creek & Cumberland.

Louisville & Nashville.—C. Gifford, Master Mechanic at Montgomery, Ala., has been appointed Master Mechanic at Mobile, Ala., succeeding H. M. Minto, resigned. D. D. Briggs succeeds Mr. Gifford.

Pennsylvania Lines West.—H. E. Culbertson, Engineer of Maintenance at Cleveland, Ohio, who has been on leave of absence for several months on account of ill health, has resigned to go into other business.

Western Maryland.—See Georges Creek & Cumberland.

Purchasing Agents.

Norfolk & Southern.—W. R. Burrows, Purchasing Agent, has resigned to go into other business. H. W. Davies, chief traveling auditor of the Atlantic & North Carolina division, succeeds Mr. Burrows.

LOCOMOTIVE BUILDING.

The South & Western is reported to have ordered 120 locomotives.

The Ocean Shore, now under construction, is in the market for locomotives.

The Norfolk & Western is reported to have ordered 25 more locomotives.

The Terminal R. R. Association of St. Louis has recommended the purchase of 12 switching locomotives.

The Fort Worth & Denver City is reported to have ordered two passenger and three switching locomotives.

The Canadian Northern, it is reported, has ordered fifteen 10-wheel locomotives from the Canada Foundry Co.

The Chicago, Burlington & Quincy is reported to have ordered 75 freight and 15 additional passenger locomotives.

The Baton Rouge, Hammond & Eastern, it is reported, will order this month 30 locomotives. Sol Wexler, New Orleans, is Purchasing Agent.

The Shawinigan Falls Terminal, Shawinigan Falls, Que., has ordered one 600-h.p. electric locomotive from the Canadian General Electric Company.

The Seaboard Air Line, it is reported, has ordered 25 locomotives from the American Locomotive Co. and 25 locomotives from the Baldwin Locomotive Works.

The Louisville & Nashville, it is reported, has ordered 20 consolidation and 10 switching locomotives from the Rogers Locomotive Works of the American Locomotive Co.

The Erie, as reported in our issue of February 15, has ordered 35 simple consolidation (2-8-0) type locomotives from the American Locomotive Company for May, June and July, 1907, delivery. Specifications are as follows:

Weight on drivers	183,000 lbs.
Total weight	202,000 "
Diameter of cylinders	22 in.
Stroke of pistons	32 "
Diameter of drivers	62 "
Type of boiler	Straight top
Working steam pressure	200 lbs.
Heating surface, total	3,353 sq. ft.
Tubes—number	380
" material	Charcoal iron
" outside diameter	2 in.
" length	16 ft.
Firebox, length	104 in.
" width	75 "
" material	Steel
Grate area	54.2 sq. ft.
Tank capacity	7,000 gals.
Coal capacity	14 tons

The Des Moines, Iowa Falls & Northern has ordered three simple mogul (2-6-0) locomotives from the Baldwin Locomotive Works, for July delivery. The specifications are as follows:

General Dimensions.

Type of locomotive	Mogul
Weight, total	140,000 lbs.
Weight on drivers	122,000 " "
Diameter of drivers	63 in.
Cylinders	19 in. x 26 in.
Type of boiler	Extended wagon top
Boiler, working steam pressure	200 lbs.
" number of tubes	280
" diameter of tubes	2 in.
" length of tubes	11 ft. 6 in.
Firebox, length	96 3-16 "
" width	41⅜ "
" grate area	27 sq. ft.
Heating surface, total	1,815 "
Tank capacity	5,000 gals.
Coal capacity	12 tons

Special Equipment.

Air brakes	Westinghouse
Bell ringer	Gollmar
Couplers	Munton
Injector	Simplex
Piston rod packings	United States
Valve rod packings	United States
Safety valve	Coale
Sanding devices	Leach
Sight-feed lubricators	Nathan Bull's-eye
Springs	Pittsburg Spring & Steel Co.
Steam heat equipment	Gould
Tires—Driving wheel	Midvale
Tires—Truck wheel	Midvale

The Indianapolis Union has ordered three simple six-wheel switching locomotives for April or May delivery from the American Locomotive Company. Specifications as follows:

General Dimensions.

Weight, total	154,000 lbs.
Diameter of drivers	57 in.
Cylinders	21 x 28 in.
Boiler, type	Straight top
" working steam pressure	180 lbs
" number of tubes	219
" material, tubes	Detroit seamless steel
" diameter, tubes	2 in.
" length, tubes	16 ft.
Firebox, length	72⅛ in
" width	65¼ "
Grate area	32 sq. ft.
Heating surface, total	2,324 sq. ft.
Tank capacity	5,100 gals.
Coal capacity	7½ tons

Special Equipment.

Air brakes	Westinghouse, American
Bell ringer	Gollmar
Boiler lagging	Keasbey & Mattison
Brake-beams	Damascus
Couplers	Melrose
Headlights	Schroeder
Injector	Ohio
Journal bearings	Streeter
Piston rod packings	United States Metallic
Valve rod packings	United States Metallic
Safety valve	Consolidated
Sanding devices	Leach
Sight-feed lubricators	Chicago
Springs	Pittsburg Spring & Steel Company
Tires—Driving wheel	Midvale

The Illinois Central has ordered 35 simple consolidation, eight simple Pacific and seven simple six-wheel locomotives for August delivery from the American Locomotive Works. Specifications are as follows:

General Dimensions.

Types of locomotives	Consolidation.	Pacific.
Weight, total	203,500 lbs.	224,000 lbs.
Weight on drivers	181,000 lbs.	140,500 lbs.
Diameter, drivers	63 in.	75 in.
Cylinders	22 in. x 30 in.	22½ in. x 26 in.
Boiler, type	Radial stayed.	
" wrkg stm pressure.	200 lbs.	210 lbs.
Tubes: number	344	302
" diameter	2 in.	2 in.
" length	15 ft. 6 in.	20 ft.
Firebox, length	107 in.	102 in.
" width	67¼ "	717 "
Grate area	50 sq. ft.	51 sq. ft.
Heating surface, total	2,946 sq. ft.	3,332 sq. ft.
Tank capacity	7,000 gals.	7,000 gals.
Coal capacity	15 tons.	15 tons.

Type of locomotive	Switching
Weight, total	138,500 lbs.
Diameter of drivers	51 in.
Cylinders	19 x 26 in.
Boiler, type	Radial stayed; straight top
Boiler, working steam pressure	200 lbs.
Tubes, number	241
" diameter	2 in.
" length	15 ft. 6 in.
Firebox, length	60 "
Firebox, width	68 "
Grate area	27 sq. ft.
Heating surface, total	1,971 sq. ft.
Tank capacity	4,500 gals.
Coal capacity	6½ tons.

The Great Northern has ordered 10 simple six-wheel switching (0-6-0) locomotives from the Baldwin Locomotive Works in addition to the 140 locomotives reported in the *Railroad Gazette* January 4. The specifications for the switching locomotives are as follows:

General Dimensions.

Type of locomotive	Switching
Weight, total	135,000 lbs.
Diameter of drivers	49 in.
Cylinders	19 in. x 26 in.
Boiler type	Belpaire
" working steam pressure	200 lbs.
" number of tubes	291
" material of tubes	Steel
" diameter of tubes	2 in.
" length of tubes	11 ft. 3 in.
Firebox, length	96 in.
" width	40 in.
" material	Steel
" grate area	27.22 sq. ft.
Heating surface, total	1,873.0 "
Tank capacity	4,000 gals.
Coal capacity	6 tons

Special Equipment.

Bell ringer	Gollmar
Boiler lagging	Magnesia
Brake-beams	Damascus
Couplers	Tower
Headlights	Adams & Westlake
Injector	Ohio
Journal bearings	Great Northern standard
Piston rod packings	Great Northern standard
Valve rod packings	Great Northern standard
Safety valve	Ashton
Sanding devices	Leach
Sight-feed lubricators	Chicago
Springs	Simplex
Steam gages	Ashton
Tires—Driving wheel	Standard
Tires—Truck wheel	Standard

CAR BUILDING.

The Fort Worth & Denver City is reported to have ordered 1,000 box cars.

The Bluff City Lumber Co., Pine Bluff, Ark., is reported to have ordered 10 cars.

C. E. Slade, Orange, Tex., has ordered 15 logging cars from the Orange Iron Works.

The Walworth & Neville Manufacturing Co., Chicago, is hearing on buying 10 box cars.

The Georgia Railway & Electric Co., Atlanta, Ga., is reported to have ordered 16 cars.

The Mississippi Central has ordered 100 box cars from the American Car & Foundry Co.

The Ludington & Northern has ordered one coach from the Hicks Locomotive & Car Works.

The Chicago, Milwaukee & St. Paul will build 3,000 steel cars; it will buy the frames and underframes.

The South & Western is reported to have ordered 5,000 hopper bottom coal cars and 25 passenger coaches.

The Canadian Northern has ordered 20 refrigerator cars of 60,000 lbs. capacity from Rhodes, Curry & Co.

The Philadelphia & Reading has ordered 1,000 box cars of 100,000 lbs. capacity from the Cambria Steel Co.

The United Railways & Electric Co., of Baltimore, has ordered 40 semi-convertible cars from the J. G. Brill Co.

The Western Live Stock Express, Chicago, it is reported, has ordered 100 36-ft. stock cars from the Ryan Car Co.

The New York Central & Hudson River, it is reported, has ordered 50 automobile cars and 20 special horse cars.

The W. E. Caldwell Co., Louisville, Ky., is in the market for 10 or 12 second-hand standard gage flat or logging cars.

The Consolidated Paper & Milling Co., Pittsburg, Pa., has ordered a number of demonstrating cars from the American Car & Foundry Co.

The Boise Valley Construction Co., Boise, Idaho, has ordered two 30-ft. and two 32-ft. semi-convertible electric cars from the American Car Co.

The Temiskaming & Northern Ontario has ordered 100 wooden freight cars from the Rathbun Co. and 100 steel ore cars from the Montreal Construction Co.

The Bolivia Railway has ordered fifty 60,000-lb. flat cars and 20 stock cars from the Middletown Car Works. These cars will have King patent steel underframes.

The Grand Trunk has ordered 500 flat cars of 60,000 lbs. capacity from the Hicks Locomotive & Car Works, and is again reported to be asking prices on 10 passenger coaches.

The Chesterfield & Lancaster, which is now nearly completed, is in the market for rail motor cars for passenger traffic. Charles H. Scott, Cheraw, S. C., is Chief Engineer.

The Spokane & Inland has ordered 250 box cars of 80,000 lbs. capacity from the Seattle Car Company. These cars will measure 40 ft. long, and are for delivery before July 31.

The Long-Bell Lumber Co., Kansas City, Mo., is reported to have ordered 175 steel truck logging cars and six steel tank cars, all of 80,000 lbs. capacity, from the Beaumont Iron Works.

The Interoceanic of Mexico, as reported in our issue of Feb. 1, has ordered one combination first and second class passenger coach and 15 flat cars of 80,000 lbs. capacity from the Mexican Car & Foundry Co.

The Baton Rouge, Hammond & Eastern, it is reported, will place orders this month for 1,000 40-ft. gondola cars, 500 flat cars, 500 box cars and 40 passenger coaches. Sol Wexler, New Orleans, is Purchasing Agent.

The Ocean Shore, now under construction, is in the market for freight equipment, and has ordered some electric passenger coaches. The coaches will be fitted with General Electric Company's electric equipment, Baldwin trucks and Westinghouse air-brakes.

The Charles E. Sholes Company has ordered two tank cars of 80,000 lbs. capacity from the Bettendorf Axle Company for April delivery. These cars will be 25 ft. 7 in. long and 9 ft. wide, over all. The special equipment includes:

Bolsters	Bettendorf
Brake-beams	Damascus
Brake-shoes	Walsh
Brasses	Camel
Couplers	Major
Dust guards	Harrison
Trucks	Bettendorf

The Delaware, Lackawanna & Western, as reported in the *Railroad Gazette* of February 8, has ordered from the Railway Auto Car Company one motor inspection car for August, 1907, delivery. The machinery will be built by the Railway Auto Car Company, and the car body by the American Car & Foundry Company. The car will weigh 70,000 lbs., and will measure 42 ft. long, 10 ft. wide and

13 ft. high, over all. The body and underframe will be of steel. The special equipment includes:

Brakes	Westinghouse high-speed
Couplers	Gould
Draft rigging	Gould
Light	Commercial Acetylene
Trucks	Railway Auto Car Co.
Vestibules	Open observation vestibule at rear

The Boston & Maine, as reported in our issue of February 8, has ordered 1,000 box cars of 60,000 lbs. capacity from the Pressed Steel Car Company for June, 1907, delivery. These cars will weigh 32,700 lbs., and will measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements, and 36 ft. 9¼ in. long, over sheathing; 9 ft. 7 in. wide and 12 ft. 6¾ in. high, over eaves. Bodies and underframes will be of wood. The special equipment includes:

Axles	Steel
Bolsters	Pressed Steel
Brake-beams	Buffalo Brake-beam Co.
Brake-shoes	Steel back
Brakes	Westinghouse
Brasses	Magnus Metal Co.
Couplers	Climax
Doors	Sheathing doors
Draft rigging	Miner tandem
Dust guards	Flexible
Journal boxes	Gould
Paint	R. & M. standard freight
Roofs	Murphy
Springs	Railway Steel-Spring Co.
Trucks	Fox pedestal

The Missouri & North Arkansas has ordered four first class passenger, one combination passenger and mail and one baggage car from the Pullman Co., for July delivery. All of these cars will be 60 ft. long and 9 ft. 8 in. wide over sills. The special equipment for all includes:

Axles	Pullman
Bolsters	Commonwealth
Brake-beams	National-Hollow
Brake-shoes	Christie
Brakes	Westinghouse
Brasses	Pullman standard
Couplers	Tower
Curtain fixtures (for first-class and combination cars)	Forsyth
Curtain material (first-class and combination cars)	Pantasote
Door fastenings	Pullman standard
Doors	Pullman standard
Draft rigging	Pullman standard
Dust guards	Pullman standard
Heating system	Safety
Journal boxes	McCord
Light	Pintsch
Paint	Pullman standard
Platforms	Pullman standard
Roofs	Pullman standard
Springs	Union Spring & Mfg. Co.
Trucks	Pullman standard
Vestibules	Pullman standard
Wheels	Pullman standard

RAILROAD STRUCTURES.

EL RENO, OKLA.—Residents of this place have raised a bonus of $50,000 for the Chicago, Rock Island & Pacific on condition that this place is made the principal Oklahoma division terminal and a roundhouse and shops be put up.

HAZLETON, PA.—The Lehigh Valley will begin work about April 1 on a brick passenger station 32 ft. x 110 ft., to be three stories high.

HUTCHINSON, KAN.—Plans, it is said, have been made by the Atchison, Topeka & Santa Fe to put up a freight house and warehouse here at a cost of about $40,000.

ST. PAUL, MINN.—The Minneapolis, St. Paul & Sault Ste. Marie has secured ground in the business section, and is planning to put up a passenger station, also to establish freight terminals.

SCRANTON, PA.—The Scranton Railway Company, it is said, will spend $300,000 putting up shops here.

TAMPA, FLA.—The Seaboard Air Line, it is said, will spend a large amount of money for improvements in seaport cities of Georgia and Florida. At Tampa it is proposed to build a bridge to connect the main line with Grassy Island, and make that place an export port for Central and South America. At Jacksonville, the company is building a 1,200-car yard, on which track laying is to be started shortly; a machine shop to cost $550,000 is also to be built. At Fernandina, Fla., the government has recently made an appropriation to deepen the channel, and it is said that the Seaboard Air Line has bought 1,400 ft. more wharf front and that this place will be used for coastwise lumber shipments.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BLOOMINGTON BELT TRACTION.—Incorporated in Illinois with $100,000 capital, and with office at Bloomington, to build a line from that place to Champaign, to form part of the McKinley Syndicate lines. W. B. McKinley, Champaign, Ill.; Peter W. Moore, L. B. Thomas, E. D. Riddle and H. C. Larch, are directors.

BUFFALO, ROCHESTER & PITTSBURG.—Plans, it is said, are under way to complete the double track from Punxsutawney, Pa., to Rochester, N. Y. The estimated cost of the work is $1,500,000. Last year the company spent a large amount of money laying second track on the main line, and there remain about 11 miles to be done from Brockwayville, Pa., north to Carmen. A branch is also projected from near Juneau, Pa., to Rossiter, to develop new coal mines. Several spurs to mines in South Indiana County are also under consideration.

CANADIAN NORTHERN QUEBEC.—An officer writes that this company, which started work last year on extensions from Garneau Junction, Que., to Quebec, 84 miles, has given contracts to O'Brien & Mullarkey, of Montreal, for the work. Grading has been completed from Garneau to St. Casimir, 35 miles. Contracts have also been given to the same company for building from St. Jerome to Montfort, 15 miles; grading completed. No track laid on any of the above.

CENTRAL CALIFORNIA TRACTION.—Building from Stockton, Cal., north via Lodi, Galt and Elk Grove to Sacramento, 50 miles. Contracts let to Moring Bros., of Stockton, to build from Stockton to Lodi, 16 miles. Four miles of track laid. An extension is projected from Stockton southeast to Modesto, an additional 45 miles. R. S. Masson, Stockton, is Chief Engineer.

DELAWARE & HUDSON.—The Northern Coal & Iron Company, which is controlled by the Delaware & Hudson, has secured considerable land in Plymouth Township to be used in the construction of its new line to a connection with the Pennsylvania. The line is to be built via Plymouth Junction, Larksville, Edwardsville, Dorranceton, Port Blanchard and Sebastopol connecting with the main line of the D. & H. near Smithville.

DENVER CITY TRAMWAY.—This company proposes to issue stock to secure funds to lay 70 miles of track to extend and improve two viaducts and to build new shops and car barns. David H. Moffat, President of the Denver, North-Western & Pacific, and William G. Evans are interested.

EL DORADO & WESSON.—This company is building from El Dorado, Ark., to Wesson, 10 miles. Contracts have been let to A. J. Seymour for seven miles, and to James Ulmer for three miles. Grading has been completed for seven miles, and track laying is to be started in March. James Harrington, Chief Engineer, El Dorado, Ark.

ERIE.—This company has incorporated the Erie Terminal Railroad to carry out some of the improvements now under way on the New York division.

The Erie is reported to be back of the Elmira, Corning & Waverly, an electric line, which is building from Waverly, N. Y., to Elmira, on the right of way of the Erie, and to be negotiating with G. T. Rogers, of Binghamton, N. Y., who recently secured the Waverly, Sayre & Athens Traction Company to buy that line and extend it to Binghamton. This would give the Erie an electric system from Corning to Waverly and Binghamton.

ERIE TERMINAL.—See Erie.

GRAND RAPIDS TERMINAL BELT.—An officer writes that this company, which was incorporated last year to build a belt line around the city of Grand Rapids, Mich., will begin grading work this spring. The line has been located from the Lake Shore & Michigan Southern to the Michigan Central, 3⅛ miles. E. H. Christ, Chief Engineer, Grand Rapids, Mich.

GREAT NORTHERN.—An officer of the Vancouver, Victoria & Eastern, under construction from Midway, B. C., west via Molson and Oroville, Wash., and Keremeos and Hedley, B. C., to Princeton, B. C., writes that grading has been completed from Midway to Keremeos, 96 miles, and track laid from Midway to Oroville, Wash., 56 miles, also from Oroville to the crossing of the Semilkameen river, eight miles. Contracts are soon to be let for extending the line from Keremeos to Princeton, 45 miles.

GREEN BAY, OSHKOSH, MADISON & SOUTH-WESTERN.—See Wisconsin & Northern.

ITHACA & SENECA FALLS INTERURBAN.—Incorporated in New York with $1,000,000 capital to build from Ithaca, N. Y., north to Seneca Falls, with branches from Willard to Ovid, and from Trumansburg to Mecklenburg, a total of 52½ miles. J. N. Hammond and T. J. Cary, Seneca Falls, and J. Rothschild, Ithaca, are Directors.

KANSAS CITY SOUTHERN.—To secure easier grades and curves this company is planning to build a cut-off from Siloam Springs, Ark., along the Arkansas-Indian Territory boundary line, south to Cherokee Junction, Ind. T., thence paralleling the St. Louis, Iron Mountain & Southern to Fort Smith, and south through Sebastian and Scott Counties, joining the old main line near Mena, Ark., in all about 120 miles.

MISSOURI PACIFIC.—This company is now laying, on the St. Louis, Iron Mountain & Southern, second track from McAlmont, Ark., to Little Rock, seven miles. About 15,000 cu. yds. of fill remains to be placed. Five miles of track laid.

NAPA & VACA VALLEY.—Incorporated in California to build a line from Vallejo, Cal., via Napa Junction, Soscol and Cordelia to

Vacaville, 30 miles. E. H. Winship, H. M. Meacham and D. A. Dunlap, of Napa, are interested.

NEW JERSEY SHORT LINE (ELECTRIC).—An officer writes that this company, which is building from Milltown, N. J., to Elizabeth, 19 miles, has given contracts to the Schuylkill Stone Company, of Philadelphia, Pa., for building from Metuchen to Elizabeth, 10 miles. Grading completed for about 50 per cent. of the way, but no track laid. Additional contracts are shortly to be let. Richard I. D. Ashbridge, Weagel Building, New Brunswick, N. J., Chief Engineer.

NEW YORK CONNECTING.—See Pennsylvania.

NEW YORK NORTHERN (ELECTRIC).—Organized in Watertown, N. Y., to build from that place south to Oswego, about 70 miles, where connection is to be made with the New York, Ontario & Western and the Delaware, Lackawanna & Western. F. P. Shines is President.

OREGON EASTERN.—See Southern Pacific.

OREGON ELECTRIC.—An officer writes that contracts have been given to W. S. Barstow & Co., of New York and Portland, for building this proposed line from Portland, Ore., to Salem, 50 miles. Eight miles already built. The work includes a bridge over the Willamette river, 800 ft. long.

OREGON SHORT LINE.—This company is reported to be planning a 30-mile extension from Kemmerer, Wyo., north to coal fields.

PENNSYLVANIA.—The Board of Estimate and Apportionment of New York City has approved the application of the New York Connecting Railroad for a franchise. This is to permit the joining of the Pennsylvania and New York, New Haven & Hartford by a line running from the Long Island Railroad terminal yards in Long Island City to the Harlem River Terminal by way of bridges to be built over the East river and Ward's and Randall's islands. For nearly two years the Board of Estimate refused to approve the franchise on the ground that the conditions made by the Rapid Transit Commission were not sufficiently favorable to the city. The amended terms differ only slightly from those originally fixed by the commission. After approving this franchise, the Board granted the application of the company to lay out the Sunnyside freight yards in Long Island City, and authorized the closing of 52 streets within the property purchased by the company for this freight terminal. Contracts will shortly be let, and the work pushed to completion as soon as the legal formalities have been finished. (See *Railroad Gazette*, December 28, 1906; page 570.)

PITTSBURG, SUMMERVILLE & CLARION.—The Millcreek branch is being extended from Millcreek, Pa., for 10 miles by the A. Cook's Sons Company, to connect with its lumber properties. Three miles have been built.

QUEBEC & JAMES BAY.—See Quebec & Lake St. John.

QUEBEC & LAKE ST. JOHN.—This company, which is building a branch from La Tuque Junction, Que., to La Tuque Falls, 40 miles, has completed grading on 35 miles, and has track laid for 30 miles. Joseph Paquet, of Levis, Que., is the contractor.

Contracts have been given to Edward Conway, of Quebec, for building the Gosford branch, from Valcartier Station, Que., to Riviere aux Pius, six miles. Track laid for five miles.

Under the name of the Quebec & James Bay surveys have been made for a line from Roberval, Que., to Chute a L'Ours, 30 miles.

ST. LOUIS & OKLAHOMA SOUTHERN.—Incorporated in Missouri with $200,000 capital and office at Pineville, to build from Pineville, McDonald County, Mo., to a point in the southeastern corner of that county, about 20 miles. I. E. Sturges, J. N. Christensen, O. St. John, A. W. Noel and C. D. Dennett, of Pineville, are interested.

ST. LOUIS, BARTLESVILLE & PACIFIC.—Incorporated in Oklahoma with $7,200,000 capital and office at Ponca City, to build from Joplin, Mo., west across the Indian Territory and Oklahoma to Pond Creek, Okla., about 240 miles. The incorporators are: G. B. Keller, J. L. Overlees, F. M. Overlees, J. J. Curl and H. J. Holm, of Bartlesville; M. Cunyon and W. L. Barnum, of Ponca City; C. Steckler and J. W. Bird, of Pond Creek.

SAN JUAN DE OAXACA.—An officer writes that this company, which is building from San Pablo Zimatlan, state of Oaxaca, Mex., to Taviche, about 17 miles, has completed all of the line except about two miles. The work includes two large bridges. Houston & Buckner, Oaxaca, contractors. William Waters, Ocotlan, Chief Engineer.

SHREVEPORT NORTHEASTERN.—An officer writes that this company is building a line from Shreveport, La., northeast via Minden and Homer, La., and Eldorado, Ark., to Memphis, Tenn., 285 miles. Contracts let to the Northeastern Construction Company, of Homer and Shreveport, to build from Shreveport to Eldorado, 85 miles. Grading completed for 25 miles, and track laid for five miles. A. K. Clingman, Shreveport, La., President, and J. T. Hardeman, Minden, La., Chief Engineer.

SOUTHERN PACIFIC.—According to local reports, final plans for building the Oregon Eastern have been made. The survey runs east from Natron, Ore., up to the middle fork of the Willamette to Salt Creek, up that stream through the cascades via Odell Pass through Christmas Lake Valley, thence down the Malheur river to Ontario, about 320 miles.

STEPHENSVILLE, NORTH & SOUTH TEXAS.—Incorporated in Texas with $250,000 capital, and office at Stephensville, to build from Stephensville, in Erath County, south to Hamilton, in Hamilton County, about 35 miles. The incorporators include B. C. Cage, Marshall Ferguson and W. S. Watson, of Stephensville, and John Spurlin of Hamilton.

TEMISKAMING & NORTHERN ONTARIO.—Contracts have been let to McRae, Chandler & McNeil, of Quebec, at about $1,000,000 for extending this road to a junction with the Grand Trunk Pacific at a point about 112 miles north of Englehart. Track has been laid to McDougall's Chute, 54 miles north of Englehart, and the work called for in the contract is for about 58 miles. Contracts for 65,000 rails have been given to the Algoma Steel Company, of Sault Ste. Marie.

TEXAS ROADS.—In addition to the order recently issued by the Railroad Commission requiring the railroads to build a causeway across Galveston Bay, the Gulf, Colorado & Santa Fe, the Galveston, Harrisburg & San Antonio, the Galveston, Houston & Henderson, the Missouri, Kansas & Texas, the Great Northern, and the Galveston Wharf Company have been directed to increase their side tracks and spurs at least 25 per cent., and all these companies with the exception of the Galveston Wharf Company to increase the present platform facilities at Galveston 25 per cent., the work to be completed by August of this year. These improvements are to be made to expedite the handling of freight at Galveston, where present facilities are inadequate.

VANCOUVER, VICTORIA & EASTERN.—See Great Northern.

WABASH.—This company has opened its new connecting line to the Clairton, Pa., plant of the Carnegie Steel Co. This gives the Wabash access to the mills in the district along the Monongahela river above McKeesport, which it has been trying to secure for several years. Traffic arrangements have been made with the Pittsburg & Lake Erie by which the use of that company's spur tracks to various manufacturing works has been secured.

WESTERN PACIFIC.—This company has let contracts to the Utah Construction Company, of Ogden, Utah, for 110 miles in Utah, 107 miles in Nevada and 174 miles in California, and to E. B. & A. L. Stone, for 185 miles in California. Grading completed and 94 miles of track laid in Utah. Contracts are to be let in February for the remaining 326 miles in Nevada. In California 130 miles of grading are completed and 10 miles of track laid. There are now about 5,000 men at work at various points on the line. The work includes 48 tunnels aggregating 48,263 lineal feet.

WISCONSIN & NORTHERN.—An officer writes that this company, which is the successor of the Green Bay, Oshkosh, Madison & South-Western, is building from Menasha, Wis., via Appleton, Shawano, Gresham, Langlade and Crandon to a connection with the Minneapolis, St. Paul & Sault Ste. Marie in North Crandon, 125 miles. Contracts have been let to McDonnell, O'Connor & Co., of Shawano, for building from Gresham to Langlade, 25½ miles. The company has already built from Shawano to Neopit, 21 miles, and from Crandon to a connection with the Minneapolis, St. Paul & Sault Ste. Marie, seven miles. Grading has been completed from Gresham to Neopit, 11 miles, on the above contract; additional contracts are soon to be let. William Cambier, Oshkosh, Wis., is Chief Engineer.

WOLF, MEGANTIC & LOTBINIERE.—An officer writes that this company, chartered to build from Lime Ridge, Wolf County, Quebec, north to Quebec, about 100 miles, has secured the right of way. The Quebec Government has granted subsidies of 2,000 acres per mile for 60 miles, and the Dominion Government $3,200 per mile, not exceeding 50 miles. Negotiations are pending with the Lotbiniere & Megantic to build the line. W. H. Lamby, Inverness, Que., Secretary.

RAILROAD CORPORATION NEWS.

ALABAMA GREAT SOUTHERN.—See Birmingham Terminal Co.

BIRMINGHAM TERMINAL COMPANY.—This company has sold $1,500,000 4 per cent. bonds, being part of an authorized issue of $3,000,000; of the unissued remainder $500,000 is reserved for terminal improvements and is not to be issued until January 1, 1908, and $1,000,000 is reserved for additions, betterments and acquisitions, and is not to be issued until January 1, 1909, and then only with the consent of the following companies, which own the entire capital stock and guarantee the bonds: Illinois Central, Southern, Seaboard Air Line, St. Louis & San Francisco, Central of Georgia and Alabama Great Southern. These six companies agree to use the station now being built by the Birmingham Terminal Company at Birmingham, Ala., during the life of the bonds.

Central New England.—A committee for the protection of the minority holders of the common stock, preferred stock and general mortgage 5 per cent. income bonds of this company has been formed. It consists of T. C. Delavan, Charles Gregory and George F. Cummings. The object of the committee is to have the management pay interest on the bonds or else buy the bonds and stock at a price considerably above the present market value. The stock is held by a voting trust for 10 years from January, 1899, or until 4 per cent. interest is paid on the general mortgage bonds for two years. Since their issue in 1899, no interest has been paid on these bonds, which are junior to the $1,250,000 first mortgage 5 per cent. bonds. The New York, New Haven & Hartford acquired in February, 1904, $5,904,000 of the $7,250,000 general mortgage bonds, $2,963,300 of the $3,450,000 common stock and $2,696,100 of the $3,150,000 preferred stock. The Central New England operates 256 miles of road, including the Poughkeepie Bridge, which it owns.

Central of Georgia.—See Birmingham Terminal Co.

Colorado & Southern.—An initial dividend of 2 per cent. on the $8,500,000 4 per cent. non-cumulative second preferred stock has been declared payable April 1 to holders of record on March 16.

Delaware, Lackawanna & Western.—The annual report for the year ended December 31, 1906, issued February 19, shows gross earnings of $32,962,880, an increase of $1,011,817; net earnings $12,490,438, a decrease of $632,565. Freight earnings increased 12 per cent. and passenger earnings 13 per cent., while coal earnings decreased 8 per cent. Other income increased $560,000, but renewals and betterments, which are included in charges, increased $1,960,000; the surplus after dividends was $587,072, as compared with $2,698,428 at the end of the previous year.

Detroit, Jackson & Chicago (Electric).—See Detroit United.

Detroit United (Electric).—The Detroit, Jackson & Chicago, a holding company which recently took over the Detroit, Ypsilanti & Ann Arbor for the Detroit United, has made a mortgage for $4,000,000 to the Security Trust Company, Detroit, securing that amount of 5 per cent. bonds; of this amount, $595,000 are reserved for improvements and extensions, and the remainder is to go to holders of the D. Y. & A. A. securities as follows: $1,610,000 to retire outstanding bonds, $990,000 to retire the remaining bonds authorized, and $805,000 to be paid to stockholders. It is said that the D. Y. & A. A. will be completed from Jackson, Mich., to Chicago, about 200 miles.

Illinois Central.—Gross earnings for the six months ended December 31, 1906, were $27,959,998, an increase of $2,640,776; net earnings $8,030,387, an increase of $404,220.

See Birmingham Terminal Co.

Interborough Rapid Transit.—W. A. Read & Co., New York, and Lee Higginson & Co., Boston, have bought $10,000,000 three-year 5 per cent. notes dated March 1, 1907, and subject to call at 101 and interest on and after March 1, 1909. The proceeds, it is said, will be used to pay off the entire floating debt of the company, to pay for the extension of the subway under the East river to Brooklyn, and to pay for securities of the New York & Queens County, the Long Island Electric and the New York & Long Island Traction. The Interborough Rapid Transit already has outstanding $15,000,000 three-year notes due May 1, 1908.

Manila Electric Railroad & Lighting.—See Manila Suburban Railways Company.

Manila Suburban Railways Company.—This company has sold $500,000 5 per cent. first mortgage 40-year sinking fund bonds, being part of an authorized issue of $2,500,000, guaranteed principal and interest by the Manila Electric Railroad & Lighting Corporation. The Manila Suburban Railways Company has been organized to build and operate lines connecting with the lines of the Manila Electric Railroad & Lighting, which controls the street railways, light and power system of Manila.

Missouri & Kansas Interurban.—Swartwout & Appenzellar, New York, are offering for sale $500,000 first mortgage 5 per cent. 50-year bonds dated January 1, 1906. The St. Louis Union Trust Company is trustee and the interest for the first two years is guaranteed by a cash deposit. The road is 20 miles long, running from Kansas City, Mo., to Olathe. It is equipped with three Strang gasolene-electric motor cars, one steam locomotive and six other cars. It has $1,000,000 capital stock and the authorized bond issue is $600,000. The $500,000 bonds were sold to pay for the construction and equipment of the road, and the remaining $100,000 is reserved for additional terminals, equipment and other uses.

Missouri River & Northwestern.—This property has been put in the hands of a receiver. The company owns 35 miles of road from Rapid City, S. Dak., to Mystic, and has $1,000,000 capital stock and $700,000 outstanding bonds. It was opened in March, 1906.

New York, New Haven & Hartford.—This company has sold to Kuhn, Loeb & Co. $29,000,000 4 per cent. 15-year debentures. They will be placed in France, Germany and Holland through a syndicate of foreign bankers.

This company has bought through Kidder, Peabody & Co., Boston, a majority of the $1,500,000 stock of the Boston & Philadelphia Steamship Co., which operates seven steamers between Boston, Providence, Fall River and Philadelphia.

See Central New England.

Northern Pacific.—Estimated gross earnings for the month of January, 1907, were $4,139,559, a decrease of $416,555; freight earnings decreased $692,846, or 20 per cent., while passenger earnings increased $272,665, or 33 per cent.

Pennsylvania.—This company has sold to Kuhn, Loeb & Co. $60,000,000 three-year 5 per cent. notes. Of this amount, $50,000,000 are to retire the $50,000,000 Pennsylvania Company 4½ per cent. 18-month notes maturing November 1, 1907. The official announcement says that "the proceeds will meet all the requirements of the company this year for construction, expenditures and otherwise, including the New York terminal. It will not be necessary to use this year any of the stock of the company or any of its bonds which the stockholders have, as a wise precaution, been asked to authorize at the annual meeting to be held on March 12 next." The notes are secured by car trust notes, water bonds and other collateral.

See Philadelphia & Erie.

Philadelphia & Erie.—The stockholders at the annual meeting approved the agreement by which the common stock not already owned by the Pennsylvania may be exchanged for Pennsylvania stock. It was announced at the meeting that the Pennsylvania would not pay cash for any shares not exchanged. (Jan. 25, p. 130.)

Philadelphia & Reading.—Gross earnings for the six months ended December 31, 1906, were $21,042,118, an increase of $219,214; net earnings $8,187,380, a decrease of $696,644.

Pontiac, Oxford & Northern.—The Supreme Court has given a verdict for $186,000 in favor of this company in its suit against Hugh Porter, who was President of the road before it went into the hands of a receiver in March, 1905. Evidence was produced showing that President Porter had drawn the above amount from the company's funds, and had used it for purposes not connected with the company. The road runs from Pontiac, Mich., north to Caseville, on Saginaw Bay, 100 miles.

St. Louis & San Francisco.—The First National Bank of Chicago is offering the unsold part of $3,300,000 5 per cent. car trust notes maturing in semi-annual installments from July 1, 1907, to January 1, 1917. These notes are secured on 3,300 freight cars costing $3,732,000, and are guaranteed principal and interest by the American Car & Foundry Company, which built the cars.

See Birmingham Terminal Co.

Seaboard Air Line.—It is reported that this company is back of the North Carolina Terminal Company, which was recently incorporated and which has bought wharf property at Wilmington, N. C., including water frontage of something more than 290 ft. It is said that the Seaboard Air Line will establish a coaling station at that point.

See Birmingham Terminal Co.

Southern.—The New York Stock Exchange has listed $250,000 St. Louis division first mortgage 4 per cent. bonds of 1951, making $12,500,000 outstanding; $800,000 Memphis division first mortgage 5 per cent. bonds of 1996, making $6,583,000 outstanding, and $1,351,000 first consolidated mortgage 5 per cent. bonds of 1994, making $48,137,000 outstanding. The proceeds of the sale of the additional St. Louis division bonds were used mostly for the Jasper-French Lick extension; the new Memphis division bonds were issued to partially pay for the building of the line from Savannah to Chattanooga, Tenn.; of the new first consolidated bonds, $778,000 were for yards, stations, side tracks, equipment and water stations, and the remainder for the redemption of the bonds of subsidiary companies.

See Birmingham Terminal Co.

Tidewater.—The Tidewater Construction Company has been organized to complete this road and has sold $10,000,000 6 per cent. two-year notes to the Central Trust Company. The notes are endorsed by H. H. Rogers and secured on $20,000,000 authorized but unissued Tidewater Railway bonds and $10,000,000 other securities. The proceeds, it is said, are to pay for the completion of the road.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Three Resignations 261
- Causes of Pennsylvania and New York Central Derailments. 261
- State Commissions. 261
- Enginemen's Hours. 262
- Economics of Traffic Agreements. 262
- The Dangers of Speed. 263
- Train Accidents in January. 263
- Refunding Cash to Forgetful Commuters 264
- Delaware, Lackawanna & Western. 265
- New Publications 266

ILLUSTRATED:
- The New Union Station of the Gould Lines at Little Rock 268
- A New Form of Suspension for Contact Wires 273
- The Timmis Bogie Lead. 276
- Details of Pacific Locomotive for National Railroad of Mexico. 283

CONTRIBUTIONS:
- Remedies for Car Shortage 266

MISCELLANEOUS:
- Working Regulations for Boston & Maine Enginemen 267
- The New Canadian Sunday Law. 269
- The Harriman Investigation. 270
- Operating Features of the Chicago Freight Tunnels. 272
- Derailment of Pennsylvania Special—Report of Committee on the Cause. 272
- Results Under Electrification in England 276
- Government Report on the Block System. . 277
- Mileage of Railroad Worked by the Block System. 280
- Final Report of the Pennsylvania Railroad Special Investigating Committee. 281
- Simplon Tunnel (Note) 269

GENERAL NEWS SECTION:
- Notes 285
- Trade Catalogues 286
- Obituary 287
- Meetings and Announcements 287
- Elections and Appointments 287
- Locomotive Building 288
- Car Building 288
- Railroad Structures 289
- Railroad Construction 289
- Railroad Corporation News 290

VOL. XLII., No. 9. FRIDAY, MARCH 1, 1907.

The most recent turn in the wheel of Panama Canal administration is the rejection of the bids of private engineering firms to complete the work on a percentage basis, and the expressed determination of the Government that army engineers shall perform this work—which is as it should be. With this news comes the announcement that John F. Stevens has resigned as Chief Engineer of the canal, and that he will be succeeded by Major George W. Goethals, Corps of Engineers, U. S. A. It chances, therefore, that three chief officers of the canal have retired in succession, for private reasons. One, in retiring, was dismissed with warm praise and enthusiastic expressions of esteem; one, with dignified silence; one, with calumny and insult. In viewing these three cases, can the President and the Secretary of War show cause why they should not make public amends to John F. Wallace?

The Pennsylvania Railroad Company has shown its capacity for self-government by a quick and thorough investigation of the cause of the derailment of its 18-hour New York-Chicago express train at Mineral Point, Pa., on February 22. It has also done a public service, without precedent so far as we can recall, in making public the full report (in another column) with its suggestive recommendation. Voluntary action of this sort by all the railroads would make unnecessary the establishment by government of such a train accident investigation bureau as was outlined in these columns last week, but this is too much to hope for. In sharp contrast with this quick, orderly and conclusive examination and report are the investigations of the similar derailment on the New York Central, still dragging along. The Coroner, the District Attorney and the state railroad commissioners are wandering far afield. On the Pennsylvania the curvature was 3¼ degrees and the speed was 50 miles an hour. On the New York Central the curvature was 3 degrees and the speed within 50 miles per hour. The Pennsylvania engineman "made an eight-pound reduction of his air to steady the train" just before entering the curve. The New York Central motorman made a like application of the brakes at a similar point for the same purpose. It was good engine running. The Pennsylvania derailment was caused "by some foreign material which became wedged between the flange of the left rear tender truck wheel and the inside, or low, rail." The peculiar and unusual shearing of the bolts which held the clips to the steel ties on the Pennsylvania was precisely like the shearing of the spikes which held the rails to the wooden ties on the Central. The elevation of the outer rail on the Central 3 degree curve was 4½ in., which counterbalances the centrifugal force due to train movement at the rate of 46 miles an hour, so that it would seem that in this case no account need be taken of the lower center of gravity of the electric locomotive. There was only a small lateral thrust due to the speed. The point where trouble began—at or near the rear wheels of the leading locomotive—is identified. With these known facts it is difficult to imagine an application of force sufficient to shear the spikes and spread the rails, acting in any other way than as a wedge. This is not saying that the forces which tore out the Central's track did so act, but it is a reasonable inference, materially emphasized by the Pennsylvania's findings. But this obvious direction of inquiry is neglected by the several investigators, who are making theoretical studies of centrifugal forces, the resistance of materials and suggestive inquiries of the reason why operating officers are not made members of the board of directors.

The infirmities of the "political" Railroad Commission of Connecticut, which we very recently had occasion to point out, have had quick illustration in other commissions of that state. The Tax Commissioner has just been removed by Governor Woodruff on evidence showing an offer to secure for $1,200 a county commissionership; an appeal has been made to the Governor by the Mayor of the city of New Britain to punish one of the two bank commissioners on the ground that his carelessness let escape a local savings bank officer who had defaulted in some $600,000; and there are reports more credible than mere rumor of charges against other commissioners yet to come. All these are samples of the same vicious system, though not often shown up so suddenly and in such extension in a single state. The bad sequence is continuous and logical. Languid and unassertive citizenship breeds the "political" appointing power; it, in turn, the political commission; and it, in its turn, the

public evil which gathers until it bursts. It is hardly a surprise that we find in Connecticut a bill in the General Assembly, supposed to have emanated from the Governor, calling for the radical reorganization of the Railroad Commission. It is possible, though far from positive, that such a proposition, joined to a similar one in New York state, heralds the beginning of an uplift in the *personnel* of the State Railroad Commissions of the country, some thirty-five in number already, and several states proposing to adopt them. The Connecticut and New York examples serve at least to blazon the evil and outline clearly its remedy.

The *Locomotive Engineers' Journal*, answering a critic, takes occasion to deliver its own views on level-headedness among enginemen and says:

"There is no business to be named wherein intoxicating liquor should be more rigidly excluded than with those in charge of locomotives, transporting hundreds of people and large property values, to say nothing of the additional risk on their own lives. One drink stimulates and when the effect of that stimulant is gone the system is as much below normal as the stimulant raised it above, and nodding instead of the usual alertness is very likely to follow. Engineers should remember that the safety of their own lives depends largely upon the alertness and energy with which they perform their extra hazardous duties, and that there is no time nor place in their work for stimulants. Everyone who has not thought of the dangers such a practice creates should think, and act on the thought. Let stimulants alone. Leave the brain clear, for all its powers are needed when in charge of a locomotive.

"Railroad men everywhere and particularly the members of the Brotherhood of Locomotive Engineers court the most rigid investigation of causes of accidents and if a bottle of spirits is found to contribute to it, the law of the order would be immediately in effect which reads, 'Should any Brother be found guilty of neglecting his duty, or injure the property of his employer or endanger the lives of persons, while under the influence of liquor, it shall be the duty of the presiding officer to declare the offending Brother expelled without a ballot to designate the degree of penalty.' Our insurance department shows how vital is our interest in the matter of safety, with 49,000 members insured, with death and casualty claims amounting to about $150,000 per month, and, having paid a total of $16,500,000 to families of deceased, we are not likely to be indifferent as to cause of accidents; and criticism of engineers, based upon facts, whether drink, carelessness, lack of judgment, or other cause is courted, so we may render all possible assistance in effecting a cure."

The railroad world is not yet beyond the need of lectures on temperance notwithstanding the great improvement that has been made over the conditions of former years, for we still hear, now and then, of neglect of duty and even of collisions which are due to intoxication, and we offer no apology for printing this brief lecture. Our main object, however, is to call attention to a few lines which the writer of this article put in merely as embellishment, but which from another point of view should be emphasized as of prime importance: the exhortation to "leave the brain clear, for all its powers are needed when in charge of a locomotive," and the declaration that the members of the Brotherhood "court the most rigid investigation of causes of accidents." In opposing the proposed Federal law to limit the working hours of enginemen, and the law proposed in Alabama to prohibit the running of unnecessary trains on Sunday, some enginemen have strenuously advocated a law that distinctly favors dull brains—the law of go-as-you-please. To leave a hundred enginemen to decide for themselves when they may safely work excessive hours is to definitely encourage 10 per cent. of them, more or less, to stay on their engines till they fall asleep, or become so drowsy that they are about as dangerous as one asleep, for in these times there will almost surely be an appreciable number of runners so mentally or morally deficient as to introduce this element of danger. With men as scarce as they now are, this caution applies also to trainmasters and engine foremen, for men who do not intelligently care for their own lives and who feel little responsibility for those of fellow employees may turn up any day. In hiring "floaters" to run engines the danger of getting a man who is in some respect unreliable is as great as ever, while the temptation to wink at his weaknesses is increased by the pressing need of getting men of any kind who can handle an engine. In courting investigation of causes of accidents the Brotherhood would, no doubt, add the proviso that the decision to be made as the result of the investigation should be a just one; but enginemen should bear in mind that under present conditions on many roads Justice has a hard time of it. She is, indeed, blindfolded so as not to be prejudiced by what she may see, but her ears hear strange tales. The engineman, whispering in one ear, tells her that he can safely work twenty hours without laying off for rest, while the trainmaster on the other side tries to hypnotize her by pretending to believe that he himself is not responsible for recklessness of that kind on the part of enginemen. A certain shrewd lawyer desired that justice should be done—provided that the result proved favorable to his side—and tried to believe that he was not damaging his reputation. The honest engineman and trainmaster cannot afford to take that position. Real justice often means less wages and fewer freight cars moved; for only on that condition can the lives of fellow employees and of passengers be rightly safeguarded.

THE ECONOMICS OF TRAFFIC AGREEMENTS.

The most prominent authority in the country on railroad finance, if not on railroad management, has been giving his ideas in public this week. Mr. Harriman, in the course of his examination by the Interstate Commerce Commission, frequently took occasion to bring forward his views on various features of railroad management. Asked by Commissioner Lane why the Union Pacific as a railroad should have the power to buy other railroads, he gave his views on the question of railroad consolidation as follows:

I believe, under proper regulation and proper statutes, which would enable railroads to combine and establish lines upon which traffic could be moved at the least cost, we could reduce our rates; but just so long as we are prohibited by law from agreeing among ourselves without the danger of being sent to state prison, you have this chaos that now exists. Just as soon as we can get laws that will enable us to combine and establish these lines so that we can conduct the traffic on the lines of least resistance at the least cost, we will then be able to reduce the charge and also to increase wages or to stand the increase in wages and not before.

Q.—What is the law that you would want to bring about this beneficial result? A.—A law that would enable corporations to make contracts between themselves under proper regulations, just the same as individuals have the right to make contracts; contracts that would be standing and enforceable for a long term of years, so that they would enable railroads to establish these lines upon which traffic could be moved at least cost, taking various parts of the lines as they now exist.

Q.—What competition would there then be between railroad lines? A.—As I said, it should be under proper regulation. I do not think it is to the advantage of the business interests of this country to force business around on improvident up and down hill lines, when there is a straighter and more economic line to be used. I do not mean to say that no business ought to be allowed to go over that line, because there are other conditions sometimes, when the less fortunate line can do business to better advantage and at less cost; that is, in filling out its trains.

But there should be some law—and I think the President of the United States had that in his mind when he sent his message to Congress last December; I do not remember his exact language—that there should be, under some proper control, a change in the laws which would enable contracts to be made between railroads.

This contention strikes at a vital point in the present discussion about railroads. As President Hadley showed some 20 years ago in his "Railroad Transportation," which is still the authority in its field, a railroad represents the most extreme form of fixed capital. Even though it is losing money, it cannot go out of business. There is, in fact, no competition so severe as that of a bankrupt road. Therefore, in the last analysis competition between railroads is impossible. There must be either agreements between the roads as to division of business or combination—this not as a result of the lawless tendencies of railroad managers, but of definite economic forces. This is a fact which seems to be generally lost sight of at present. And it is hardly surprising that it is so when existing railroad laws, both Federal and State, so generally insist on competition. Since the passage of the Sherman Law in 1890, if not since the enactment in 1887 of the original Interstate Commerce Act, the railroads have been face to face with a necessity, based on an ultimate economic fact, which they were forbidden to meet lawfully in either one of the two possible ways. By the act of 1887 competing lines were forbidden to pool their traffic; by the Sherman Law, to combine. The situation has been relieved by the prosperity of the last ten years which has prevented the necessity for cut-throat competition, but nevertheless the results of the double prohibition to the railroads has been the formation of gentlemen's agreements and other similar arrangements just outside the reach of the law. Mr. Harriman's desire is to end this anomalous situation by allowing railroads by one course or the other to meet this obvious economic fact of their existence; the public weal to be safeguarded by giving the Interstate Commerce Commission full regulation as to rates and service. Not only would this serve to put railroad competition on a legal basis, but also it would make possible great economies in operation by apportioning the traffic in the most economical way among the different lines. This suggestion of Mr. Harriman's goes to the heart of the railroad problem. It is a large view of the subject by a large man. For however much we may criticize his financial methods, there is no doubt whatever that as a railroad organizer and executive his ability is exceptional.

THE DANGERS OF SPEED.

In his testimony this week before the New York Railroad Commission, Mr. Newman, President of the New York Central, made two statements: (1) Fast trains are furnished because the public demands them. (2) The limit of safety for fast express trains has not yet been passed. The first of these statements is unquestionable. The experience of the 18-hour trains between Chicago and New York proves that enough people to fill those trains want to travel at that speed and also that this fast traffic is increased traffic, inasmuch as the loading of the other trains has not been materially lessened. The passenger movement by the Empire State Express was, from the beginning in 1891, found to be almost entirely in addition to the then passenger movement on the road. Voluntary competition in speed, for any considerable period, is unusual. It is more apt to take the form of increases in comfort and luxury, as in the admirable trains of six competing lines between Chicago and St. Paul.

The second statement, that the limit of safe speed has not been passed, needs examination. The record of some high-speed scheduled trains seems to corroborate it.

On October 26, 1891, the Empire State Express began running on regular schedule between New York and Buffalo at an average rate of speed, including four stops, of over 52 miles an hour. For 15 years and four months this train has performed this fast service each week day with unusual punctuality. The average speed has been increased to 53.3 miles per hour, which involves a daily running over considerable stretches at more than 70 miles an hour, and the speed is said to have been at times 100 miles an hour. In the past 4,800 week days the two east and west expresses have run 4¼ million miles with no serious accident involving the loss of a passenger's life.

On the Great Western Railway, in England, between London and Bristol, over 118 miles, daily trains each way have been running for many years, covering the distance in two hours, with an average speed, including one rather long stop, of 59.2 miles per hour. No serious accident has occurred.

In looking over the record of high-speed scheduled trains we find fatal accidents, but it is necessary to examine further and find whether or not the speed was a factor in causing those accidents. The two fastest scheduled trains in the world are the Pennsylvania's and the Reading's Camden and Atlantic City trains, the first of which is timed for a speed of 68.1 miles per hour for a distance of 59 miles, and the second a speed of 66.6 miles per hour 55½ miles. These trains have not been immune from fatal accidents, but with one exception there have not been great accidents and that one was not due to fast running—either that fast running due to the schedule or to a violation of orders. The most serious accident occurred on July 30, 1896, when the engineman of the Reading train disregarded his signal at a grade crossing of the Pennsylvania's line. Due to this negligence, and probably not even indirectly due to his speed, his train collided with a slow Pennsylvania Railroad train at that crossing and killed 47 people on the slow train. No passenger on the fast train was killed.

During the Chicago Exposition year, 1893, the Columbian Express made its daily 20-hour trips between New York and Chicago, over the New York Central and the Lake Shore, without serious accident. This cannot be said of the 18-hour trains running for nearly two years on both the New York Central and the Pennsylvania. On June 21, 1905, the New York Central's train ran through an open switch at Mentor and 15 passengers were killed. The speed of the train had nothing to do with the cause of this derailment; it would have occurred at a speed between 30 and 40 miles an hour, although it is undoubtedly true that the destructive effects on the train after the derailment, and probably the number of passengers killed, were greatly increased because of the high speed. These destructive effects increase as the square of the speed.

It should be borne in mind that scheduled high-speed trains have been made as safe as they appear to have been made only by reason of extra care and watchfulness in their running, by the use of cars of strong construction, vestibuled throughout, and also by running them on tracks set apart in most cases for passenger service. It is recognized by all railroad officers that these are the only conditions under which fast service can be maintained safely.

Nevertheless the prevailing opinion that fast running is the cause of many wrecks and losses of life is fully substantiated. For example, a newspaper train on the New York Central was derailed near Little Falls, N. Y., on a 7 deg. curve solely because of excessive speed. Two were killed and one was injured. A passenger train on the Wabash, at St. Louis, was derailed on a 10 deg. curve. As the speed was estimated at 60 miles an hour there can be no question as to the cause. One was killed and 43 were injured. A mail train on the Pennsylvania was derailed on a 7 deg. curve at an estimated speed of 66 miles an hour, and no further investigation of the cause was needed. Two were killed and four injured. It has, however, a sobering effect on any attempt at quick judgment to consider two recent derailments, one on the Louisville & Nashville at a speed of 12 miles an hour where nine people were killed, and another a derailment on a bridge where the speed was 60 miles per hour and none were killed.

The official reports of the Interstate Commerce Commission since June 30, 1906, are not yet available, but an examination of a reasonably correct record during the past three months furnishes some lessons. Of 64 serious accidents in November last, 25 were caused by passenger trains and 39 by those classed as freight trains. There were two high-speed accidents, but neither of them was a high-speed scheduled train. Of the 52 serious accidents reported for December of last year, 28 were caused by passenger trains and 24 by those classed as freight. One of those accidents, which occurred in a fog, was undoubtedly due to the speed being beyond the control of the engineman, but it occurred under the unsafe permissive system of using block signals. In 45 serious accidents in January 123 persons were killed. Twenty-three of these accidents were collisions and caused the loss of 80 lives; one was due to a dynamite explosion which killed 16 persons: another due to a boiler explosion which killed five persons. We do not find indication of any of these accidents being caused by high speed; nevertheless this is not conclusive; the causes have not all been reported.

We arrive then at only a partial conclusion. High-speed running has been made reasonably safe under a certain set of conditions. It is unsafe unless the track and train are strong enough, unless the track is devoted exclusively to passenger service or the way is entirely cleared by special order. There are other absolute requirements: The high speed brake is essential. The distant and home signals must be so placed as to allow the engineman to control and stop his train within the required distance under all weather conditions. Of course, every turnout and drawbridge must be interlocked with the signals. This is not a complete enumeration of the physical conditions necessary for fast running, but any competent railroad officer can complete the list.

The final essential condition—effective discipline and uniform obedience to orders by the trainmen and trackmen—can never be secured. The ideal can be approximated. It is a general prevailing opinion among railroad officers that in this country we are now not approximating the ideal; we are retrograding. A lack of zeal and fidelity among railroad employees seems to be growing. The cause of this is, to some extent, a psychological study. Perhaps it is in part due to the prevailing prosperity, which unsettles the minds of many otherwise contented men; perhaps it is partly due to the open encouragement, by those in high governmental authority, of the trade unions and the increasing development of the most vicious elements in the trade union idea. This study would be interesting, but for the moment it is unprofitable. Whatever may be the cause of the present deterioration in discipline the present duty of railroad officers to get and maintain better discipline is plain.

Train Accidents in January.

Our record of train accidents occurring on the railroads of the United States in January includes 23 collisions, 18 derailments and three fires and explosions, 45 accidents in all. This record is not published in full, as has been done heretofore, except in the cases of the few accidents which are especially prominent—in the present instance four collisions, two derailments and one explosion. The record of "ordinary" accidents—which term includes, for our present purpose, only those which result in fatal injury to a passenger or an employee or which are of special interest to operating officers—will henceforth be given as below, in the shape of one-line items for each accident, showing date, location, class and number of deaths and injuries.

As most of our readers already know, this record is based on accounts published in local daily newspapers, except in the cases of accidents of such magnitude that it seems proper to send a letter of inquiry to the railroad manager. The official accident record published quarterly by the Interstate Commerce Commission is regularly reprinted in the *Railroad Gazette*.

The seven prominent accidents in January are distinguished

from the others in the list by the use of two lines for each of the seven items. Following are condensed accounts of the circumstances of these seven cases.

The collision near Alta Vista, Kansas, on the 2d, resulting in the killing of 31 Mexican laborers and three other persons and the destruction of most of the bodies by fire, has already been reported in the *Railroad Gazette*, pages 26 and 37. Southbound passenger train No. 29 left Volland after an order had been received there for it to wait for northbound train No. 30, the operator failing to deliver the order. No. 29 had been on the side track, and backed out while the meeting order was being received. The operator claims to have set the signal to stop the train, but it did not stop and there seems to be a belief that, expecting the train to stop to take water, he did not set the signal. There is a rule requiring that where a meeting order for a passenger train requires the train to stop at the station where the order is delivered, torpedoes shall be used, but this rule was not complied with in this case. This operator was only 18 years old, though in applying for employment, a few months ago, he gave his age as 23. He had been in the service of the Rock Island but three days.

The circumstances of this case so strongly indicate that the operator's lack of experience or of training or of moral character must be taken as the immediate cause of the collision, that extended comment does not seem to be called for. The need of training, experience and moral character in operators has been set forth in the columns of the *Railroad Gazette* times without number. As was said by a prominent daily paper in commenting on this collision, if competent and trustworthy operators cannot be had at any price it is time to consider whether one can travel by railroad in reasonable safety unless we reduce the speed of all trains. According to the newspapers the block system had just been put in operation on this line; but evidently it was for the protection of trains from rear collisions only—a half-way measure that, we should think, would be very unsatisfactory.

The collision at Bardwell, Ky., on the 11th, occurred about 11 p.m., and resulted in the wreck of a locomotive and 10 cars. The leading train had stopped to set out a defective car and the other train not only approached the station too fast but, it is said, had disregarded a block signal set against it. The wreck was covered with oil from two tanks, but it does not appear that it took fire. The engineman was arrested on a charge of manslaughter.

The train derailed at Barney, N. Mex., early on the morning of the 13th was No. 30, which was one of the two involved in the collision at Alta Vista. At Barney two passengers, two trainmen and an unidentified Mexican were killed. The engine was overturned.

The trains in collision at Fowler, Ind., on the 19th, were passenger train No. 38 from Chicago to Cincinnati and a westbound freight train. There was a dense fog at the time (2.30 a.m.) and the engineman of the passenger train ran past the station and met the freight about 4,000 ft. beyond. The wreck took fire at once and three of the passenger cars were burnt up. All of the persons killed were in the leading passenger car (a combination car), and their bodies were mostly destroyed in the fire. The preponderance of evidence is that the engineman of the passenger train ran past a stop signal, but the engineman denies this and there is nobody to corroborate him. The operator claims he gave a stop signal and is corroborated by the village night policeman, who makes a sworn statement that he personally noticed the position of the signal before the arrival of the train and that it showed red. Five or six passengers were killed or fatally injured, three trainmen were killed and ten passengers were injured. The passenger engineman was about 49 years of age, a man of exemplary habits and character, and considered in all respects one of the very best men on the road—one who is usually careful about signals and about the observance of rules. But the statement of the operator, supported by the statement of the night policeman, that the signal was red, is accepted by the Superintendent.

The accident at Sandford, Ind., at about 9 p.m. on the 19th, was the wreck of westbound local passenger train No. 3 by the explosion of powder in a car in a freight train standing on the side track at Sandford station. The whole passenger train was instantly wrecked, and the wreck began burning at once. The fire destroyed the whole wreck. Fourteen passengers and two employees were killed (and, it is reported, several other persons), and 33 persons were injured. The cause of the explosion is not known, but the theory most favored by the officers of the road is that it was due to lightning. An electrical storm was raging a few miles away.

The train derailed at Delaware, Tex., on the 20th was an express from Fort Worth. It was running at high speed on a curve when the baggage car and two passenger cars jumped the rails and fell down a bank. The injured were all passengers.

In the collision at Deerfield on the Boston & Maine on the 29th a westbound passenger train was unexpectedly stopped about 4 a.m. and was run into at the rear by a following freight, which had followed the passenger from a station six miles back. The collision was a violent one and the reason that the list of fatalities is so small is that the rear car of the passenger train was nearly empty. All of the killed were employees of the road, riding in this car. Four of them were off duty.

Train Accidents in the United States in January, 1907.[1]

Date.	Road.	Place.	Kind of Accident.	Kind of Train.	No. persons reported Killd.	No. persons reported Inj'd.
1.	Louisville & Atlantic.	Evelyn.	Flange.	Pass.	0	8
1.	Rio Grande Western.	Price, Utah.	bc.	P. & Ft.	3	1
2.	Atch., Top. & S. Fe.	Kingfisher.	ms.	Pass.	0	3
2.	Northern Pacific	Hawley.	rc.	Eng.& Ft.	3	4
2.	Northern Pacific	Livingston.	xc.	Eng.& Ft.	2	0
†*2.	Chicago, Rock Island & Pacific.	AltaVista,Kan.	bc.	Ft. & P.	34	33
2.	Union Pacific	Brule, Neb.	rc.	P. & P.	1	2
3.	Southern Pacific	Comstock, Ore.	bad track.	Pass.	2	0
4.	Lake Erie & Western.	Montmorenci.	derail.	Ft.	2	0
5.	Louisville & Nashville.	Oxmoor.	xc.	Ft.	1	2
†6.	Chic. & North-West'n.	Loveland, Ia.	fire.	Pass.	1	3
6.	Atch., Top. & S. Fe.	Blue Water.	ms.	Pass.	0	3
*6.	New York Central.	Red Creek.	rc.	Fts.	2	3
11.	Great Northern	Petersburg.	rc.	Fts.	2	6
11.	Illinois Central	Bardwell, Ky.	rc.	Fts.	4	0
12.	Buffalo, Roch. & Pitts.	Silver Lake J.	runaway.	Ft.	1	4
†13.	Chicago, Rock Island & Pacific.	Barney, N. M.	ms.	Pass.	5	8
13.	Missouri Pacific	Salina.	rail.	Pass.	1	1
13.	Chicago & Alton.	Bloomington.	xc.	Ft.	2	6
14.	Chicago & W. Ind.	Chicago.	rc.	Pass.	0	7
14.	Atlantic Coast Line.	Benson.	bc.	P. & Ft.	0	4
14.	Southern Pacific.	Montello.	unx.	Pass.	1	8
14.	Chic., Rk Isld & Pac.	Waldron, Mo.	bc.	P. & Ft.	3	4
14.	Atlantic Coast Line.	Screven.	xc.	Ft.	2	0
16.	Phila. & Reading.	Bridgeport.	boiler.	Ft.	5	0
18.	Atch., Top. & S. Fe.	Sylvia.	bc.	P. & Ft.	1	Many.
18.	Penn., West of Pitts.	Millville.	xc.	Fts.	1	2
18.	N. O. & North Eastn.	Purvis.	bc.	P. & Ft.	1	6
19.	Chic., Ind. & Southn.	Schneider.	bc.	Fts.	2	0
19.	Lake Sh. & Mich. So.	Osborne, Ind.	ms.	Pass.	0	13
†*19.	Cleveland, Cincinnati, Chicago & St. Louis.	Fowler, Ind.	bc.	P. & Ft.	8	10
19.	Pere Marquette	Alma.	washout.	Pass.	1	3
†*19.	Cleveland, Cincinnati, Chicago & St. Louis.	Sandford, Ind.	explosion.	Pass.	16	33
20.	St. Louis & San Francisco.	Delaware, Tex.	loose rail.	Pass.	0	20
21.	Lake Sh. & Mich. So.	Blissfield.	ms.	Pass.	1	12
22.	Illinois Central	Aplington.	brake-bm.	Ft.	1	3
22.	Gulf & S. I.	Lumberton.	acc. obst.	Ft.	1	4
23.	Michigan Central.	Tekonsha.	xc.	Fts.	1	0
23.	Baltimore & Ohio.	Letart.	bad track.	Ft.	3	1
24.	Southern Pacific	Deeth.	rail.	Pass.	1	3
28.	Northern Pacific	Dickinson.	bc.	Pass.	1	3
28.	Seaboard Air Line	Rockmart.	acc. obst.	Ft.	1	0
29.	Mo., Kan. & Texas.	Crowder City.	bc.	P. & Ft.	0	8
29.	Boston & Maine.	Deerfield, Mass.	rc.	Ft. & P.	6	2

*Wreck wholly or partly destroyed by fire.
†Passenger or passengers killed.

It has been announced that on the Long Island Railroad henceforth duplex tickets will be issued to passengers where commutation tickets have been forgotten; and that by presenting the commutation ticket and cash fare ticket at the office of the company the cash fare paid to the conductor will be refunded. This would seem to be a very reasonable concession, provided passengers are reasonable also. It seems unfair—in the language of the typical "commuter," a damnable outrage—to make a passenger pay twice for the same ride, especially if he be one of those who do not cheat the company at every opportunity. But, on the other hand, if refunding is too easy some passengers will forget so often that conductors will be bothered unnecessarily, and we shall lapse back into the condition of thirty years ago, when every regular suburban passenger felt that he had a vested right to "travel on his face," and the chief qualification of the suburban conductor was his ability to remember a thousand faces, so as not to let the go-as-you-please plan of payment get entirely beyond bounds. The Long Island will require pas-

[1]Abbreviations used in Accident List:

rc	Rear collision.
bc	Butting collision.
xc	Other collisions; as at crossings or in yards. Where only one train is mentioned, it is usually a case of a train running into a standing car or cars or a collision due to a train breaking in two on a descending grade.
rail	Derailment due to broken rail.
bridge	Derailment due to failure of bridge.
switch	Derailment due to broken or defective switch.
frog	Derailment due to broken or defective frog.
dr	Other derailments due to defects in roadway.
wheel, axle, truck, beam, (brake-beam), drawbar	Derailment due to breakage of part named.
eq	Derailment due to other defects of equipment.
derail	Derailment at derailing switch.
ms	Derailment due to misplaced switch.
trackmen	Derailment due to negligence of track repairers.
dn	Derailment due to other kinds of negligence.
cattle	Derailment due to animals on track.
washout, snow, ice, landslide	Derailment due to causes indicated.
acc. obst.	Derailment due to accidental obstruction.
malice	Derailment due to malicious obstruction of track or malicious misplacement of switch.
unf	Derailment due to other unforeseen causes.
boiler	Explosion of boiler of locomotive of moving train.
fire	Cars burned while running.
unx	Unexplained derailment.
Pass.	Passenger train.
Ft.	Freight. Any train or engine not a passenger train.

sengers to go to the general office to get their money back. If, still, they are too numerous the proper remedy will be to move the general passenger agent's office to the fourth floor of a building which has no elevator.

Delaware, Lackawanna & Western.

The report of this rich trunk line coal railroad for the year 1906 is both a record of prosperity and a warning that, given a continuance of present hostility against railroads less favorable results must be expected in future. The position of the company in regard to the provision of the rate law, which makes it unlawful after May 1, 1908, for a common carrier to transport in interstate commerce coal mined or purchased by it, thus separating the transportation of coal from its mining and merchandising, it also made clear. The management has been advised by its legal representatives that the company cannot be required to dispose of its coal properties under guise of regulating interstate commerce, especially as by the terms of its charter it has the undoubted right to mine, purchase, transport and merchandise coal.

The results of the year's operations were satisfactory, in spite of the six months' suspension of anthracite mining in April and May, since all other departments of traffic showed important increases. This is particularly true of the higher grades of freight traffic, and, in fact, of the freight traffic as a whole, for general freight earnings increased 12 per cent. This represents an increase in total tonnage of 16 per cent. The figures for earnings from merchandise traffic are not available, but its tonnage increased 22 per cent., and tonnage of miscellaneous commodities was larger by the same amount. As shown in a recent article on the Lackawanna fast freight service (*Railroad Gazette*, February 15, 1907) the road has, within a few years risen from the seventh road in point of first-class tonnage (including other tonnage reduced to a first-class basis) westbound from New York to be fourth among the trunk lines. The methods there described in handling this remunerative traffic suggest the general development of the merchandise freight department which has been going on along with the general improvement of the whole road during recent years. Passenger earnings, too, showed a satisfactory increase for the year—a little more than 12 per cent., or about the same as total freight earnings.

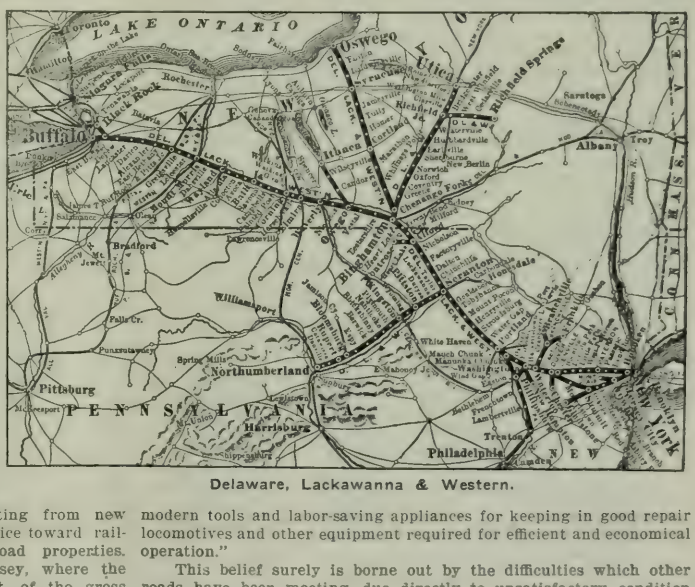
The gain in other than coal freight earnings was almost exactly offset by the loss in earnings from the transportation of coal. The increase in earnings from passengers, mails, express, miscellaneous, ferries and other sources, however, brought up the gross earnings to nearly $33,000,000, an increase of $1,000,000, or 3 per cent., over the figure for 1905. Operating expenses increased slightly more than gross earnings, leaving a decrease of $59,651 in net earnings. Accentuating this decrease in net results was an increase of $572,915 in payments for taxes. This is larger by 57 per cent. than in the previous year, and is particularly referred to by Mr. Truesdale as resulting from new laws following the feeling of hostility and prejudice toward railroads which change the basis of taxing railroad properties. The increase in taxes came notably in New Jersey, where the taxes levied for 1906 amount to over 9 per cent. of the gross earnings and over 30 per cent. of the net earnings of the company on all its business of any kind, through or local, in that state.

The loss in net earnings and the increase in taxes, amounting together to $632,565, were nearly covered by increases in miscellaneous income from investments, etc., and in coal department earnings, which, in spite of the loss of time, increased nearly 10 per cent. for the year. First charges were, approximately, the same as in the preceding year, but nearly $2,000,000 more was charged against income for renewals and betterments, a total for the year of over $5,500,000 on this account. It is for this reason largely that the surplus for the year was only $587,000, against $2,111,000 in 1905. In other words, net income was about the same as in 1905, but more of it was applied to the general betterment of the property.

The large increase in operating expenses is attributed to the scarcity of labor and consequent increased wages necessary, together with the high price paid for all supplies and materials. The amount charged to maintenance of way under regular operating expenses was at the rate of $5,160 a mile, against $4,849 a mile in 1905. Of this, ordinary expenditures cost $3,003, and extraordinary expenditures, which are listed separately in detail, $2,157 last year. The 1905 figures were $2,629 for ordinary and $2,220 for extra ordinary expenses. These figures are, of course, exceptionally large and indicate the high standard which is being carried out. Repairs cost $1,461 per locomotive, against $1,533 in 1905; $472 per passenger car, against $539 in 1905, and $46 per freight car, against $48 in 1905. These figures, it is clear, cover repairs and nothing else. They seem low at first when contrasted with the amount spent per unit of equipment for repairs and renewals by other roads, but not when it is learned that 50 new locomotives, 50 passenger train cars, 52 ballast cars and 4,323 freight cars were bought and paid for in full out of income during the year at a net cost of $4,433,733. This amount came out of renewals and betterments charged against net income, which also covered $496,475 for new shop plants.

The important general improvement policy of recent years has been actively carried on. Yards have been extended at Secaucus, Newark, Scranton, Taylor, Elmira and Buffalo, the automatic block signal system completed over the whole line between Hoboken and Buffalo and a third track built from Scranton east to Nay Aug (*Railroad Gazette*, March 16, 1906) at a cost of $162,000. This third track is to be extended from its present eastern terminus at Moscow to the top of the eastbound mountain grade. This will improve operating conditions by providing a slow track for freight trains all the way up the grade. The ferry terminal at 22d street, New York, destroyed by fire in December, 1905, has been rebuilt and the new passenger terminal at Hoboken was last week put in use. Work has been begun on a new double-track tunnel through Bergen Hill, just west of Hoboken. Plans have been made for a new passenger station and office building at Scranton and a large new locomotive repair plant at that place, the latter to cost about $2,000,000, and to be finished about the middle of 1909. In regard to facilities for repairing equipment, the report speaks as follows:

"The management is entirely convinced that nothing is more vital to the successful operation of a large railroad property than provision of ample repair shop facilities, equipped with the most modern tools and labor-saving appliances for keeping in good repair locomotives and other equipment required for efficient and economical operation."



Delaware, Lackawanna & Western.

This belief surely is borne out by the difficulties which other roads have been meeting, due directly to unsatisfactory condition of their motive power.

The following are quotations from the report dealing with the present problems of railroad operation and management:

"The increase in loss and damage account is significant as indicating the extended responsibility imposed on the railroads each year by the laws of Congress and of the different states, also by courts and juries in administering the laws. This is not only true as respects the duties of the railroads to their patrons traveling or shipping over their lines, but as well in cases of accident or damage at crossings or stations or due to an infinite variety of occurrences with which those charged with the operation of railroads are familiar.

"The operating cost of this and all other railroads will increase largely during the coming year, as further general and substantial increases in salaries and wages were made in the latter part of 1906, some of which did not become effective until the first part of the new year. It is with no feeling of resentfulness or pessimism that many officials charged with the responsibility of managing the railroad properties of the country express serious doubts and misgivings over the future outcome as respects the net results of the operation of these properties. They realize from daily experience that the large increase in wages paid will not be in any measure compensated for by increased efficiency of service. On the contrary, they are impressed with the belief that a spirit of independence and

unrest has been engendered and broadly disseminated through one agency or another among the rank and file in all branches of railroad service, the effect of which has been, and may continue to be, to lower the general standard of efficiency of railroad employees. Even though this may not be the effect on most of the old, loyal, well-tried railroad men who have spent many years of their lives in the service, the fact is that many of these men are being retired from service each year; that the demand for shorter hours of service, which is being conceded, requires a larger number of men to perform the same service, and that the great and steady growth of the railroad business each year makes it necessary to employ more new men from year to year. Thus the problem of securing a sufficient number of new men of tried ability and experience to competently conduct the transportation service is a serious and difficult one, and this at a time when the demands and requirements of the service were never so great or exacting. That serious doubt is felt as to the efficiency of railroad service being maintained as hitherto, notwithstanding the higher wages paid, is not to be wondered at, in view of these conditions and outlook.

"The most serious aspect of the present situation as seen from the railroad standpoint is the universal and pronounced feeling of hostility which exists toward the railroads and those controlling and managing them, and the alleged attitude of indifference or unconcern of the latter as to the character, efficiency and safety of the service rendered by the railroads to the traveling and shipping public. No doubt there is some justification for this feeling. On the other hand, there is little doubt that the conditions complained of are not as bad or as universal as claimed, but that they have been exaggerated and distorted very considerably, resulting in much unreasonable prejudice being aroused and bitterness engendered, which are likely to work great wrong and injustice to the railroad interests of the country, and in so doing injure its general business interests without securing proper and adequate remedy of conditions and practices which no doubt do exist and which need prompt and intelligent action to correct. Legislation by Congress and by many of the states is being actively pressed as a universal panacea for all the delays, troubles, losses or embarrassments which can by any possibility be laid at the door of the railroads which undertake to regulate and prescribe the details of their management or seeks to place in the hands of Government officials wholly without knowledge or experience in railroad operations, a supervision and control over them, which, if made effective and enforced, would hamper and embarrass the transportation interests of the country beyond measure."

It is evident that here Mr. Truesdale speaks for the railroads of the country as a whole and sums up the unfavorable conditions which to-day face railroad officers.

The principal operating statistics for the year ended December 31, 1906, are as follows:

	1906.	1905.
Mileage worked	957	957
Coal freight earnings	$12,902,851	$13,993,585
Other freight earnings	10,342,423	9,230,787
Passenger earnings	6,216,224	5,529,002
Gross earnings	32,962,880	31,351,064
Maint. way and structures	4,937,771	4,640,208
Maint. of equipment	2,909,235	2,871,911
Conducting transportation	10,503,943	9,816,196
Operating expenses	18,899,442	17,827,975
Net earnings	14,063,438	14,123,089
Coal department earnings	3,655,119	3,295,426
Total income	16,989,813	17,061,966
Net income	11,378,690	11,525,913
Renewals and betterments	5,551,619	3,587,486
Surplus	587,072	2,698,429

NEW PUBLICATIONS.

The Peabody Atlas of Coal Mines and Coal Railroads in the central commercial district of the United States, accompanied by chemical, geological, and engineering data. By. A. Bement. Published by the Peabody Coal Company, Chicago. 16x18; 149 pages; 42 illustrations; 27 maps. Cloth, $5.

In 1902 the publishers of this atlas issued a large wall map of the coal fields of Illinois and Indiana with the shipping mines indicated thereon. It was accompanied by a bound volume with tabulated lists of these mines. Up to that time there was no publication giving adequate information of this character about the mines of these two states. A revised edition was issued the following year. The present volume has a much greater scope, Ohio, Michigan, western Kentucky, Iowa and Missouri being included; instead of a wall map, sectional maps, page size, are bound into the volume; also a double-page map of the United States, showing its coal areas, and a double-page map of the territory covered in detail by the atlas. Various technical information concerning coal is given, including a brief description of the geology of each coal field, detailed treatment concerning the various coal seams, with their names and numbers, relative importance, localities where the working of them is most active, and chemical analyses showing relative composition of coals from the different states. Methods of manipulation and management of fires are presented, and the determination of conditions of combustion by analysis of the chimney gases is given in such a form as to enable the engineman or fireman to use this means of securing economical combustion, the essential instruments needed being illustrated and described. Several types of the best forms of smokeless boiler furnaces are illustrated and discussed by the author. The volume is one of considerable value to railroad officers, coal producers and consumers. Former issues of the publication were for complimentary distribution. In view of the cost of the production of this atlas, however, and the fact that otherwise it would not be listed or carried in stock by book dealers, a price has been put on the volume.

Official Industrial Guide and Shippers' Directory. Issued by the General Freight Department of the Chesapeake & Ohio. Paper; 8x11; 460 pages. Illustrated.

This publication has just been issued by the general freight department of the Chesapeake & Ohio for the use of the company's patrons and others seeking facts about its territory and resources. This covers the mining, agricultural, manufacturing, commercial, financial and educational advantages of the territory. The first part of the book has many illustrations showing scenery along the lines, views of different industries, particularly coal and coke workings, and also of various agricultural products of the territory. Then follow descriptions of various towns along the line of the road with many photographs. The illustrations are, many of them, poor, but as a whole give a good idea of the regions served by the road. The information is detailed and complete. The book represents a large amount of condensed information, the result of a great deal of work in its preparation.

CONTRIBUTIONS

Remedies for Car Shortage.

Pittsburg, Feb. 18, 1907.

To the Editor of the Railroad Gazette:

Viewing the car shortage question from a number of standpoints, the remedy for it would not come altogether from an increase in what are called terminal facilities, unless these facilities were made most extensive. If the Pennsylvania Railroad, for instance, should provide a storage bin at its Greenwich pier to hold 10,000 cars of coal, it would only be a few weeks until these cars would again be reloaded, and be used as storehouses, and the mines just as short of cars as they may be now. This, of course, is an extreme illustration, but it embodies a principle that applies generally, not only to coal, but to ore, grain, hay and other commodities shipped in bulk.

There is no doubt that at certain points, and for certain commodities, enlarged facilities are needed to take care of current commercial wants. One of the most effective means of lessening the car shortage, with or without the increased terminal facilities, is the regulation and control of the loading of traffic for a given destination. This regulation should take place before the cars are exhausted and the yards and side tracks blocked. It is recognized that no officer of ordinary authority could be expected to discharge this function in an efficient manner; hence the suggestion that an officer, ranking next to the President—say the Senior Vice-President—should be held responsible for the regulation of traffic and also for the movement of cars. His efficiency would be still more pronounced and far-reaching if he were a member of the Board of Directors.

While he would increase the movement of cars and the volume of tonnage, he would also, through his acts as traffic regulator, lessen the expenses of the operating department. Being responsible for the tonnage moved by the equipment, which means revenue to the company, he would naturally have an active interest in providing facilities of all kinds that would expedite the movement of cars on the road and the handling of freight at terminals. Therefore, he should also be the main factor, after the President, in determining when and where facilities should be provided. A Vice-President on a large railroad, with the responsibilities named above, would have duties extensive and urgent enough to require his exclusive time, and the other executives could handle the rest of the business, as is now being done.

Another change that would help the movement of cars is "decentralization." For years the authority of the division officers has been gradually taken from them and centralized at headquarters. The effect has been most pernicious, not only as to the development and economical handling of the tonnage, but also as to the development of men for higher places in the service.

The Division Superintendent's powers should be enlarged, and he should have final authority on improvements involving moderate expenditures.

Another administrative defect is the rebilling of freight at transfer or junction points. This should have long since been abolished. There is no reason why a car of bulk freight should not go from point of origination to its final destination on one bill, and the bill, which accompanies the car, carry on its face sufficient information to enable the agent at destination to make prompt delivery.

When the delays in waiting for bills at junction and transfer points, and at destination, are wiped out, a great many cars will be put into active service. D. F. MAHONEY.

Working Regulations for Boston & Maine Enginemen.

In connection with the recent increase of pay of enginemen on the Boston & Maine a new code of rules was adopted governing the conditions under which these men are to work. As this code represents a good example of such a document, revised in the light of recent experience, we reprint it in full, with the exception of the first six sections, which have to do with the rates of wages. These rates are classified for: (1) Consolidation engines; (2) engines of other types not in passenger service; (3) switching engines; (4) all other classes. The day's run is 100 miles or less, except on local freights, where it is 75 miles or less.

7. Whenever engines of different classes are used during parts of day's work the higher rate will be allowed for day's work.

8. In case of emergency, and a regular engineer is called upon to do extra work, between his regular laid-out day's trips, or before registering off duty, he will be allowed 10 miles for less than 10 miles, or less than one hour; 50 miles for 10 miles or over up to 50 miles, or one hour or over up to five hours; all over 50 miles or five hours he will be paid as per articles in schedule covering classification of pay. It is understood this will cover emergency work en route, the time consumed to be deducted from the overtime made outside of scheduled or assigned run. A regular engineer called after registering off or during his lay-off to do extra work will be allowed one day for 100 miles or less, or 11 hours or less as per class of engine employed on.

Regular engineers will not be called upon to do extra or emergency work when extra men are available.

9. The mileage of freight trains each way between Springfield and White River Junction and round trips, Northampton and Oakdale, Woodsville and Berlin, Newport and Woodsville, Lyndonville and White River Junction, shall be 150 miles, first hour's overtime to begin 15 hours and 31 minutes after commencement of day's work.

10. In computing overtime it is understood that 30 minutes or less will not be counted, 31 to 60 minutes to be reckoned one hour, and so on for each additional hour. Overtime to be allowed when the hours exceed the miles, figuring 10 miles to equal one hour.

11. A day's work for engineers will begin at time of registering on duty 30 minutes prior to the ordered or scheduled departure from engine house, and shall end when registering off duty immediately after engine is delivered back in engine house, or into care of some person appointed to take charge of same at end of trip.

12. Callers will be provided for all extra men, also all regular men going on duty between 11 p.m. and 7 a.m., if requested. Spare engineers will be required to live within one mile of engine house, and no regular men will be called beyond that distance. Extra men on call will stand first in first out, if qualified. Callers will be furnished with a book showing names of engineers, when and for what trains wanted, and engineers will be required to sign same when called.

13. Hostlers will be provided at Boston, Fitchburg, East Deerfield, Troy, Mechanicville, Rotterdam, Bellows Falls, Worcester, Nashua, Rochester, Springfield, Northampton, Portland, Manchester, Concord, West Lebanon, Woodsville, Lyndonville, Newport, Sherbrooke, Plymouth, Greenfield, Ayer, Lowell, Salem, Portsmouth and Lawrence.

Hoisting of engines shall consist of receiving them on a designated track near engine house, cleaning fires, sparking, taking fuel, water, sand, filling signal lamps, headlights and cleaning reflectors. This will not relieve engineers from properly inspecting, so far as they can see without going under engine, and reporting all necessary work in book provided at engine houses for this purpose. At Boston Terminal engineers in local passenger service making less than 100 miles per day will take their fuel between trips when fuel shed is located between train terminal and ash pit.

14. Engineers charged with a misdemeanor shall have their case investigated promptly and if found innocent will be paid for time lost; if guilty, they will be informed promptly of the decision arrived at. A representative of the Motive Power Department will be present at all investigations in which engineers are concerned. In case of discipline, right of appeal will be granted if exercised within 30 days.

15. Vacancies will be filled in order of seniority, everything else being equal, within 30 days, the same to be advertised within 10 days for 10 days on the bulletin boards of the division and to be assigned within 10 days thereafter. In case a train is advertised and not bid in, it shall be readvertised every 30 days and recovered from the board, it being considered a vacant run until it is bid in.

All new trains will be first advertised as temporary and remain as such until it is evident they are to be permanent or until the change of time-table. After an extra train has run continuously for 60 days it will be advertised.

16. Switchers will not be advertised. All vacant switchers will be filled by the oldest engineer making application for the same. Vacant permanent switchers will be assigned to the oldest man applying within 30 days from date of vacancy. New switchers will be assigned to the oldest man applying within 60 days from date of vacancy. After the expiration of above limit of time, the first man applying will be assigned. If a road man becomes disqualified, he will be allowed to take any job held by a younger man in switching service. Men who are superseded on account of men becoming disqualified or their switcher taken off will be given seniority rights in switching service. It is understood that a disqualified man will be given the youngest qualified man's job, provided he can get no other through seniority.

17. When engineers have been on duty 16 consecutive hours, they shall not be called on again for service until they have been off duty 10 hours, except in cases of emergency.

18. Engineers attending courts, inquests, etc., by order of the company will not be subject to any loss of time or compensation. If on lay-off day, they will receive regular rate of pay; will, if at home terminal, receive one-half day for five hours or less; over five hours, one day.

19. Extra engineers called for duty and reporting at engine house will be allowed three hours' time if train is canceled and will stand first out; three hours' time will be allowed all regular men whose train is canceled after reporting at engine house. When engineers cross the table with engine, one road day's pay will be allowed.

20. Engineers failing to complete a day's work on account of sickness or any other cause of their own will receive only proportionate pay.

21. Engineers will not be expected to do any repairs, pack boxes or inspect nettings and ash pans on engines putting up at points where repair men are employed.

22. When a train is pulled off (exclusive of temporary trains) the men affected shall have their choice of trains, if exercised within 10 days, according to their age in the service as engineers, everything else being equal. Men who are superseded by those whose train has been pulled off will be entitled to the same privileges. When temporary trains are continued as permanent runs, they shall be readvertised. When temporary runs are mixed in with permanent runs and the temporary runs are taken off, the permanent runs will revert back to the original engineer.

23. When the initial point of a train is changed, a round-trip run changed so that the run does not return to its initial point every day, or part of a run taken away, the man holding the same shall have the first right to it, but if given up it shall be advertised. The man giving up the run shall have his choice in trains, if exercised within 10 days, according to his age in the service as engineer. The words "or part of a run taken away" will not apply unless his earnings are decreased 20 miles or more, his length of day increased two hours or more, or, if in passenger service, a part of his run changed to freight. That clause will apply when a day run is made a night run, although the length of day may not be increased two hours or more. Where special arrangements are made on runs covering change of time-table, that part is not effective.

24. Switch engines running regular trains will receive road pay for same. Switch engines having to go outside of yard limits will be allowed a road day's pay, 10-hour day to apply.

25. Engineers will not be required to work in the engine house. When called for emergency duty they will be allowed 10 miles per hour at standard rate of pay; 100 miles or less, one day.

26. Engineers called and making short mileage will, if requested, remain at engine house subject to further mileage to finish the day or 100 miles.

27. Engineers called for emergency duty and sent out on the road will be allowed actual miles made, house and road miles inclusive; 100 miles or less, one day.

28. Engineers on emergency duty five hours or more will only be used on short mileage to finish the day, except in case of necessity.

29. Engineers called for emergency duty and sent out on a regular man's job will be allowed the man's pay and house time, inclusive.

30. Engineers who voluntarily leave the service and are subsequently re-employed will rank as new men.

31. Engineers transferred permanently from one division to another at their own request shall be listed as new men. If transferred by the proper officials on account of transfer of traffic, etc., they shall retain seniority rights.

32. In case of a surplus of extra men so that they are not getting reasonable weekly wages, the force shall be reduced in the reverse order of seniority.

33. Engineers doubling hills or going after water or coal on account of conditions beyond their control will be allowed mileage in addition to trip.

34. Engineers will be allowed half mileage for deadheading over the road on company's business.

35. The Superintendent of Motive Power will furnish the committee annually a seniority list of engineers on each division.

36. Through freights will not be required to do any switching at terminals or at any other points where switchers are employed, except the regular setting out or taking in of cars.

37. All road mileage will be based on actual distance as given in official time-table. When this distance terminates in a fraction, five-tenths of a mile or less will not be counted; fractions over five-tenths will be reckoned one mile. Shifting miles in road service will not be considered in computing pay of engineers. All mileage made between Fitchburg and East Fitchburg, Worcester Union Station and engine house, and Northampton Passenger Station and No. Tower Yard will be allowed.

38. All trains loading and unloading freight or doing switching shall be classed as locals. This will not apply to trains making less than six stops to take on or set off cars, requiring less than 11 switches at the five or less stops, exclusive of the necessary switching on account of placing air-brake cars for use to handle train, or, when necessary, freight may be unloaded at not more than three of the stops.

Trains consuming more than 30 minutes icing beef shall be classed as locals.

The present practice of handling caboose cars will continue and not be considered switching.

A switch is defined as follows: The setting off of cars from two places in train or taking on a car or cars not ahead on one track.

39. In case an engineer is off sick for six months and no immediate prospect of his return to work, his train shall be advertised as a permanent run; should he be able to resume work he shall take his train, but in the event of his train being discontinued in his absence, he shall retain his seniority rights. The man superseded will be covered by Article 22.

40. Seniority will cover all spare men on their respective divisions. When the spare list is reduced at any point, the men affected will have the right (if exercised within 10 days) to spare work at any point where there are younger spare men. When the spare list is increased at any point, spare men at any other point will have the right to spare work at that point (if exercised within 30 days).

41. Engineers may be granted leave of absence for a period of six months, provided proper notice of the same is given, and this can be done without impairing the interests of the company, and his run shall be advertised as a temporary run. If at the expiration of six months he does not report for duty, his run shall be readvertised as a permanent run.

42. Switch engineers will be allowed one hour for meals between the hours of 11.30 and 1.30 day or night, or not earlier than 4½ hours, or later than 6½ hours, after commencing work. If required to work during the time specified, 30 minutes will be allowed for meals with one hour additional pay.

43. Engineers bidding off trains running over any part of the division which they are unfamiliar with will learn these parts at their own expense.

Engineers whose trains are changed or extended on to parts of the road which they are unfamiliar with will have pilot furnished or time allowed to learn the road at company's expense.

When a division or part of a division is merged into another division or trains are put on to run over two or more divisions of the road, a pilot will be furnished or time allowed to learn the road at company's expense.

Spare men, so as not to lose their turn, will have pilot furnished or time allowed at company's expense to learn parts of the division which they were not required to learn before promotion or which may have been merged since their promotion.

44. Seniority of engineers will date from the day they are regularly assigned to the service as an engineer in accordance with the seniority rule of promotion, it being understood that if through no fault of his own he is not assigned when due, he will be given the seniority date of the first younger man assigned and the older man will be assigned as soon as possible. When two or more men are assigned the same day, their names will be placed on the roster according to their length of service on locomotives of this company. When two or more men enter service the same day and are assigned the same day, their names will go on the roster alphabetically.

45. Engineers on trains receiving a day's pay in one direction who are required to take rest, thereby losing their opposite trip, will be allowed to deadhead at the company's expense to the opposite terminal so as to be ready to take their train next trip.

46. Freight crews receiving a day's pay in one direction, if held at other than home terminal, will be paid at through freight rates after 12 hours. This will not apply to men whose runs are scheduled for a layover of more than 12 hours.

47. When trains are run over two or more divisions, the trains will be awarded so that the mileage made by all the interdivision trains will be equalized as near as possible.

48. When time made by engineers is not allowed as per time slip, it shall be returned to them for correction.

On the New York, New Haven & Hartford all men in engine or train service are required, in every case where they have been on duty 16 hours, to lie off at least eight hours for rest; but they are not to be taken out of service until arrival at a terminal. This rule has been in force about a year and a half, and is now satisfactory both to the men and to the company, although some of the men at first made objections.

On the New York Central an order has been promulgated that engineers, conductors and trainmen after completing a trip taking more than 12 hours and less than 16 hours, must take not less than eight hours off duty for rest. When they are on duty more than 16 hours up to 18 hours, they must take 10 hours off duty for rest. Engine house foremen and yardmasters are required to see that this rule is carried out and report to superintendent any violation thereof. On arrival at terminals, all engineers, conductors and trainmen are required to report the number of hours they have been on duty.

The New Union Station of the Gould Lines at Little Rock.

The St. Louis, Iron Mountain & Southern is building at Little Rock, Ark., a new passenger station to replace the old wooden structure which had so long done duty at that place. It will be a union station for joint use with the St. Louis Southwestern, as heretofore. Besides the main line of the Iron Mountain, branch lines to Ft. Smith, Ark., and to Alexandria, La., center at Little Rock. It is also the headquarters for the Southern District of the operating department. For the following brief description and accompanying plans we are indebted to Mr. E. F. Mitchell, Engineer of Construction of the Missouri Pacific system.



Elevation; Little Rock Union Station.

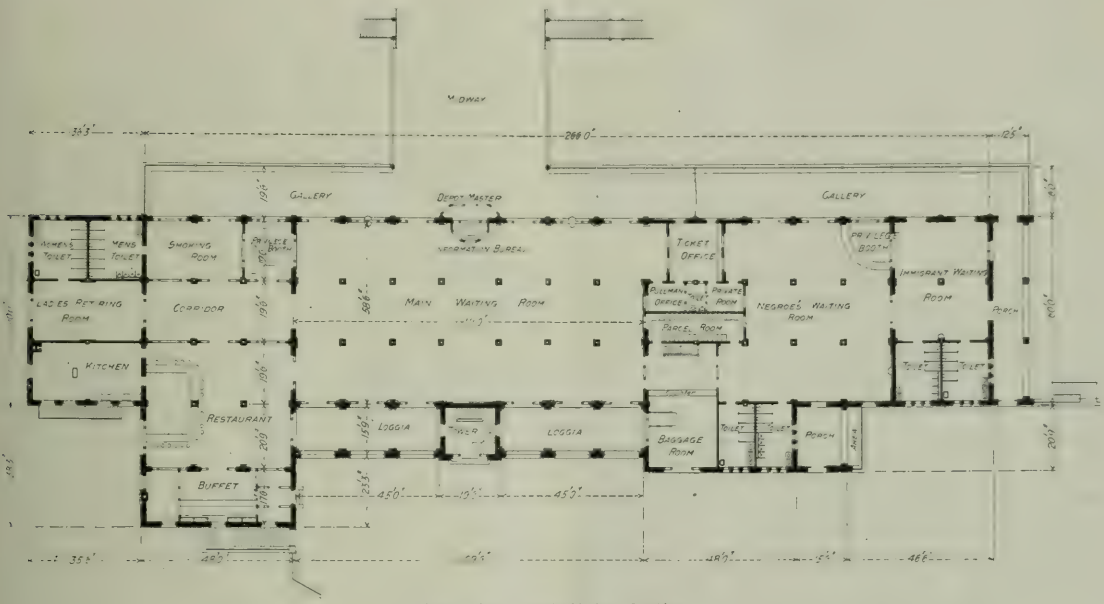
The building, which is two stories high, with a basement and attic, and a tower 120 ft. high, will have its main front toward the city. The building will be 315 ft. long by 60 ft. wide at the ends and 78 ft. wide through the central portion, and will have an ell at the west end 48 ft. wide and 23 ft. long. It will be built of gray pressed brick with Batesville stone trimmings and the roof will be of red tile.

The surroundings and topographical conditions were favorable to an elevated station and that type was chosen. The floor of the

basement is at the track level and the floor of the main waiting rooms is approximately at the level of the main streets approaching them, which merge into a plaza on the southerly side of the building opposite the tracks. From the main floor level a covered "midway" bridge extends over the passenger tracks and platforms, which are reached by easy stairs. Four passenger platforms, covered with umbrella sheds, will be built, each 1,200 ft. long, extending 600 ft. each way from the center of the "midway."

The basement floor, which is at the track level, will be occupied by the baggage rooms, express rooms, commissary, store rooms and kitchen. The main baggage room at the west end of the building is reached by a street approaching from the south at a lower level than the main traveled streets leading to the passenger entrance of the building. The express room at the east end is reached by an inclined driveway from the main streets.

In the central part of the first or main floor is the main waiting room, 110 ft. x 57 ft. It is entered from the plaza through a loggia



Plan; Little Rock Union Station.

14 ft. deep, extending its full length. This room will have marble tile floor, marble wainscot, plastered walls, and the exposed woodwork will be oak. At the west end of this floor is a ladies' retiring room and toilet room, and a smoking room and toilet room for men; also the restaurant and kitchen. On the east of the main waiting room are the railroad and Pullman ticket offices, parcel check room and receiving room for baggage, the latter having a chute to the main baggage room in the basement. Beyond these, in the east end of the building, is the waiting room for negroes, 45 ft. x 57 ft., and for emigrants, 32 ft. x 57 ft., each having toilet rooms. Along the northerly side of the main floor is a gallery 16 ft. wide, connecting with the "midway," on which center the station master's office and the bureau of information.

The second floor of the building will contain the offices of the general superintendent, division superintendent and the operating department organization. A portion of the attic will be finished and used for record rooms.

The foundation of the building has been completed and work is under way on the superstructure and on the retaining walls. Theodore C. Link, St. Louis, is the architect, and the contractor for the superstructure is the Murch Brothers Construction Company, of St. Louis. The foundations were built by Westinghouse, Church, Kerr & Co., New York.

An engineer of the firm which furnishes electric locomotives for the Simplon tunnel says that at a speed of 50 miles an hour in the tunnel the air resistance absorbs 400 h.p., or 40 per cent. of the capacity of the locomotive, against 95 h.p. in the open air. There has been a great falling off of passenger traffic through the tunnel since the Milan Exposition, but such an increase in freight that the number of freight trains has been increased from two to four.

The New Canadian Sunday Law.

The act respecting the Lord's day, which was passed by the Canadian Parliament last summer, and which goes into effect on March 1, is, in some respects, quite stringent, and in forbidding all persons to carry on any business on Sunday (with certain exceptions) appears to make unlawful the running of freight trains for 24 hours, 12 to 12; but the exceptions are numerous. Any person may do any "work of necessity or mercy," and some of the things included in this term are named. Among the things which these exceptions permit to be done are: transmitting telegraph and telephone messages; maintaining fires in furnaces where a stoppage would produce serious injury; necessary work in supplying electric current, light, heat, cold air, water and gas; the conveying of travelers; the continuance to their destination of trains and travelers in transit when the Lord's day begins; loading and unloading merchandise on or from passenger boats or passenger trains; emergency work on railroad tracks and clearing them of snow or ice; yard switching before 6 a.m. and after 8 p.m.; loading or unloading ocean going vessels to prevent serious delay; loading or unloading grain, coal or ore vessels before 7 a.m. and after 8 p.m. after the 15th of September; the conveying of mails; the operating of interprovincial or international street cars for passengers on any line now regularly operated; any work which the railway commissioners may deem necessary to permit in connection with railroad freight traffic. This last clause in full reads: "Any work which the Board of Railway Commissioners for Canada, having regard to the object of this Act and with the object of preventing undue delay, deem necessary to permit in connection with the freight traffic of any railway. The costs of all applications to the Board under this paragraph shall be borne by the applicant, and, if more than one, in such proportions as the Board determines. Notice of application, in which the reasons to be relied on shall be fully set out, shall be given to the Department of Railways and Canals. In all other respects the procedure under *The Railway Act*, 1903, shall, so far as applicable, apply." Except in emergency, employees doing work on Sunday in the telegraph or telephone business or in any industrial process, or in connection with transportation, must be allowed 24 consecutive hours off within the next six days; except that men working in industrial processes not over eight hours a day shall not be subject to this section. Section 5, forbidding games and performances where an admission fee is charged, has a clause including in these any free performance where a fare—as a street car fare—for riding to the performance, includes a charge—direct or indirect—for seeing the performance. The fine for violation of the Sunday law is to be from $1 to $40, and an employer who authorizes or directs unlawful acts may be fined from $20 to $100; corporations are liable to still larger fines. Prosecutions for violation of the law must be begun within 60 days after the offense.

The Harriman Investigation.

The following are extracts from the testimony of E. H. Harriman, President of the Union Pacific, before the Interstate Commerce Commission in New York on February 25 and 26:

THE UNION PACIFIC'S INVESTMENTS.

Mr. Kellogg (the Government's attorney): Now, you have not been buying securities, you say, for speculation? A. That is right.

Q. Then do I understand that the stock of the Illinois Central, of the Baltimore & Ohio, of the Chicago & Alton, of the New York Central, and the North-Western and the St. Paul are for permanent investment or control? A. They are certainly not for control.

Q. Are they for permanent investment or for sale again? A. They are for income from the proceeds, reinvestment of the proceeds of the Great Northern and Northern Pacific.

THE CHICAGO & ALTON.

Q. The Alton was bonded at that time, at the time you bought it, for about $8,500,000, was it not? A. Something like that; eight and a half or nine millions.

Q. Yes; somewhere about eight and a half or nine millions. You immediately placed a mortgage of $40,000,000 upon the property, did you not? A. Yes, and sold $32,000,000 out of it.

Q. You sold those $32,000,000 of bonds to the stockholders for $650 a bond, did you not? or sixty-five cents on the dollar? A. That is right.

Q. And this syndicate [including Mr. Harriman, Mortimer H. Schiff, George J. Gould and James Stillman] got substantially all of the bonds, all but about $436,000? A. Was it that syndicate? I think there was a subsequent syndicate formed, composed of 100 different individuals.

Q. No; I think the bonds were divided among that syndicate. A. That is, they were divided with the stockholders, whoever they were.

Q. Ten million of the bonds were sold for 96? A. I think they were.

Q. And thereby the stockholders, you gentlemen, reaped a profit of over 300 a bond? A. On your statement that is correct.

It was next brought out that out of the proceeds of the $32,000,000 bond issue an extra dividend of $6,669,180 was paid to the four gentlemen on their old Alton stock.

There was an item of $970,000 paid out on coupons of some prior lien bonds of the road, which suddenly seemed to have jumped from one side of the ledger to the other. Mr. Kellogg wanted to know how a debt of the company suddenly became an asset to swell its capital. Mr. Harriman said that he couldn't explain it.

"There must have been some mistake about it," he said. "I think it was carried during the time as a matter of interest on the books of the company by some mistake."

Q. Do you think that it would creep into the assets of the company from its debts without your knowing it? A. It evidently did in that case. It got there some way or another on your statement.

Following this came another mistake of the books, as Mr. Harriman put it, by which the sum of $12,444,177 did some jumping. There was no surplus at the time, but Mr. Harriman explained that when he got the Alton the finances needed readjusting. He said that this sum had been paid out on the road from the income, and that by the "readjustment" half of it had been paid back to the stockholders in the form of this extra dividend.

Q. Immediately after you got the property there was charged in the accounts of the company $12,444,177.60, construction, expenditures uncapitalized. Is that true? A. I presume that is just what is referred to.

Q. Is it not a fact that from year to year during the management of the prior Chicago & Alton whatever had been charged against its income and spent upon the road had been closed each year by the Board of Directors? A. I presume so; but under the former management of the Chicago & Alton the whole territory served by the Chicago & Alton was drying up very fast and so was the railroad itself.

Q. It certainly has not dried up since? A. No, sir; it has not.

Q. There is water enough to satisfy everybody? A. Yes, and business enough to satisfy.

Q. Would you think distributing $6,669,000 as a 30 per cent. dividend to the stockholders who had already had 8 per cent. would prevent it from drying up? A. Combined with the other methods of financing which were adopted by the Chicago & Alton, yes.

Q. The 30 per cent. dividend was paid on May 7, 1900, soon after the acquisition of the property by the syndicate, $6,669,180? A. Yes, it was 1899. I guess that is right.

Q. Now, $12,444,000 was money which the Chicago & Alton railroad had spent on betterment or improvements of its property during a long period in the past, back in 1898, was it not? A. No doubt about it.

Q. Or money which the original stockholders had lost in their investments, isn't that true? A. What difference does it make whether it is original stockholders or stockholders then in existence?

Q. Do you think that money lost twenty years ago should now be paid? A. I only know that the road cost a good deal more than the capital, and the Directors decided to reimburse the stockholders in this amount.

Commissioner Prouty: You and three other men bought $32,000,000 of bonds at 65 and with the proceeds declared a dividend of 30 per cent., and some of the remaining $8,000,000 of the bonds were sold for 90 and 95? Do I understand it correctly? A. Yes.

Mr. Kellogg: Didn't you four men organize the Alton Railroad? A. I suppose we did. You are trying to show that we sold bonds for less than they were worth. Well, suppose that we did?

Q. Weren't all the bonds of the $22,000,000 issue sold to you four men? A. I don't remember.

Q. Didn't these 3 per cent. bonds that you sold to yourselves for 65 sell in the market for 93? A. Did they? Didn't know they went to 93.

Q. Then if you men got these bonds for $13,000,000 you made a profit? A. I suppose we did. That's what we bought the Alton for—not to lose.

Q. When you bought the railroad company it was capitalized at $39,000,000 par value? A. Yes.

Q. From that time until last October, when you got out, the capital was increased to $122,872,327? A. Yes.

Q. How much of this increase was invested in the property itself? A. I will tell you if you will let me; $22,500,000.

Q. Now, isn't the $60,000,000 water? A. Isn't any doubt about it.

Q. Do you consider Alton worth $40,000,000? A. Yes.

Q. And you don't consider the 3 per cent. bonds worth more than 65? A. That was a privilege granted to the stockholders.

Q. Couldn't these bonds have been sold in June for more than 65? A. I don't know; market conditions change.

Mr. Harriman: It seems to me that too much importance has been attached to what counsel calls overcapitalization. There has been expended on the Alton on improvements $22,000,000 or over. The income resulting from that improvement has increased from $5,500,000 in 1898 to $11,500,000 in 1906. That increase is because of expansion permitted by the improvements. The rates charged for freight were 30 per cent. greater in 1898 than in 1906; business has expanded threefold. If the same rate prevailed in 1906 as in 1898 the net income would be $2,250,000 more. The syndicate found itself in the position of having paid $42,000,000 for the stock and property, less $6,000,000 it received in dividends, or $36,000,000. Now, the return of about $1,600,000 a year is less than 4½ per cent. on the money invested. It would seem as though it was not a very liberal distribution, but we took all the chances of what the markets might be, and the common stock was somewhat in relation to what you might say discounting the future. In 1898 we were just beginning to emerge from the depression of 1893 and the shock of 1896. It was doubtful when we bought the Alton if we could sell our bonds at 65. The next few years made great changes in values. I want to say that I don't believe Alton could be duplicated for the amount of the bonds outstanding. Nearly 50 per cent. of the holders of the Alton preferred declined to sell, believing that it was worth more. The Rock Island wanted the Alton's line from Kansas City to Chicago. The Union Pacific was to co-operate with the Rock Island, using the Alton between Kansas City and St. Louis. It was not a stock transaction pure and simple, but a transaction which carried with it supposedly an alliance which would benefit the Chicago & Alton, the Union Pacific and Rock Island. As time went on, the Rock Island people seemed to have changed their minds. They did not use the Alton, and this precluded the Union Pacific from tying itself up with the line from Kansas City to St. Louis."

SALE OF SOUTHERN PACIFIC STOCK TO WILLIAM ROCKEFELLER.

Q. I notice that your statements show that since that time, since the acquisition of the other 150,000 shares in 1902, I believe, that at all times since either the Union Pacific or the Short Line has owned 900,000 shares of Southern Pacific common stock. Now, where did you get the 300,000 shares of stock that you sold to William Rockefeller on March 13, 1903? Is that a part of the 900,000 shares? A. Yes, sir. This was a reciprocal agreement between Mr. Rockefeller and myself. He was to have the privilege on the 1st of May, 1904, to deliver the stock back to us at the same price at which we sold it to him, and a reciprocal agreement on our part that we were to have the privilege to take it back. It was a protective measure pure and simple. There had been a syndicate or a pool formed in Wall street to speculate in Southern Pacific stock, and they were said to have acquired about 300,000 shares. They had appealed to the stockholders and had appealed to the courts, and had tried to get enough proxies with their stock to prevent us from continuing in the management of the Southern Pacific, and to force in some way a distribution to the stockholders, so that they could get a market for and sell their stock out to advantage. We were fearful that they might get a temporary injunction and prevent us from voting on the whole 900,000 shares of stock, and in order to protect us against such a condition we took this method of disposing of enough stock, we thought, that would enable us,

with the proxies that we might obtain from the other stockholders, to control the election as against this speculative syndicate. It was purely to protect the interests of the Union Pacific or Short Line stockholders. We wanted to get 300,000 shares of stock in the ownership of somebody who would act against the attempt of this speculative pool to control the property. The annual report of the Southern [Union, Ed.] Pacific was not approved by its Board of Directors until after November 12, 1903. It has been the custom of the comptroller to hold his books open until after the annual report has been approved by the Board of Directors. Now, then, when this stock was returned in November, on November 12, some six months prior to the time of the agreement at which Mr. Rockefeller was to have the right to return it to us, the comptroller made his entries as of June 30, 1903, and that was the reason that the 300,000 shares were not shown to have been disposed of during that year.

THE INTEREST IN THE SANTA FE.

In regard to an interview with Mr. Ripley or Mr. Morawetz, of the Santa Fe, Mr. Harriman said:

"It was in substance that we were to try to establish better relationship between all the railroads, in the line that we should deal more frankly with each other, more publicly and more frankly, and not operate our lines for the purpose of destroying each other, but for the purpose of helping each other, and for developing the territory served by each, and to that extent I even went so far with Mr. Morowitz as to tell him that as far as the Southern Pacific was concerned I would be willing to even put him on the executive committee of the Southern Pacific, so that he might know what our intentions were, if he chose to. After considerable talk on those lines, they concluded that they would give representation—not to the Union Pacific Railroad—for I cannot say that it was representation for stock that was owned by myself and some of my associates, but that they would elect to the Atchison board two men that were suggested by us, and to that end they elected Mr. Rogers and Mr. Frick."

Chairman Knapp: Was there any corresponding arrangement by which the Directors of the Santa Fe were elected to the directory of the Union Pacific?

Mr. Harriman: No, sir.

The Chairman: So that, in point of fact, up to this time there is no officer or director of the Santa Fe who is also a director of the Union Pacific, the Southern Pacific, or the Atchison?

Mr. Harriman: I think not.

THE SAN PEDRO, LOS ANGELES & SALT LAKE.

Mr. Kellogg: The San Pedro Railroad, from Salt Lake to California, is also under joint control, between the Union Pacific and Mr. Clark? A. Yes; but we built that road jointly with him.

Q. Jointly with him? You sold him 512 miles belonging to the Short Line company did you not? A. For the purpose of enabling the line between Salt Lake and Los Angeles to be completed quicker than it otherwise could have been.

Q. That is, you contributed to that line of railroad 512 miles; is that correct? A. Undoubtedly.

Q. Mr. Clark contributed some money and some railroad that he had been building? A. Yes, some insignificant lines.

Q. And you put into it a railroad, and the Union Pacific or the Short Line and Mr. Clark owned the securities jointly? A. Yes.

Q. You provided for a joint management? A. Yes; we developed a new railroad.

Q. And you brought the Southern Pacific into that with a contract? A. And opened new avenues of traffic.

Q. Yes, but they all lead to the same place, the Union Pacific? A. I hope so. The Union Pacific is quite capable of doing it.

THE ILLINOIS CENTRAL PRESIDENCY.

Some influence was exerted to change the president, was it not, after the acquisition of Illinois Central stock by the Union Pacific? A. Do you want me to tell you about that?

Q. I just want that question answered. A. I will tell you how the change in the presidency of the Illinois Central took place. In September, 1903, after I had been abroad about three months, on arriving here I was approached by several of the influential directors of the Illinois Central, asking me of the advisability of reporting certain acts of the president of the Illinois Central to its Board of Directors, with a view of having them request the president to resign at that time. I took steps to smooth over the difficulty which had arisen, and which showed that the president of the Illinois Central had been using his position as president to further his own personal interests. I prevented action by the Board of Directors at that time, in the interest of the president, and retained him in office, but subsequent to that he continued to act in the same line, and the Board of Directors of the Illinois Central, purely and simply from the interests of that company, took steps to relieve him from that position.

RATES, CAPITALIZATION, TRAFFIC AGREEMENTS AND CONSOLIDATIONS.

Commissioner Lane: Q. I would like your opinion upon this, Harriman: Why should the Union Pacific, as a railroad, be empowered or have the right, out of its credit as a railroad, to buy other railroads?. A. Mr. Lane, it is a pretty broad question and pretty hard to answer it offhand. It would require a great deal of deep thought. If we had not had the power to buy the Southern Pacific with the credit of the Union Pacific, the territory of the Southern Pacific would have been 10 years behind what it is now. If we had acquired the Northern Pacific, the Northern Pacific territory would have been 10 years ahead of what it is now.

Q. Then you think, also, if you acquired the Santa Fe you might improve that? A. That is a very different question. I believe we could. I believe under proper regulation and proper statutes, which would enable railroads to combine and establish lines upon which traffic could be moved at the least cost, we could reduce our rates; but just so long as we are prohibited by law from agreeing among ourselves, without the danger of being sent to state prison, you have this chaos that now exists. Just as soon as we can get laws that will enable us to combine and establish these lines, so that we can conduct the traffic on the lines of least resistance, at the least cost, we will then be able to reduce the charge and also to increase wages or to stand the increase in wages, and not before.

Q. What is the law that you would want that would bring about this beneficial result? A. A law that would enable corporations to make contracts between themselves, under proper regulations, just the same as individuals have the right to make contracts—contracts that would be standing and enforceable for a long term of years, so that it would enable railroads to establish these lines upon which traffic could be moved at least cost, taking various parts of the lines as they now exist. If there had been such a right the purchase of the Burlington by the Northern Pacific and the Great Northern might not have taken place.

Q. What competition would there then be between railroad lines? A. As I said, it should be under proper regulations. I do not think it is to the advantage of the business interests of this country to force business around on improvident up and downhill lines when there is a straighter and more economical line to be used. I do not mean to say that no business ought to be allowed to go over that line, because there are other conditions sometimes when the less fortunate line can do business to better advantage and at less cost; that is, in filling out its trains. But there should be some law—and I think the President of the United States had that in his mind when he sent his message to Congress last December; I do not remember his exact language—that there should be under some proper control, a change in the laws which would enable contracts to be made between railroads.

Q. As a matter of fact, there are perhaps 220,000 miles of railroad in the United States. Are there 2,000 miles that you know of that are actually competing in rates? A. I think every mile is.

Q. You know all the rates are made by bureaus and after consultation with each other? A. I don't know that. I know this, that in the struggle for business, the traffic managers of the railroads try to fill out their trains, and they take the business at the best terms they can get, as a rule, in order to do that. That is true even in your local business; that is, competitive business. There is not a point on the Union Pacific that is not competing with a point on the Atchison—that is, situated under the same conditions, although they may be 200 or 300 miles apart. If we are going to develop the traffic and the industries along our transportation lines, we have got to give the same service that exists at similar points on another railroad, or better service, no matter whether it is local or not.

Commissioner Harlan: I understood you to say that you thought it would be a wise thing to have a law permitting the consolidation of railroads. A. The combination of lines; I don't say consolidation of railroads.

Q. The combination of lines, rather, and that it would result in the connections to the roads and possibly reflect itself in the rates; that is, giving lower rates to the people. A. Yes.

Q. And that if such a law were passed you thought it would also be wise to have this Commission, or some other power, to review and pass upon the terms of such a combination? A. That is right, as to whether they were proper.

Q. Well, I understand you are looking forward to a time when there will be dividends on this common stock of the new Chicago & Alton? A. Well, I think if we had been able to maintain the same rate in 1906 and 1905 that was charged in 1898, that we would have been paying 8 or 10 per cent. or 11 per cent. on the common stock of the Chicago & Alton. We expected, by putting this new money into the Chicago & Alton, to give the territory tributary to it an opportunity to expand and to increase the volume of business that would pass over the Chicago & Alton; but the benefit was all absorbed in the reduction of the rate.

Commissioner Lane: Supposing you concentrated two or three roads more, you might take some other line and go right into New York? A. Suppose we had a line from New York to San Francisco—I suppose that is what you mean—would it not be a good thing—not that we have any idea of doing it, but would it not be a good thing?

Q. Supposing that you got the Santa Fe? A. You would not let us get it.

Q. How could we help it? A. How could you help it? I think you would bring out your power to enforce the conditions of the Sherman Anti-Trust act pretty quick. If you will let us, I will go and take the Santa Fe to-morrow.

Q. You would take it to-morrow? A. Why, certainly I would; I would not have any hesitation. It is a pretty good property.

Q. Then it is only the restriction of the law that keeps you from taking it? A. I would go on as long as I lived.

Q. Then after you had got through with the Santa Fe you would also take the Northern Pacific and Great Northern, if you could get them? A. If you would let me.

Q. And your power, which you have, would gradually increase as you took one road after another, so that you might spread not only over the Pacific coast, but spread out over the Atlantic coast? A. Yes; but hasn't your organization increased its power?

Q. It undoubtedly has. That is what I am coming to. Do you think the law itself should intervene there and should restrict you in your power to use money raised for railroad purposes and raised on railroad securities to the actual improvement of that railroad, or should you be allowed to use it for the acquisition of other railroads? A. I think we should be allowed to use it for the acquisition of othe railroads, under proper regulation.

As the law exists, railroads are prevented from consolidating or combining. Take the instance of the Burlington and Great Northern and Northern Pacific. It was not a good thing for the Northern Pacific and the Great Northern and Burlington or for the Northern Pacific and Great Northern to buy all the stock and eliminate from the situation 15,000 or 16,000 small stockholders. That is what they did. They turned those 15,000 or 16,000 small stockholders from stockholders into creditors, so that they were eliminated from the development of the business on the lines of railroad. They did not care anything about it so long as they got the interest on the bonds. Now, if we had some legal method whereby the Burlington and Northern Pacific and Great Northern, under some legal restriction, had been permitted to make contracts by which they could approximately have accomplished the same thing, it would not have been necessary to issue the $200,000,000 of bonds to acquire the Burlington stock, and the ownership of these securities would have been in the hands of the people, where I believe it is better it should be.

Q. And you want the powers of the company still further increased—— A. (interrupting). I cannot say that I do, unless we have our own powers increased.

Q. You want your powers increased so that you can combine, and you want us to have power in the first place to insure the rate? A. Yes, to regulate and go hand in hand with us.

There is no other country in the world where the business interests are so antagonized by the government as this one. In any other country in the world the government takes a practical interest in encouraging transportation facilities.

Mr. Harriman declared there should be no limits to the profits a railroad could make nor to the dividends it might pay so long as it kept up its property and maintained rates no higher than those given by other systems.

"What would you have us do with the money?" he asked. "Give it to the government?"

"No," said Commissioner Clements, "but there are several ways by which you might give it back to the shippers."

Operating Features of the Chicago Freight Tunnels.*

There are now 46 miles of tunnels completed, reaching beyond the Chicago river, north and west, and going under the river in 11 different places. Further extensions are to be made. The bottom of the tunnels is about 40 ft. below the street level. The tunnels now cover the territory from Erie street, eight blocks north of the river, to 16th street on the south, and from Lake Michigan to Halsted street, five blocks west of the river. Permanent track has been laid in 41.53 miles of the subway, and 39.67 miles of permanent trolley has been installed.

Except in several instances of steep grade where the tunnels are brought to the surface, the overhead trolley is the only means of motive power. On one or two of the grades mentioned a rack-and-pinion arrangement is used for safety and tractive power.

There are now in operation in the tunnels 65 electric locomotives and 590 cars. The locomotives are of several types, and were built by the Morgan Electric Machine Co., of East Chicago, the General Electric Co., Jeffrey Manufacturing Co., of Columbus, and the Goodman Manufacturing Co., of Chicago. The Baldwin Locomotive Works is now building still another locomotive for trial.

By February 1, 1907, all of the railroad passenger stations in Chicago were connected with the Post Office through the tunnels. Nine of the principal railroad freight houses had tunnel connections and others were being connected. Two coal-carrying railroads have special connections for carrying coal to the basements of downtown buildings. At present some 20 of the large buildings in the business district have their basements connected with the tunnels and have underground freight service.

The first freight business done by the tunnel company was the removal of earth from excavations in the preparation for the construction of new buildings. This is now an important part of the company's business. This plan has many advantages over the old method. In the construction of several large buildings all the earth excavated was lowered into the tunnels and taken to the dumping grounds, and new material for the foundations taken in through the bores, with no inconvenience to the public. By the tunnel method there was removed from one basement over 2,100 cu. yds. of excavation of 24 consecutive hours. The best record by teams in 24 consecutive hours, under similar conditions, is said to be 420 yds., and to do this the contractors were required to stop overhead work entirely. The tunnel method allowed the progress of overhead work without hindrance. Many of the newer buildings in Chicago are built with three- and four-story basements, so that the lowest basement is on a level with the tunnels. This offers opportunity for economical handling of coal and ashes and for loading and unloading merchandise. Where it is not practicable to sink sub-basements under buildings already built the tunnel connection is made by shafts, in which the cars are raised and lowered by electrically operated elevators. This is also the usual method of making the railroad freight-yard connections. From a railroad freight house tunnel cars are individually lowered into the tunnel by an elevator. The locomotive is not raised to the surface; the cars, when not easily movable by hand, are drawn to and from the elevator platform by a cable. Besides the coal and ash handling done through the tunnels, the freight yards and stores connected transfer much of their freight and merchandise in the tunnel cars. Merchandise trains are usually made up of seven or eight cars.

The tunnel company has for some time been transferring United States mail between the Post Office and the railroad stations, thereby permitting the removal of most of the clumsy mail wagons from the streets. Some trouble was encountered in getting this service into working order, which might be expected when the size of the undertaking is considered. Officials of the company are confident the service will prove satisfactory to the Government. In one day last month 772 mail trains were run. They carried 27,250 mail bags, 2,209 parcels and 63 packages. The report of earnings from the subway for the year 1906 gives the amount as $221,176, compared with $108,300 for the year 1905. The present year will probably see this amount greatly increased.

*Abstract of an article in the Western Electrician, Feb. 23, 1907.

Derailment of Pennsylvania Special—Report of Committee on the Cause.

On the night of February 22, about 11:42 o'clock, Pennsylvania Railroad train No. 29, the 18-hour express from New York to Chicago, was derailed on a curve at Mineral Point, Pa., about seven miles east of Johnstown, and three of the four cars fell down a high bank into the Conemaugh river, lodging in about two feet of water. The train had left Altoona about 40 minutes late, and is said to have been running at about 50 miles an hour. The number of passengers on the train was 54, and reports say nearly all of these were injured, but none fatally. The engine was one of the company's standard Atlantic type.

Mr. W. W. Atterbury, General Manager of the road, at once appointed a committee of three to investigate the wreck, determine if possible its cause, and report to him. The men composing this committee were Mr. A. C. Shand, Chief Engineer, Mr. L. R. Zollinger, Engineer of Maintenance of Way, and Mr. H. M. Carson, Assistant to the General Manager. Their confidential report to Mr. Atterbury has been made, and its text, given out in full by the company, follows. In accordance with the committee's suggestion, the 3,000 steel ties which had been installed as an experiment will be removed.

REPORT.

Mr. W. W. Atterbury, General Manager.

Dear Sir:—Your committee appointed to investigate the cause of the accident to train No. 29 west of Mineral Point, on the Pittsburg division, on the night of February 22, arrived on the scene about four o'clock on the afternoon of the 23d. Previous to our arrival No. 3 track had been rebuilt for the entire stretch and was in service. The wreck occurred on the section of track laid with experimental Carnegie steel cross-ties, the first indication of derailment being a point 287 ft. west of the east end of these ties, and on a 3¼ degree curve to the left. The track had been torn up from this point a distance of 1,244 ft., where the locomotive stopped.

[A plan is shown, from which it appears that the combination car stopped 594 ft. short of the locomotive, and that the other three cars fell down the bank to the right, lodging on their sides partly in the shallow water of the Little Conemaugh river.]

All of the wheels of the locomotive and tender were on the track,

according to the best evidence obtainable, except the two rear wheels of the rear tender truck, which were off the track and lying between the rails. The combination car remained on its trucks, although all the wheels were derailed. The high rail was found clear of the ties on top of the embankment. The outside bolt fastenings had been sheared and snapped off the entire distance of 1,244 ft., the point the locomotive stopped. As evidence of the force with which these bolts were broken off, some of them were found in the river bed about 200 ft. from the track. The steel ties were badly crushed. We also found that the inside clips on the low rail had been badly damaged by the derailed wheels, and these had also broken pieces out of the base of the rail at intervals, although it was not thrown out of its original position. At the point of the accident, the first splice bar ahead of the point of derailment, on the high side, was broken through the second bolt hole and bent outward by a lateral thrust.

We then went to Altoona, interviewed the engineer and fireman, and examined the locomotive and trucks in the enginehouse. The engineer's statement was that he had been making a good run down the western slope, but at no place was running at an excessive speed; and before striking the stretch of steel ties, he made an eight pound reduction of his air to steady the train, as was his custom. He states positively that before he appliled his brake he was not going more than fifty miles an hour, and record taken from the train sheet corroborates his statement. An instant after he applied the air, he felt the emergency go on and, thinking it was a burst hose on the train, released his air and looked back, when he saw the cars going over the bank. He reapplied his brake, and as soon as he stopped, got down to examine the locomotive, the fireman going ahead to flag the eastbound track. He found the two rear wheels of the rear tender truck derailed and between the rails and the brake beam down on the left side, pressing against the flange of the left rear wheel. The brake shoe, half the brake hanger and the brake head had been lost from the left side of the brake beam. The beam was supported on the right or high side by its brake hanger, and the shoe was in place. An examination of the locomotive in the enginehouse afterwards corroborated the engineer's statement, a piece of the brake hanger and part of the brake head having been subsequently found along the track, the brake head 500 ft. and the half of the brake hanger 264 ft. back of the point where the locomotive stopped. No part of the brake shoe has been recovered, although search was made for it. This is not surprising, however, considering the fact that the roadbed was badly torn up for a distance of five or six hundred feet and had been replaced. We afterwards made an examination of the brake beam and found that the end on the left side had been caught under the flange of the wheel, as the mark made by the flange plainly indicated, although the abrasions on the end of the beam were hardly sufficient to indicate positively that the beam came down at the time of derailment and had dragged the entire distance. It should also be noted that an examination of the two parts of the broken brake hanger, which was rectangular in shape and made of one piece of three-fourths inch iron, showed that one corner of it had been worn by the flange of a wheel at some previous time, although in this condition it was strong enough to withstand ordinary service.

It seems to be the impression of those division people who were first on the ground, that the accident was primarily caused by the brake beam falling down on one side. At the same time, it is impossible for us to definitely attribute the cause of the accident to that source. A portion of the torn-up track had been renewed with wooden cross-ties before we reached the ground and was in service for trains at slow speed, so that we are unable to definitely attribute the cause in any way to defective track. We made careful inspection of the track of steel tie construction ahead of the portion damaged by the wreck and therefore not affected thereby, a distance of about half a mile, and found it in first-class condition, all the outside clips being tight against the base of the rail, the bolts on the inside, with few exceptions, being tight, holding the clips in condition, the line and surface being as nearly perfect as it was possible to get track, and the whole mass of steel crossties frozen tight to the ballast and not the slightest indication of shifting in any direction whatever; nor was there the slightest indication of movement on the top of the steel crossties by any of the rails for the entire distance.

If the accident had occurred on the section of track laid with wooden cross-ties, it is our judgment that less injury would have been done to the track structure for, after the one pair of wheels of the tender of the locomotive was derailed, the bolts of the outside of the high rail were snapped off throughout the entire distance the tender was derailed; the rail on this side having been shoved out and off the end of the cross-ties. A large portion of this rail was simply lifted back into position and with new bolts and clips again placed in service, as there was little injury done to the steel cross-ties west of the point where the combination car stopped.

We are unable to definitely account for the cause of the accident, but the best reason for it that we can advance is, that at the point where derailment occurred some foreign material became wedged between the flange of the left rear tender truck wheel and the inside or low rail, which, on account of the rigidity of the steel ties and fastenings, and on account of the low temperature, the temperature being 12 deg. F. below zero, produced sufficient lateral force to shear the bolts on the outside rail. It is possible that this foreign substance was the brake shoe or a part thereof, which, as before stated, has not been found. We are informed that the usual inspection was made of the locomotive before leaving the enginehouse, and the gage of the wheels was measured in our presence after the accident and found to be correct.

We are of the opinion, on account of the lack of positive evidence as to the cause of this derailment, and on account of the fact that the damage subsequent to the derailment was more serious than would have been the case with wooden ties, that the remaining steel ties should be removed.

A New Form of Suspension for Contact Wires.

BY JOSEPH MAYER.*

There are two fundamentally different designs of overhead contact wires in use: copper wires suspended at distances of about 100 ft. and copper wires suspended from one or two steel ropes at more frequent intervals varying from 10 to 50 ft. Ganz & Co., Budapest, made experiments for two years with various kinds of rope suspension, but they adopted for the Valtellina line a wire without ropes. This did not prove satisfactory and ropes are reported to have been later adopted. For the Simplon tunnel approaches a double wire without ropes is used.

For the purpose of finding a satisfactory design it is advisable to investigate the reasons why all the designs so far adopted are defective. The sum of the strains from all the incident forces in any member of a structure should be smaller than the elastic limit of the material of this member. It can be shown that the designs so far used which have not proved satisfactory, even with the present limited speeds, and which will be still more inadequate with the maximum speeds of steam railroads, do not meet this requirement.

The strains in the contact wire arise from the following incident forces:

1. Weight of the wire.
2. Wind pressure.
3. Pressure of the sliding bow.
4. Resultant pull at the suspenders.
5. Changes of temperature.

The weight and the wind pressure produce over the whole length of the wire a tension depending in amount on the size of the wire on the deflection, and on the span. It is given by the formula, $T = \frac{PL}{8D}$ where T is the horizontal component of the tension in the wire with small deflections approximately equal to its total amount. L is the length of the span in feet and P is the total force per span acting on the wire normal to it. $P = L\sqrt{w^2 + p^2}$ where p is the weight and w the wind pressure per foot of wire. The deflection D varies with the length of the wire and depends on the tension and the temperature.

The tension is, however, not the only, or even the most important strain in the wire with the usual manner of suspension. The pressure of the sliding bow produces bending strains in the contact wire. For a 00 round wire the bending strain per square inch is approximately $s = 14{,}000\ \frac{Q}{\sqrt{T}}$ where Q is the pressure of the sliding bow and T the tension in the wire in pounds. For a 0000 round wire the formula is $s = 12{,}000\ \frac{Q}{\sqrt{T}}$. These formulas are approximately correct.

The most important bending strains occur at the suspenders. These are usually short clamps gripping the wire, which leaves them in a direction either horizontal or slightly inclined downward. Assuming at the end of the clamp a downward slope of the wire equaling the average vertical end slope of a flexible wire, the direction of the wire where it leaves the clamp is that of its position without wind pressure. Changes of temperature produce changes of the vertical end slope of the wire, and the wind pressure produces horizontal changes. With the usual clamps and with long spans bending strains are produced beyond the elastic limit of the wire, either alone or, at least, when the strain due to the tension is added. When a wire is fixed as in a clamp and exposed to a tension T, acting in the direction of the wire, and a force Q, normal to it, the wire bends downward. The bending strain where the wire leaves the clamp is approximately for a 00 round wire $s = 28{,}000\ \frac{Q}{\sqrt{T}}$; for a 0000 round wire $s = 24{,}000\ \frac{Q}{\sqrt{T}}$.

For long spans these bending strains produce alternately above and below and to the right and left, tensions beyond the elastic

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limit. They arise from changes of wind and temperature, and produce after considerable time fracture of the wire.

In a 00 wire with 200 ft. span and 4½ ft. maximum vertical deflection, the deflection with the temperature 140 deg. lower is 2.02 ft. The mean deflection of this wire is 3.26 ft. and the mean end slope of a flexible wire is 6.52 per cent. I shall assume that the vertical slope of the wire where it leaves the clamp is 6.52 per cent. so that there is no vertical bending with the mean vertical deflection. This wire weighs 0.4022 lbs. per ft., and the weight of the half span is 40.22 lbs. The tension in the wire at maximum temperature is 447 lbs., or 4,277 lbs. per sq. in. Where the wire leaves the clamp the vertical component of the tension is 0.0652 × 447 = 29.13 lbs. The clamp carries from one side 40.22 lbs. The force Q normal to the wire where it leaves the clamp is 40.22 — 29.13 = 11.09 lbs. (approximately). The bending strain is

$$s = 28{,}000 \times \frac{11.09}{\sqrt{447}} = 15{,}560 \text{ lbs. per sq. in.}$$

With maximum wind pressure normal to the wire the pressure is approximately 0.365 lbs. per foot, or 36.5 lbs. per half span. The tension in the wire is then 590 lbs. The bending strain due to wind pressure is $s = \frac{28{,}000 \times 36.5}{\sqrt{590}} = 42{,}080$ lbs. per sq. in. To this must be added the tension of 5,636 lbs. per sq. in. It is evident that the total strain is beyond the elastic limit of any copper wire.

The vertical bending downward of the wire at the maximum temperature has another effect harmful to it. The strain per square inch due to vertical bending at the end of the clamp is 15,560 lbs. The radius of curvature of the wire produced thereby is given by the formula $s = \frac{r\,E}{R}$ where r is the radius of the wire, R its radius of curvature and E the modulus of elasticity = 20,000,000 lbs. for copper. This gives for our case $R = \frac{0.1825}{15{,}560} \times 20{,}000{,}000 = 234.6$ in. = 19.55 ft. The sliding bow moves along the wire when the wire is convex upwards as in this case. The centrifugal force due to the curved motion increases the ordinary pressure of the sliding bow. This centrifugal force is $C = \frac{W}{32.2} \times \frac{V^2}{R}$ where W is mainly the weight of the sliding bow and of its rigidly attached parts moving in the same manner. G is 19.55 ft., V is the train velocity. The contact wire should on some roads be safe for a velocity of 80 miles per hour, or 117.33 ft. per second. Introducing these values in the formula we obtain $C = \frac{W \times 117.33^2}{32.2 \times 19.55} = 21.88$ W. W is at least two pounds. The total pressure of the sliding bow becomes so large that it produces bending strains near the clamp beyond the elastic limit.

From the foregoing it is evident that the wire should not be convex upward after leaving the clamp, or if so, the radius of curvature should be so large as not to increase the pressure of the sliding bow to a dangerous extent. The wire should leave the clamp in a direction approximately identical with the direction of the resultant pull which depends on the varying vertical and horizontal deflection. The wire must bend up and down and to the right and left, but this bending should be in circles of large radius so as to keep the bending strain within moderate limits. The radius of curvature of the wire where it is convex below should preferably be large enough to prevent the momentary breaking of contact between wire and sliding bow, due to centrifugal force, and the consequent sparking.

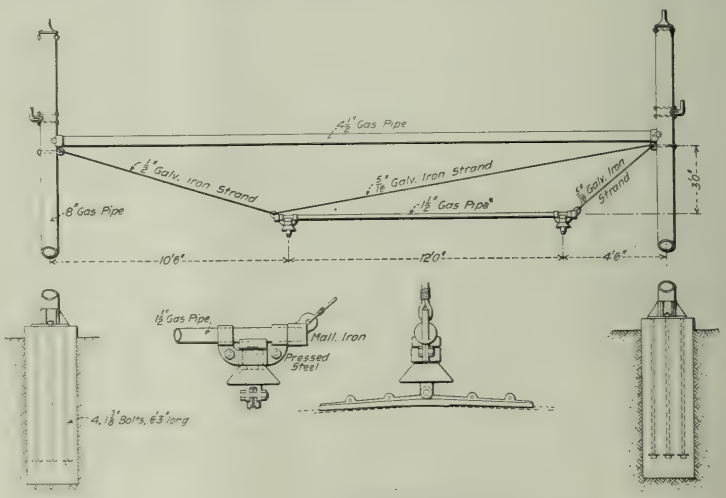
These ends are attained by the suspender shown in the drawing, which is a design for a suspender for a copper contact wire No. 00 (.365 in dia.) for a 250-ft. span with a maximum vertical deflection of 3 ft. It is suitable without the use of strain adjusters where the variation of temperature does not exceed 84 deg. Fahr. Where this variation is greater, as in most cases, it must be used in combination with suitable strain adjusters placed about a mile apart, by means of which the length of the contact conductor can be changed twice or four times a year so as to reduce the changes in length to the equivalent of a variation of temperature with one length of contact conductor of 84 deg. Fahr.

The suspender consists of two castings of malleable iron or other suitable metal, firmly bolted together. For the 6 in. in the center the sliding bow runs along the cylindrical bottom surface of the suspender, a radius of 5 ft. 2⅜ in. convex upward. It exerts an upward pressure on the casting and not on the wire. For ease in manufacture this central part of the suspender contains a straight horizontal channel 2 in. long wherein the wire is protected from contact with the sliding bow but does not touch the walls of the channel. Beyond the ends of this channel are two straight tubes each 2 in. long with a vertical slope equal to the largest vertical end slope of the wire, and a horizontal slope equal to that of the wire without wind. These tubes firmly grasp the wire. The bottom of the wire, 3 in. from the center of the suspender, is tangent to the cylindrical bottom surface of the suspender. The design here shown has for its essential feature the direction and position of the wire where it leaves this part, and the fact that the wire is firmly held to this direction and position and is protected from large bending strains due to the upward pressure of the sliding bow. This central part is substantially the same in its function, if not in its exact details, to the whole suspender of the usual designs.

The wire emerges from the central 6 in. of the suspender into two rectangular channels each 11 in. long. Here the sliding bow runs along the bottom of the wire and does not touch the bottom of the suspender, which is above the former. The upper walls of these rectangular channels are cylindrical surfaces which are tangent to the wire at points 3 in. from the center of the suspender. The radius of these cylinders is 44 ft. 6 in. The wire can therefore bend up to a circle of this radius. It will leave the suspender with a vertical slope at most ½ per cent. greater than the vertical end slope of a flexible wire in its highest position which occurs at minimum temperature with maximum wind pressure. The bending strain due to the vertical bending is 6,835 lbs., and never exceeds this amount. The two vertical walls of the rectangular channels are cylindrical surfaces with the same radius and also tangent to the wire at points 3 in. distant from the center of the suspender. The bending strain due to lateral bending is 6,835 lbs. per sq. in. The total bending strain due to lateral and vertical bending is 6,835 $\sqrt{2}$ = 9,668 lbs. per sq. in. This occurs with the maximum tension produced by weight and wind pressure at minimum temperature. The wind pressure is 21,475 lbs. per sq. in. The total maximum strain is therefore 31,743 lbs. per sq. in., which is well below the elastic limit of a hard drawn copper wire of this size.

The suspenders are alternately 3 ft. to the right and left of the center line of track. This causes a lateral deflection of the wire without wind of 6 ft. in 250 ft., or 2.4 per cent. This necessitates a corresponding lateral deviation of the center lines of the two halves of the suspender. The wear of the sliding bow is by this arrangement distributed over most of its length.

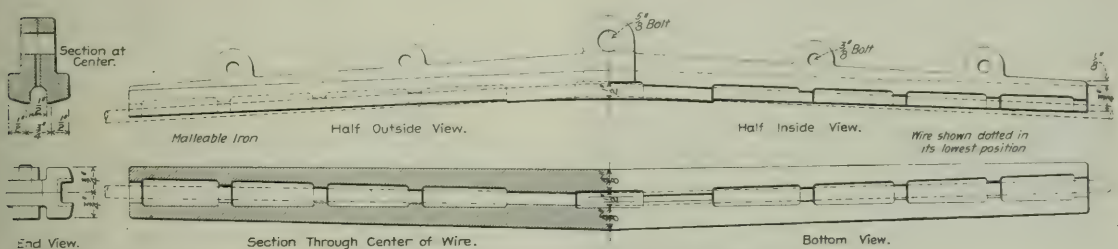
The design here shown saves carrying ropes and suspension frames at short intervals. The small round wire exposes little surface to the wind and the small weight carried produces small longitudinal forces in case of rupture; a very light supporting structure can therefore be used. With a special sliding bow the size of the wire required will be governed mainly by the conductivity needed. The wire most suitable for this design is a round wire since it receives the smallest wind pressure. A contact wire of the design proposed weighs about one-quarter and receives about one-sixth as much wind pressure as a grooved contact wire with double rope suspension for 300-ft. spans.



Detail of Supporting Structure.

The writer estimates that with steel construction about $3,000 per mile of double-track will be saved by this design, and that the cost of maintenance will be reduced in still larger proportion.

For lines of small traffic with moderate maximum speeds timber construction for the supporting structure is the cheapest method. A suspender similar to the one described, but designed for different end slopes, can be used with spans of about 200 ft. without strain adjusters. It will be cheaper and safer than the single or double catenary suspension. Spans of about 300 ft. can be used with strain adjusters. Smaller wires than with the present methods are practicable and safe with a special sliding bow hereafter described and by means of high voltage a cheap and safe design becomes possible. A single pole line with hinged brackets permitting slight motion of the suspenders in the direction of the line can be used or two-pole lines with span wires are suitable. One of the drawings shows a steel construction for 250 ft. spans suitable for double track. The two suspenders are hinged to insulator pins. These latter are fastened to 1½-in. gas pipes by means of insulators suitable for the voltage adopted. To the ends of these gas pipes three strands are attached connecting them to the two posts. These are 8-in. gas pipes, standing in and bolted to cast-iron bases, which are anchored to concrete blocks 2 ft. 3 in. x 2 ft. 3 in. x 7 ft. buried in the soil. The two posts are connected on top by 4½-in. gas pipes by means of malleable iron coupling pieces and bolts. On the top of the posts are insulators. On the side of each post is one other insulator for a telephone or signal wire. The feeders and other wires should be fastened to the insulators so that they can slide without excessive friction. In case of a derailment one post or a pair of them may be overthrown and all the wires of an adjacent span ruptured. The nearest contact wire suspenders will then swing away from the break and will increase the deflection of the adjacent spans of the contact wires and reduce their tension. The feeders and other wires will slide over the adjacent insulators and will spread the one-sided pull over several posts. To limit the disturbance caused by a derailment to a short distance, the strain adjusters should be firmly attached to bridges able to withstand the one-sided pull. All the wires should be firmly attached to the insulators at the posts carrying these bridges so that they cannot slide.



Detail of Suspender for High Speed Contact Wire.

Sliding Bow.

At high speeds the pressure of the sliding bow against the contact conductor varies with the degree of curvature of its motion. To make the bow move in a curve instead of in a straight line there must act on it a force having a component normal to the motion. This component called the centripetal force is given by the equation $C = \frac{W}{32.2}\frac{V^2}{R}$. W is the moving weight in pounds, V is the velocity of motion in second feet, R is the radius of curvature and C is the centripetal force in pounds. The greatest speed may be assumed at 80 miles per hour, or 117.33 ft. per second. If the sliding bow is not to leave the wire at the suspender where the radius of curvature is 44.5 ft. the upward pressure imparted to it must be at least equal to the centripetal force. This is $C = \frac{W}{32.2} \times \frac{117.33^2}{44.5} = 9.61$ W. A suitable sliding bow can be designed for W = 2.0 lbs. This gives C = 19.22 lbs.

The pressure between sliding bow and contact wire also varies with the rising and falling of the bow, which is generally held up by means of pneumatic pressure. When it rises the pressure on the piston overcomes the friction opposing the upward motion, and the remaining balance produces pressure on the wire. When the bow falls the pressure of the wire overcomes the friction opposing the motion of the apparatus and balances the air pressure. The pressure between wire and sliding bow is, therefore, much more when the bow falls than when it rises. Half the difference must be sufficient to overcome the friction and the friction should therefore be small. Other causes of variation of pressure between wire and sliding bow are the variation of air pressure and the nature of the mechanism between the air piston and the sliding bow.

The mechanism pressing up the sliding bow must be able, when the bow is near or at the suspender, to produce the centripetal force of 19.22 lbs. necessary to prevent the breaking of contact, otherwise the contact will be broken during about $^1/_{100}$ of a second at each suspender at minimum temperature with a speed of 80 miles per hour. The required pressure decreases as the square of the speed. At 60 miles per hour it is only 10.81 lbs., at 50 miles 7.5 lbs. At low speeds small contact pressures are adequate to prevent interruption of contact at the suspenders, even with smaller radii of maximum curvature of contact line than in the foregoing example.

The design of a suitable sliding bow proposed is not in its fundamental features original. The bow used in the Zossen high-speed experiments and that used in the Simplon tunnel are essentially, but not in their details, the same. They consist of a light part following alone the small and rapid undulations of the contact point, hinged and connected by means of springs to a heavier part following only the large and slow oscillations of the sliding bow. By means of this contrivance the weight of the light part alone determines the variation of contact pressure produced by the sharp but short curves of the contact conductor.

The light part should consist of one horizontal aluminum pipe of 1.315 in. outside, and 1.048 in. inside diameter, of 6 ft. 9 in. long. It is firmly attached to two radial arms 2 ft. 6 in. long, made of aluminum pipes of the same diameters; they are forced into hubs sitting loosely on a shaft. To this shaft spiral springs are attached which transmit the needed torsion to the radial arms for producing the desired contact pressure.

On the shaft, which runs in bearings at the ends of two poles, is a sprocket wheel which is turned by a chain going down to the hinge for the two poles, to another sprocket wheel turned by the piston rod of an air cylinder. The two main poles are held up to a sufficient maximum height by means of another air cylinder with piston, piston rod and crank.

Patents have been applied for on all the apparatus above described.

Supplement.

A defect in this investigation is its complicated nature and the necessity of trying a number of different maximum deflections for the purpose of finding the most favorable one. A number of trials with 0000 and 00 wires have shown that 300-ft. spans are quite safe, with 4 ft. maximum deflection with either 0000 or 00 wires, and that for 250-ft. spans a maximum deflection of 3.5 ft. will give much smaller maximum strains than one of 3 ft., and is therefore preferable. These results are important since the cost of the carrying structure is considerably reduced by the adoption of 300-ft. spans. Due to this fact I can safely assert that the cost of the carrying structure for double track here proposed is less than one-half that with designs using 300-ft. spans, two ropes per track and steel bridges.

The results summarized are as follows:

First.—0000 round wire, 300-ft. spans with strain adjusters. Maximum vertical deflection 4 ft.; maximum strain by tension and bending due to weight, wind, sliding bow and changes of temperature 30,315 lbs. per sq. in. The normal pressure of the sliding bow at slow speeds may vary between 21 and 42 lbs. without overstraining of the wire or sparking at the suspenders. The sliding bow must be 7 ft. 3 in. long center to center of radial arm. The suspender should be 2 ft. 6 in. long with a central portion 6 in. and two end channels each 12 in. long. The carrying structure may be either as shown in the drawing but with 4 ft. drop in the span wires, or a larger factor of safety may be used, resulting in 9-in. pipes for the two posts.

Second.—00 round wires and 300-ft. spans. Maximum vertical deflection 4 ft.; maximum strain in wire 30,400 lbs. per sq. in. The normal pressure of the sliding bow at slow speeds may vary between 23 and 35 lbs. Length of sliding bow 8 ft. 1 in. center to center of radial arms. The suspender needed is 2 ft. 6 in. long, with a central portion 10 in. long and two channels each 10 in. long. The carrying structure is the same as before.

Third.—00 round wires and 250-ft. spans. Maximum vertical

deflection 3 ft. 6 in.; maximum strain in wire 26,600 lbs. per sq. in. Sliding bow 7 ft. 3 in. long center to center of radial arms. The normal pressure of sliding bow may vary between 21 and 32 lbs.

Results Under Electrification in England.

The North-Eastern Railway, which has an electrified line from Newcastle to Tynemouth, carried during the last half-year 4,195,339 passengers, as against 3,548,206 in the same half of the previous year before electrification. The receipts from fares showed a corresponding increase, while working expenses decreased. At present experience of electric working has been so short that it is impossible to accurately calculate the depreciation chargeable, but it is hoped to be able to do so in a year or two.

The Timmis Bogie Lead.

The bogie or truck lead illustrated herewith was designed by Mr. I. A. Timmis,* of London, England, to do away with the nosing or hunting of a bogie truck caused by the fact that the center plate pushes it instead of pulling it. When a car is pulled at its leading end in the ordinary way it is free to turn on the center plates on which it rests. The trucks are thus swiveled at these points and are pushed by their center plates. Consequently, if the leading axle is driven, by any cause, to one side, the rear axle is apt to move in the opposite direction and hunting results.

In the Timmis arrangement the top center plate C (Fig. 1) is fitted to the body bolster in the usual manner and rests on an intermediate center plate C'; the swiveling is between these two plates. The plate C' is not, however, fastened to the truck bolster like the ordinary center plate but is smooth on the bottom and rests on the bolster plate A. The intermediate plate C' is free to move to a limited extent over the bottom plate longitudinally but cannot move laterally—all because of lugs that project downwards on each side and grasp the lower plate. The king bolt P fits easily in the holes through C and C', but the holes in A and the bolster are somewhat elongated, allowing the king bolt a slight longitudinal motion. The plate C' is also attached to the truck frame by the bars B and B', which end in slotted holes, allowing a limited longitudinal play. These tie the intermediate center plate to the truck. It is evident that, when the car body moves, both C and C' must move with it, and so must B and B', and the truck will be pushed at the leading end, regardless of the direction of the motion.

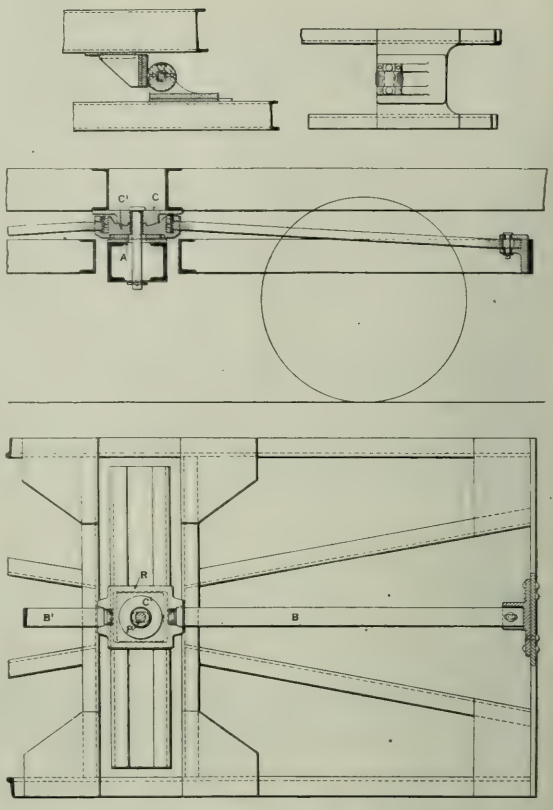


Fig. 1—Timmis Bogie Lead.

In another arrangement (Fig. 2) a roller is fastened at each end in the center line of the truck. Fitted to the car body underframe, close to each roller, is a quadrant, the face of which is struck from the center of the truck. It is made of hard steel and comes up against the roller. As the car body is pulled, the leading quadrant pushes the truck at its leading roller and the frame is thus pulled from the front instead of pushed from the center. A lead is thus given to the truck and it is claimed that all hunting is avoided. The roller has no play laterally because the side movement of the truck is restricted to its swing in passing curves, so there is but little wear on the quadrants and rollers. A roller in this position is needed to prevent wear, as the truck frame is constantly rising and falling.

This device is now in use on a number of roads in England and India, and it is claimed that it does away with much of the nosing. Two diagrams (Figs. 3 and 4) are presented herewith showing the horizontal motion of two cars running at the same speed, 42 miles per hour; one was fitted with the bogie lead and the other was not. In the case of the one with the bogie lead, the actual motion was about $^{3}/_{32}$ in. and in the other it was about $^{5}/_{16}$ in.

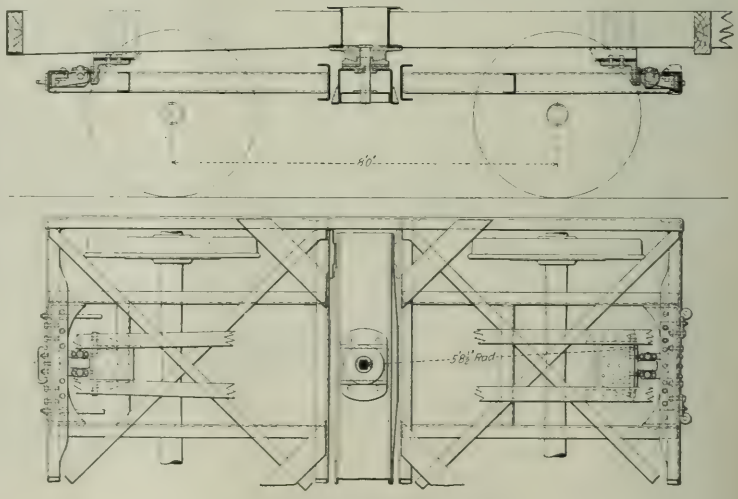


Fig. 2—Timmis Bogie Lead.

*Illius Augustus Timmis, M. Inst. C. E.: died Dec. 18, 1906.



Fig. 3—Diagram Showing Horizontal Motion of Car Without Bogie Lead.



Fig. 4—Diagram Showing Horizontal Motion of Car With Bogie Lead.

Government Report on the Block System.

On Saturday last the Interstate Commerce Commission sent to Congress its report on block signal systems and automatic train stops, which has been prepared in obedience to resolution No. 46, passed by Congress last June. This report consists mainly of (1) a table showing the mileage of railroad block signaled in the United States in September last; (2) a general report on block signal practice in the United States, including a brief chapter on history, and (3) a discussion of the feasibility of using, in general railroad service, an automatic stop like that used in the New York City subway and on a few other city railroads. The report sent by the commission to Congress is based on one made to the commission by B. B. Adams, Associate Editor of the *Railroad Gazette*, and C. C. Anthony, Inspector of Signals of the Pennsylvania Railroad, and the commission has also sent to Congress a copious appendix to Messrs. Adams and Anthony's report embracing brief technical descriptions of the principal signals and appliances used on the railroads of the United States, and some accident statistics.

The first part of the report, dealing with history and with the present practice on the block signaled railroads of this country, is made up largely of matter with which the readers of the *Railroad Gazette* are already measurably familiar, and its publication will be deferred to a future issue. The mileage table is reproduced on another page of this issue.

Below are those parts of the report dealing with automatic stops and other appliances not in general use, and those containing the conclusions and recommendations of the commission.

AUTOMATIC STOPS.

Automatic stops are in use on the Boston Elevated Railroad and on the express tracks of the New York City subway. Neither of these lines is interstate, but the applications are of interest as illustrating the practical working of automatic stops, although their use on steam railroads would unquestionably be attended with many serious difficulties not met with under the special conditions of city rapid transit lines. The devices used are practically the same on both of the lines named. An arm or trip is placed alongside the rail and so arranged that it lies below the top of the rail when the signal is clear and is raised above the top of the rail when the signal indicates stop. The trip, like the signals, is operated electropneumatically. On the cars are valves in the brake-pipes having levers projecting downward so as to come in contact with the trips when the latter are raised. The striking of a valve lever against a trip opens the valve, allows the air to escape from the main brake-pipe and so, by the regular working of the automatic air-brake, causes the application of the brakes on all the cars and the stopping of the train.

Another automatic stop was used on the elevated railroad at the World's Fair, Chicago, and, for several years, on two of the elevated roads in Chicago; it was also tried to a limited extent on a few standard railroads. This device included a trip and an air valve in the brake-pipe, but the design was quite different from that mentioned in the preceding paragraph and was made with more particular reference to the conditions on standard steam railroads.

A system that may be regarded as a modification of the automatic stop, and which has been tried by a few railroads, uses an electric circuit completed through a contact device placed near the rail to actuate the mechanism which shuts off the steam on the locomotive and applies the brakes of the whole train. With this system, however, it is in the power of the engineman to open the throttle and release the brakes as soon as the device has operated, so that he can prevent the train from stopping or can regulate the speed so as to make the stop at any desired point. Thus the apparatus performs the function of calling to his duty an inattentive engineman, while yet not causing excessively sudden or unnecessary stops.

Automatic stops, except those of the class last mentioned, act independently of the engineman and bring the train to a stop before they can be released. They are therefore in the nature of emergency appliances, intended to stop a train before it reaches a point of danger if the engineman fails to do this himself. Obviously the automatic stop must act at such a distance from the actual point of danger that the train can be brought to a stop by the brakes before reaching that point. And if, in the ordinary course of operation, the engineman is to bring the train to a stop before the automatic device can come into action, the stopping point must be arbitrarily moved back, and the signal erected at the point where the trip or contact for the automatic stop is placed. Ordinarily, then the engineman will stop at a point (the "home" or stop signal in its new location) a safe stopping distance away from the place where the stop signal is usually located; but if, for any reason, he fails to do so, the train will still be automatically stopped short of the point beyond which it cannot safely run. The automatic stop that can be released at once by the engineman does not necessarily require any change in the location of the signals. The actuating device would naturally be placed at the distant signal (the signal set 100 or 200 rods back as a warning that the stop signal is being approached). In case the engineman should fail to do anything himself towards stopping the train, the automatic appliance would make the stop short of the home signal. But, if the engineman is in possession of his faculties and is attending to the running of the train when the distant signal is reached, he can prevent an emergency stop and bring his train up to the home signal exactly as he could if the automatic stop was not there. A disadvantage of this is that the stopping device does not guard against miscalculation or the result of unforeseen conditions that may make it impossible for the engineman to stop as he intends; it is fully effective only in case he is asleep or dead, or for any other reason fails to act when he passes the distant signal. But by the use of a proper recording device, used in connection with the stop, to check the action of the engineman, this disadvantage may be in a measure overcome.

It seems clear, then, that an automatic stop, to provide for all contingencies, should be absolute; and, in that case, as already pointed out, there must always be a section of "dead" track in the rear of every danger point, or, with automatic block signals, moving trains must be practically one block farther apart than they need be under present actual practice. This means a very decided reduction in the capacity of the road; that is, the number of trains that can be moved over it in a given time—a condition that in extreme cases would necessitate a costly increase of track facilities. It is this serious loss in capacity of the road, and, in addition, inconveniences that would result from stopping trains at a distance from the proper stopping points, with many practical difficulties in the application and operation of automatic stops, that has prevented any use, in ordinary railroad service, outside the experimental field, of an appliance so desirable theoretically.

It is undeniable that collisions on our railroads could be reduced to an exceedingly small number by the efficient management of block signals as now used, including well-known, well-tested and generally approved safeguards; it is also unquestionable that an efficient automatic stop would prevent that last small percentage of such accidents as are due to the engineman falling dead at his post and other like causes.

OTHER APPLIANCES.

A considerable number of inventions, embodying cab signals, automatic stops and combinations of the two, have been brought to the attention of the Commission. Most of these indicate on the part of their inventors an entire lack of familiarity either with the practical conditions of railroad operation or with the present state of the art of signaling. Many violate a universally accepted principle that, in the electrical control of signal appliances, the closing of the electric circuit should be necessary for the display of the clear signal, while the breaking of the circuit, intentional or accidental, should result in the stop indication of the signal. Many appear to have merit, but in the absence of actual continued use or even extended trial on any standard steam railroad no very definite opinion concerning their practicability can be formed.

SIGNALING ON ELECTRIC RAILWAYS.

On electric roads, other than standard steam roads on which electric traction has been installed, the development of block signaling has been on quite different lines from those followed in steam road practice. Station attendants are of course generally lacking, and, without them the means of cheaply operating a simple manual block system has not been available.

Interurban roads of moderate length and attaining moderately high speeds have at first been operated without signals of any kind; dependence has been placed upon the time-table for the meeting of cars on single track, and when this has failed, by reason of certain cars losing time, it seems to have been deemed reasonably safe, in view of the low speeds and generally good view, to leave it to the motorman and conductors to use their own judgment in making passing places. This way of operating has naturally, however, proved unsatisfactory and the next step has generally been to place electric lamp signals at the passing places and to operate these signals by electric switches thrown by the conductors or motormen. With these simple appliances it is possible for the men in charge of a car, on passing a siding, to signal the movement of their car to the next siding against a car moving in the opposite direction.

Electric lamps have been used very generally in signals for electric roads, for day as well as night indications, because of the ample supply of current to operate them and their simplicity as compared with signals having moving parts and requiring motors of some kind to move them. Lights, however, can hardly make as effective day signals for high-speed movements as do semaphores or even discs.

The track circuit has hardly been considered as a means for the automatic control of signals on electric roads of ordinary character, because of the special and expensive construction necessary to make the track circuit reliably operative in connection with the heavy current from the car motors which must also traverse the rails.

Automatic signal systems have been used on such roads to a

limited extent. These generally make use of contact devices touched or moved by the trolley. The brief electrical impulses given by these devices as the cars pass actuate the signal-setting and signal-clearing mechanism. To insure that the first car going out of a block shall not clear the signals when one or more following cars are still in the block, a counting device is used. This is set forward one point by each car entering the block and reversed a point by each car passing out; it therefore comes back to its normal position, permitting the signal to clear, only when as many cars have passed out of the block as have entered in succession. While counting devices may give quite satisfactory results on electric roads running single cars and having few irregular movements, it is plain that they would be practically useless under the complicated conditions imposed by freight traffic.

The automatic block systems for electric roads violate an important principle in that the stop signal indication is given by the closing of an electric circuit. The objection to this is somewhat lessened by the provision of a more or less positive indication to the motorman that the stop signal has been displayed; in the absence of such indication the motorman is required to proceed carefully through the block. But in this and other respects these systems fall below the standards of automatic signaling as generally recognized by signal engineers and all competent authorities on the subject.

CONCLUSIONS AND RECOMMENDATIONS.

Under questions 7, 8 and 9 in its order of August 24th, the commission sought to obtain information from railroad officials concerning the economy of the block system, the extent to which it had reduced the number or cost of collisions, and how far it had increased the capacity of their lines.

The answers to these questions have not been, in all respects, entirely satisfactory. Many railroad officials have freely expressed themselves in favor of the block system, and the manager of one of the most important systems of railroad in the country, on which automatic block signals of the latest type have been installed very extensively within the past few years, declares unequivocally that the investment which his company has made in this direction is one of the best that it has made in any department. A great many managers, however, appear reluctant to make positive statements with respect to the actual results attained from the operation of the block system on their lines.

It appears that the block system has been introduced from mixed motives. One road, for example, will incur the added expense of several hundred dollars per mile per year because it has been mulcted a considerable sum for damages in a collision of passenger trains; another will introduce the system because of numerous lesser collisions of freight trains, causing much loss and showing the likelihood of greater loss. Another will emphasize the feature of reputation, knowing that passengers will feel safer under a scientific system, and this feeling will influence their patronage. If a competing line already has block signals this argument may be forced on a manager. Another manager, particularly sensitive to the reputation of his road, will be influenced by the effect on his subordinates and on his own peace of mind. They all breathe more freely after getting rid of the anxieties incident to the time interval and flagging system.

The salient facts shown in the statements which have been received from carriers are that—

(1) Fifty of the principal railroads of the country have introduced and are using the block system on their important lines, though with considerable difference in details of apparatus and methods of operation.

(2) The telegraph block system is operated at moderate expense, with a great improvement in safety as compared with former methods of train control.

(3) Automatic block signals, almost universally looked upon in this country as the highest exemplification of the art, have been and are being developed with great energy and skill and liberal expenditures of money.

(4) Automatic signals are superseding the telegraph block system to some extent, and seem destined to do so increasingly in the future.

(5) Thirty roads of considerable length and importance have not yet adopted block signals of any kind.

(6) The block system has proved decidedly profitable even on lines where the signal equipment is not complete, this being accomplished by careful adherence to modifying rules making provisions against the deficiencies of the block system and by the continuance of the train despatching regulations which were used before the block system was adopted.

It is proper to add that all of the railroads continue in force their rule requiring that when a train is unexpectedly detained a flagman shall go back with a red flag or lantern to stop any following train; though, as the accident records show, flagmen have repeatedly failed to stop trains that have wrongfully passed block signals.

The main facts which have been elicited concerning the present policies of the railroads of the country in respect to block signaling are:

(1) The principal railroads use the block system on their lines of heaviest traffic, and most of them report that it is economical.

(2) Many of these roads use it also on lines of light traffic and some are rapidly extending it.

(3) All railroad officers deem the system an improvement over any other method of guarding against collisions. In other words, they consider it a means of safety.

(4) Many say that it has reduced the number and cost of collisions.

Those who do not testify on this last point simply plead ignorance, saying that their records are imperfect. One reason why some of the roads do not keep records of the results of the block signal system is, no doubt, that they are convinced that as a means of safety it is an improvement over the old system without statistical proof. Another is that its benefits consist partly in an amelioration of unfavorable conditions which cannot be definitely compared one period of time with another. It is probable that one reason why records are withheld on the plea of incompleteness or slight inaccuracies is that they show the prevalence of permissive blocking or other practices not generally approved.

The various conditions under which the different block signal methods are used may be observed by considering briefly the practice on typical roads as follows:

The controlled manual system is used on the four-track lines of the New York Central & Hudson River and the New York, New Haven & Hartford. These are the principal examples of this system in the United States. It is, of course, equally adapted to two-track lines. The electric train staff, which is a type of controlled manual apparatus, is used on 100 miles of a single-track division of the Southern Pacific and on short sections of other roads. The train staff is universally approved as a safety device, but its failure to secure more general recognition appears to be due to a general feeling that the controlled manual apparatus which is used on double-track lines is perfectly adapted to single-track work, and is superior to the staff in that trains need not be stopped or slackened for the purpose of delivering the staff.

The telegraph block system, the cheapest method in use, is found on four-track sections of the Pennsylvania Railroad (though according to the present policy of the road these signals will in the near future be supplanted by automatic signals); it is used on double-track lines by the Baltimore & Ohio, the Pennsylvania, the Chicago, Burlington & Quincy, the Chicago, Milwaukee & St. Paul, the Chicago & North-Western, the Erie, the New York Central Lines, the Philadelphia & Reading and a number of roads of less importance than these. The telegraph block system is used extensively on single-track lines of the Atchison, Topeka & Santa Fe, the Bessemer & Lake Erie, the Chesapeake & Ohio, the Chicago & Alton, the Chicago Great Western, the Lehigh Valley, the Norfolk & Western, the Northern Pacific, the Southern, the St. Louis & San Francisco, and on the lines just mentioned as using it on double track.

The automatic block system is in use on the four-track lines of the Boston & Albany, the Boston & Maine, the Central of New Jersey, the Pennsylvania, the Philadelphia & Reading and the Pittsburg & Lake Erie. It is in use on double-track lines of these roads and of the Baltimore & Ohio, the Chicago & Alton, the Chicago & Eastern Illinois, the Chicago & North-Western, the Delaware, Lackawanna & Western, the Illinois Central, the Lehigh Valley, the New York Central Lines, the New York, New Haven & Hartford, the New York, Ontario & Western, the Southern Pacific, the Union Pacific and on short sections of 14 other roads. It is used on single-track lines of the Chicago & Alton, the Cincinnati, New Orleans & Texas Pacific, the Delaware & Hudson, the Missouri Pacific, the Oregon Short Line, the Oregon Railroad & Navigation Co., the Southern Pacific and the Union Pacific, and on short sections of four other roads.

With regard to the telegraph block system, most of the roads using it show records of long continued immunity from collision, but the 13 collisions which are referred to in this report, details concerning which are given in the appendix, with others occurring more recently and still fresh in the public mind, compel us to recognize that the system is not perfect.

The only reason specifically formulated by any railroad manager for not introducing the block system is financial inability, except in the case of lines on which the passenger business is extremely light. Looking at the policies of some roads as they are known and at others in the only way in which they can be interpreted in the light of facts, it is quite clear that, generally speaking, the roads which have been dilatory in adopting the block system or in extending its use have simply pursued that temporizing policy which postpones appropriation of money until necessity will permit of no further postponement. An appropriation for the erection of block signals or for the expense of maintaining them is not viewed with favor because railroads operating without such signals have, in many cases, made fair records for a long time. It is true that important railroads have carried thousands of passengers for many

years, with no block system, without fatally injuring a single one of them in a collision. Such a record is justly regarded with pride; but a single collision ten years hence, which is an admitted possibility, would extinguish the pride and becloud the record of the past.

Many important roads have introduced the telegraph block system with the expenditure of very little money, simply by establishing a few new telegraph offices. There are also cases where a road, which has apparently held the view that the block system is impracticable by reason of its cost, has quickly changed its policy after the occurrence of a collision on its own line. It is true that roads which introduce the block system without increasing their telegraph facilities usually find themselves obliged, for a part of the time at least, to run freight trains under permissive blocking (which, strictly speaking, is not block signaling at all), but the action of such roads is significant because it marks decided progress. Their imperfect system protects passenger trains and it educates trainmen to the need of a space interval for all trains.

A number of prominent roads which have shown enterprise in safeguarding their more important lines by means of block signals are continuing the old methods on other lines. A disastrous collision in the state of Indiana in November affords a striking illustration of this fact. A few roads which enjoy ample prosperity have as yet done little or nothing in providing block signals.

The present investigation has been conducted for the purpose of setting forth the actual facts under present practices, and of affording the best guide as to what can or should be done to improve the safety of travel on the railroads of the United States. The conclusions reached confirm the views which have been heretofore expressed by the commission in its annual reports for the years 1903, 1904 and 1905. In its report for the year 1903 the commission presented the draft of a bill similar to the one introduced in the House by the Hon. John J. Esch, of Wisconsin, which provides for the introduction of the block signal system and also for the exercise of supervisory power by the commission through the employment of suitable agents and inspectors.

Supervision is necessary, not only to insure that the specific requirements of the law are complied with, but also because of differences in methods of construction and operation and in the standards of perfection and safety on different roads where the block signal system is already in use. This point was not especially emphasized by the commission at the time the bill was laid before Congress, but the present investigation has more clearly emphasized the need of such supervision. The differences of practice, etc., are reflected in the results of operation. In reporting the faults of signals and errors in operation, different companies make widely different showings. This is a vital matter in which the function of the government in securing publicity is a particularly useful one, and in which no authority other than the government can act efficiently. To investigate accidents, as is done in England and to some extent by state commissions in this country, may be called an indirect method of securing information as to the efficiency with which safeguards to life and property are administered. To investigate signals and signal practice directly, without regard to accidents, would be a more direct method of promoting safety. Accidents should be investigated, for they increase so rapidly year after year that the record is looked upon as a reproach upon our American system of railroad management; but it is even more logical and reasonable to investigate signal practice, for, as regards the worst class of accidents, namely, collisions, investigation and regulation which look to prevention are chiefly of value. Investigation to this end is needed under four heads, namely:

(1) The telegraph block system on the larger roads (mainly double track) as regards the personnel and the routine; the use or non-use of distant signals, and the practice of permissive block signaling.

(2) The telegraph block system on single-track lines and minor roads, as regards the personnel, the routine, distant signals and permissive signaling, and also as regards the use of time rules and despatchers' orders to make up for incompleteness in the block signaling arrangements.

(3) The automatic block system should be investigated on all roads with respect to the efficiency of the apparatus and of the methods of inspection and care, and the integrity of the records of signal operations in respect to their completeness.

(4) The automatic block system on single-track lines should be investigated with respect to the features named in the foregoing paragraph, and also as regards the use simultaneously with the block signals of despatchers' orders and other measures designed to prevent collisions irrespective of the block signal system.

If legislative enactment should not require the early introduction of the block system on all railroads, government inquiry should be pursued with a view to determine the necessity for its installation on particular lines or parts of lines on which it is not now in use. The principal and, indeed, the only argument against the enactment of a compulsory block signal law is that a large number of railroads are now making fair progress in the extension of block signals without compulsion. Certainly the roads which come within this class can have no fault to find with such a mild measure of compulsion as that provided for in the bill proposed by the commission; while as to roads which have taken no action, some compulsion should be employed to require them to bring their service up to a proper standard within a reasonable time.

The question of the need of apparatus for automatic control of trains is a somewhat difficult one. Collisions occur occasionally under both the telegraph and automatic block systems, which an efficient automatic stopping apparatus might prevent. The locomotive engineman has most exacting duties. An individual runner may be far above the average in mental poise and moral character and yet may fail in vigilance or in judgment occasionally, and such failure may mean disaster. Again, the individual engineman may be efficient in a high degree, and yet the efficiency of a force of enginemen as a whole may be unsatisfactory. The engineer performs such an innumerable succession of important acts on every trip that, even with an infinitesimal percentage of failures, the 40,000 or 50,000 engineers of the United States may still be chargeable in the course of a year with a large aggregate of fatal and non-fatal injuries. Anything less than perfection is cause, at least, for investigation, if not for decided dissatisfaction. Every great accident due to an engineman's fault is followed by a strong public demand for the introduction of automatic train stopping devices. As previously shown in this report, such devices used to a limited extent, though not on interstate roads, seem to have given a fairly good account of themselves; but these records do not justify the commission in making any recommendation as to their use or non-use without a more thorough and complete investigation.

The limited extent to which devices of this character have been used makes it practically impossible for the commission to obtain anything more than theoretical and technical knowledge concerning them. It is therefore apparent to the commission that Congress cannot be furnished with much further information concerning these appliances, which would appear [to be] extremely valuable, theoretically, without extensive tests conducted by officials of the government and at government expense. For this reason and because the resolution under which this inquiry has been made does not confer authority to make such tests, the commission, on January 3, 1907, addressed a communication to Congress recommending that supplemental legislation be enacted authorizing the commission or some other official body to supervise and conduct experimental tests of such safety devices as appear to be meritorious, and that an appropriation be made sufficient to secure the most competent experts and defray the other expenses incident to such a project. The commission can only repeat this recommendation, believing that such experimental tests would be of great value in determining the direction which legislation not now recommended should take in seeking to add to the safety of railroad operations.

The recommendations of the commission for immediate or early legislation are summarized as follows:

(1) That the use of the block system should be enforced on the passenger lines of the country in general according to the provisions of a bill in substance like the one submitted to the Congress by the commission in December, 1903,* . . . except that the time to be allowed for final compliance with its compulsory features should be made three or four years from the present.

(2) That with or without the passage of a law requiring the use of block signals, there should be a law authorizing an official investigation of train accidents, and providing for the employment of competent men to perform the duties imposed by such an enactment.

(3) That investigation by official tests of automatic appliances for the control of railroad trains should be authorized in accordance with the commission's recommendation of January 3, 1907, with an appropriation of sufficient amount to conduct such tests in a proper manner.

Recently a disastrous collision occurred in the District of Columbia (at Terra Cotta station on the Baltimore & Ohio Railroad, December 30, 1906), in which over 30 passengers and other persons were killed. This collision occurred on a line equipped with block signals. It was the subject of much discussion in the press and elsewhere, and the circumstances attending it were such that the whole question of the management of railroad trains when running at high speed was brought prominently before the public, including the comparison of the block system of signals with other methods. The commission therefore instituted an inquiry into the case, as well as into another collision which occurred in November on the Southern Railway, causing the death of Mr. Samuel Spencer, the President of that railroad. These inquiries are not yet completed, but these accidents are referred to here simply for the purpose of observing that consideration of them has not been omitted. The investigations have proceeded far enough to show that the fault in these cases is not to be charged to the signal system in use, but to laxity in the methods of operating it. Collisions from the same or similar causes have occurred many times before, and these causes

Railroad Gazette, Jan. 1, 1904, page 14.

have had full consideration in the present report. As has been observed in the annual reports of the commission to Congress, the block signal system remains superior to any other system, both theoretically and by the test of actual experience, after all due weight has been given to the records of failures in the running of trains under it. It is the intention of the commission to submit a further report covering these matters, and other questions that have not been fully treated herein.

Answering specifically the questions (not hereinbefore answered) which are embodied in the Senate resolution of January 29, 1907:

The length of time that would be required to put in operation the telegraph block system would depend on the facility with which telegraph operators could be trained to act as signalmen, and, in most cases, on the ability of manufacturers (railroad shops or independent concerns) to provide and erect the signals and apparatus. As these questions have to be decided in each case, on the special conditions of that case, a general answer could not be made; but a period of from one to three years would undoubtedly be fair. For the installation of automatic signals a longer time should be allowed (in the present state of manufacturing business, with all shops over-worked, a much longer time, because the apparatus is delicate and costly, requiring time and extensive facilities for manufacture). The commission has not recommended the specific requirement by law of any particular kind of signals, and it is not believed that the introduction of automatic signals should be made compulsory at the present time. * * *

Mileage of Railroad Worked by the Block System.*

The length of railroad lines in the United States on which trains are run under the block system, as shown by reports made in September, 1906, in response to the order of the Commission, is 48,743.2 miles. The items making up this total are shown in the table which appears herewith. A length of 6,826.9 miles is shown as being equipped with automatic block signals, and a length of 41,916.3 miles as worked by manual signals; and these are further subdivided into single-track lines, double-track, etc. Of the lines worked manually, 911.8 miles, on seven different roads, are equipped with controlled manual apparatus; that is to say, the signal levers have electric locks providing interlocked control from station to station. This electrically controlled apparatus is substantially all to be found on double-track lines. A less complete "control" apparatus is in use on 915.7 miles of single-track lines, belonging to four companies. Another method of electrical control, the electric train staff, adapted for the protection of trains on single-track lines, is in use on 179.3 miles of road, belonging to 13 different companies.

A number of important companies have made considerable extensions to their block-signaled lines during the year 1906. Comparing the totals now reported with those appearing in a table published by the *Railroad Gazette* in January, 1906, the following increases appear:

Roads.	Miles.
Atlantic Coast Line	152
Central of New Jersey	97
Chesapeake & Ohio	135
Cleveland, Cincinnati, Chicago & St. Louis	205
Delaware & Hudson	101
Del., Lack. & Western	38
Erie	72
Great Northern	176
Hocking Valley	31
Illinois Central	146
Lake Shore & Mich. Southern	1,137
Lehigh Valley	46
Long Island	13
Louisville & Nashville	374
Michigan Central	630
Mobile & Ohio	24
N. Y. Central & Hudson River	279
Norfolk & Western	490
Oregon R. R. & Navigation Co.	77
Philadelphia & Reading	19
Pennsylvania (including controlled lines west of Pittsburg)	468
Southern Railway	101
Southern Pacific and controlled lines	374
St. Louis & San Francisco	38
Union Pacific	88

In a number of cases the mileage now reported is less than that which appears in the *Railroad Gazette's* table of a year ago. * * * Some of these discrepancies are accounted for by the fact that in the Commission's statistics subsidiary companies are shown separately; others appear to have been due to incorrect reports made by the railroad companies to the *Railroad Gazette*. In two or three cases railroads then reported that on all of their lines not completely block signaled, passenger trains were protected according to the space-interval principle, by supervision from the train despatchers' offices, and this mileage, suitably explained, was included in the *Railroad Gazette's* table; but these roads made no such claim in the reports which they sent to the Commission.

It will be seen that nearly all of what are called the great railroads of the country are represented in the table, showing that on the broad question of the merit and adaptability of the block

*From report made to Congress by the Interstate Commerce Commission.

Block Signals on the Railroads of the United States.

Table showing, for each company, the aggregate length of its lines or parts of lines on which the Block System is in use; September, 1906. Companies not appearing in the list have reported that no block signals are in use on their lines.

Names of railroads.	Automatic block signals. Track. Single.	Double.	Three.	Four.	Total auto.	Non-automatic signals.[1] Track. Single.	Double.	Three.	Four.	Total non-auto.	Total all kinds.	Total miles operated.*	Per cent. operatd under block system
Alabama Great Southern	29.5	..	..	..	29.5	2.0	..	..	..	2.0	31.5	291.1	11.0
Ann Arbor	..	..	..	..	..	1.4	..	..	..	1.4	1.4	292.0	..
Atchison, Topeka & Santa Fe	..	18.2	—	..	18.2	965.6	227.0	..	..	..	—	—	—
	..	..	..	..	..	s 18.8	..	..	..	4.8	4.8	87.0	5.5
Atlanta & West Point	..	..	..	..	..	..	4.8	..	..	1,211.4	1,229.6	5,043.0	23.3
Atlantic City included in Phila. & Reading	..	..	..	..	..	..	..	..	..	..	..	..	..
Atlantic Coast Line	..	..	..	..	..	431.7	64.5	..	..	496.2	496.2	3,981.8	12.5
Baltimore & Ohio	..	102.4	..	..	102.4	308.4	373.5	3.0	8.5	693.4	795.8	2,960.7	26.8
Cleveland, Lorain & Wheeling	..	..	..	..	..	12.0	2.8	..	..	14.8	14.8	135.0	11.0
Baltimore & Ohio Southwestern	..	..	..	..	—	—	24.0	—	3.0	27.0	27.0	981.0	2.4
Baltimore & Sparrow's Point	..	..	..	..	..	..	3.2	..	..	3.2	3.2	4.9	65.3
Bessemer & Lake Erie	..	..	..	..	..	135.3	61.2	..	..	196.5	196.5	198.7	98.9
Boston & Albany	—	164.7	—	16.0	180.7	—	—	—	—	—	180.7	377.5	48.0
Boston & Maine	..	62.0	0.5	2.1	64.6	..	108.0	..	..	..	..	..	..
	..	..	..	..	..	..	c 4.8	..	..	112.8	177.4	2,238.6	8.0
Buffalo, Rochester & Pittsburg[3]	..	..	..	..	..	322.6	106.9	..	..	429.5	429.5	429.5	100.0
Central of Georgia	—	—	—	—	—	52.6	10.0	—	—	62.6	62.6	1,853.0	3.3
Central of New Jersey	..	258.6	..	32.8	291.4	..	..	..	..	..	291.4	584.0	50.0
	..	..	..	..	..	890.9	237.6	..	..	..	..	..	..
Chesapeake & Ohio	..	..	..	..	..	..	c 116.2	..	..	..	..	..	..
	..	..	..	..	..	s 9.2	..	..	..	1,303.9	1,303.9	1,549.1	84.2
Chicago & Alton	159.9	103.5	—	..	263.4	s 14.1	..	..	..	—	—	—	—
	..	..	..	..	..	341.2	41.2	..	..	396.5	659.9	937.0	70.0
Chicago, Burlington & Quincy	..	20.3	..	7.1	27.4	777.5	448.0	17.1	..	..	..	..	..
	..	..	..	..	..	s 1.3	..	..	..	1,243.9	1,271.3	..	..
Chicago, Burlington & Quincy (see notes)	..	..	..	..	..	2,932.5[4]	..	..	..	..	..	8,876.7	93.6
	..	..	..	..	..	4,107.1[5]	..	..	..	7,039.6	7,039.6		
Chicago & Eastern Illinois	2.0	101.6	—	—	103.6	c 135.7	—	—	—	135.7	239.3	793.3	30.0
Chicago Great Western	..	4.8	..	..	4.8	288.7	7.9	..	..	296.6	301.4	714.2	42.0
Chicago, Indiana & Southern	..	2.0	..	..	2.0	21.5	..	..	..	21.5	23.5	328.0	7.2
	..	32.2	..	..	32.2	s 7.5	..	..	..	..	..	..	..
Chicago, Milwaukee & St. Paul	—	—	—	—	—	c 1.0	..	..	..	—	—	—	—
	..	..	..	..	..	2,157.0	355.7	..	..	2,521.2	2,553.4	7,180.0	35.6
Chicago & North-Western	..	404.7	8.5	6.0	419.2	2,871.2	378.6	..	..	3,249.8	3,669.0	7,479.7	49.0
Chicago Terminal Transfer	..	3.0	..	..	3.0	..	..	..	..	..	3.0	37.0	8.1
Chicago, Rock Island & Pacific	—	9.3	..	..	9.3	s 4.7	69.5	..	..	74.2	83.5	6,490.0	1.3
Chicago & Western Indiana	..	7.5	..	..	7.5	..	c 19.8	..	..	19.8	27.3	27.3	100.0
Chicago, St. Paul, Minneapolis & Omaha	1.2	..	..	..	1.2	629.0	29.9	..	..	658.9	660.1	1,655.8	40.0

(Table continued on next page.)

*For passenger traffic.
[1] All items under non-automatic represent the telegraph block system, unless otherwise indicated by "c," meaning controlled manual, or "s," meaning electric train staff.
[2] On all but 26 miles the block signals protect from rear, but not from butting, collisions.
[3] Buffalo, Rochester & Pittsburg: Block signals used only for protection of rear of passenger trains and snow plows.
[4] C., B. & Q.: 2,932.5 miles for protection of passenger trains only.
[5] C., B. & Q.: 4,107.1 miles for protection of passenger trains, but not throughout the 24 hours of the day.
[6] More than four tracks.
[7] Lehigh Valley: Block signals on 72.3 miles not used by passenger trains (29.3 miles double track and 43.0 miles single track).
[8] All freight.
[9] Excluding lines on which but one train is run.
[10] Pennsylvania R. R.: Item 191.5 miles includes 1.8 miles of line having more than four tracks; Item 192.8 miles includes 1 mile of line having more than four tracks.
[11] Including Atlantic City R. R.: North East Pennsylvania R. R.: Perkiomen R. R.: Philadelphia, Newtown & New York Ry.: Reading & Columbia R.R.
[12] Excluding 231 miles on which only one train crew is in service.
[13] St. Louis Merchants' Bridge Terminal: Block signals on 1.2 miles of freight lines.
[14] Caution signals.
[15] Four-track and six track.
[16] Wabash R. R.: Item 1,965.9 miles includes 763 miles of line on which block signals are used only for protection of rear of passenger trains.
[17] The items representing lines on which the use of the block system is partial (Buffalo, Rochester & Pittsburg; Chicago, Burlington & Quincy; Wabash) aggregate 8,232.1 miles.

BLOCK SIGNALS ON THE RAILROADS OF THE UNITED STATES. (*Continued.*)

Names of railroads.	Automatic block signals—Track				Total, auto.	Non automatic signals—Track				Total, non-auto	Total all kinds	Total miles operated	Per cent. operated with auto. sig.
	Single.	Double.	Three.	Four.		Single.	Double.	Three.	Four.				
Cincinnati, Hamilton & Dayton						76.0	25.0			101.0	101.0	1,038.2	10.0
Cincinnati, New Orleans & Texas Pacific	303.2	16.4	..	..	319.6	c 5.9 8 5.5	..	..	..	11.4	331.0	333.6	99.0
Cleveland, Cincinnati, Chicago & St. Louis	..	..	..	..	..	795.7	263.0	..	..	1,058.7	1,058.7	1,887.1	56.0
Cumberland Valley						22.3				22.3	22.3	165.2	13.7
Delaware & Hudson	123.0	86.0	1.5	8.5	219.0	..	..	..	..	..	219.0	829.0	27.0
Delaware, Lackawanna & Western	3.0	128.0	..	4.1	435.1	..	..	..	..	..	435.1	927.6	47.0
Erie						768.4	665.8						
Galveston, Harrisburg & San Antonio	7.0	..	..	6.8	6.8 7.0	c 14.5 s 2.0	..		c 21.0	1,472.5 2.0	1,479.3 9.0	2,381.1 1,329.7	62.1 ..
Great Northern	..	..	..	..	..	s 3.5	..	..	..				
Hocking Valley	..	..	..	..	..	172.5	..	..	..	176.0	176.0	5,230.8	3.4
Illinois Central	5.4	227.5	..	5.2	..	76.9 c 758.7	..	..	..	76.9	76.9	338.5	22.7
	..	..	..	..	..	5.1	..	..	..	..	..	..	..
Kentucky & Indiana Bridge & R. R. Co.	..	..	..	8.4[3]	246.5	..	..	..	..	763.8	1,010.3	4,459.1	22.7
Lackawanna & Wyoming Valley	..	..	..	..	..	8.0	2.1	..	..	10.1	10.1	10.1	100.0
Lake Erie & Western						s 2.2	1.2			3.4	3.4	23.0	15.0
Lake Shore & Michigan Southern	..	..	..	..	..	18.6	..	..	..	18.6	18.6	686.0	2.7
Lehigh Valley	31.3	131.5	46.5	118.9	296.9	1,134.1	222.2	18.9	5.2	1,380.7	1,677.6	1,677.6	100.0
	..	401.8	36.1	..	469.2	690.0	54.2						
	..	..	..	..	..	s 6.2	..	..	..	750.4	1,219.6	1,117.3	100.0[3]
Long Island	2.6	62.2	..	..	64.8	..	c 14.1	..	c 1.2	15.3	..	..	..
	..	..	..	..	..	..	15.1	..	2.7	17.8	97.9	392.0	22.0
Louisville & Nashville	..	..	..	..	..	342.7	31.1	..	..	373.8	373.8	4,011.0	9.3
Maine Central	13.1	..	..	..	13.1	..	..	..	..	..	13.1	807.5	1.6
Michigan Central	..	272.0	..	..	272.0	938.7	..	..	..	938.7	1,210.7	1,309.9	92.4
Missouri Pacific	42.5	17.2	..	..	59.7	..	..	..	..	..	59.7	3,482.5	1.7
St. Louis, Iron Mountain & Southern	28.8	5.7	—	—	34.5	..	..	..	..	..	34.5	2,459.1	1.4
Mobile & Ohio	..	2.3	..	..	2.3	50.7	..	..	..	50.7	53.0	926.0	5.7
Morgan's Louisiana & Texas	..	..	..	..	..	..	..	..	..	..	..	..	..
Louisiana Western	123.0	—	—	—	123.0	—	—	—	—	—	123.0	552.6	22.3
Iberia & Vermillion	..	..	..	..	..	..	..	..	..	..	..	..	..
Nashville, Chattanooga & St. Louis	..	..	..	..	..	94.2	8.6	..	..	102.8	102.8	1,226.0	8.5
Newburgh & South Shore	..	..	..	..	..	3.0	2.0	—	..	5.0	5.0	..	..
New York Central & Hudson River	..	112.2	..	7.1	119.3	1,814.3	356.0	..	..	..	..	..	..
	..	..	..	..	..	c 1.2	c 155.3	..	c 281.4	2,306.2	2,725.5	2,941.2	92.5
St. Lawrence & Adirondack	..	..	..	..	..	10.2	..	..	..	10.2	10.2	10.2	100.0
New York, New Haven & Hartford	27.0	199.2	—	—	226.2	159.9	53.8						
	..	..	..	..	..	..	c 156.1	..	c 70.6	440.0	666.6	1,900.0	35.0
New York, Ontario & Western	13.7	74.7	..	..	88.4	..	..	..	..	..	88.4	492.8	17.5
New York, Susquehanna & Western	..	..	..	..	..	..	19.6	..	..	19.6	19.6	205.0	9.5
New York & Long Branch	..	38.0	—	—	38.0	..	..	..	..	..	38.0	38.0	100.0
Norfolk & Western	..	..	..	..	..	1,446.0	218.0	..	..	1,664.0	1,664.0	1,825.0	92.0
Northern Central	..	..	..	..	..	290.9	127.8	..	17.4	436.1	436.1	437.1	99.7
Northern Pacific	—	14.8	..	..	14.8	961.7	98.1	..	..	1,059.8	1,074.6	5,352.4	20.0
North Shore	..	10.0	..	..	10.0	..	..	..	..	..	10.0	95.0	10.0
Oregon Short Line	35.9	..	..	..	35.9	..	..	..	..	..	35.9	1,092.8	3.3
Oregon R. R. & Navigation Co.	188.0	—	—	—	188.0	..	..	..	..	..	188.0	828.0[3]	22.7
Pennsylvania Railroad[37]	..	49.5	..	191.5	241.0	531.5	652.0	23.3	192.8	1,399.6	1,640.6	3,191.5	51.4
Pennsylvania Company	23.0	5.0	11.0	18.0	57.0	232.0	616.0	20.0	25.0	893.0	950.0	1,334.0	71.3
Pittsburg, Cincinnati, Chicago & St. Louis	..	5.0	—	2.0	7.0	526.0	435.0	7.0	—	968.0	975.0	1,393.0	70.0
Peoria & Eastern	..	..	..	..	..	..	5.2	..	..	5.2	5.2	342.6	1.5
Peoria & Pekin Union	..	..	..	..	..	..	7.5	..	..	7.5	7.5	15.4	48.7
Philadelphia & Reading	13.7	352.6	35.0	11.7	413.0	206.6	139.8	..	..	..	..	..	..
	—	..	..	..	—	c 0.8	..	—	..	..	..	..	..
	..	..	..	..	..	s 3.6	..	..	..	350.8	763.8	1,166.9	65.5
Philadelphia, Baltimore & Washington	..	11.0	20.4	..	31.4	..	124.6	..	40.5	165.1	196.5	657.1	30.0
Pittsburg & Lake Erie	..	105.8	8.7	26.3	140.8	27.0	..	..	..	27.0	167.8	167.8	100.0
Richmond, Fredericksburg & Potomac	—				—	9.8	77.9	—	—	87.7	87.7	87.7	100.0
Seaboard Air Line	..	..	..	..	..	155.0	..	..	..	155.0	155.0	2,330.0	6.6
Southern	..	..	..	..	..	1,062.7	77.8	..	..	1,140.5	1,140.5	6,397.5[12]	18.0
Southern Pacific: Pacific System	..	..	..	..	..	20.0	..	..	..	..	..	..	..
	369.4	50.3	..	..	419.7	s 97.0	..	..	..	117.0	536.7	4,330.0	12.4
East of Sparks	216.1	..	..	..	216.1	..	..	..	..	..	216.1	1,006.7	21.5
Lines in Oregon	..	..	..	..	..	..	..	..	..	..	..	..	..
St. Louis Merchants' Bridge Terminal	..	8.5	—	—	8.5	..	1.1	—	—	1.1	9.6	8.4	100.[3]
	5.0	3.0	..	..	8.0	346.0	27.0	..	..	..	..	..	..
St. Louis & San Francisco	..	..	..	..	..	s 3.7	..	..	..	378.7	386.7	4,055.9	9.5
	..	..	..	..	..	c 2.0	..	..	..	..	..	..	..
Staten Island Rapid Transit	..	9.2	..	..	9.2	..	..	..	..	..	9.2	9.2	100.0
Terminal R. R. Association of St. Louis	—	6.1	—	—	—	—	c 1.0	—	—	—	—	—	—
	..	1.2[24]	..	..	7.3	..	0.6	0.6	1.3[25]	3.5	10.8	11.2	97.0
Texas & New Orleans	41.0	..	..	..	41.0	..	..	..	..	..	41.0	438.6	9.0
Union (Pittsburg)	[9]	1.0	..	..	1.0	3.2	1.8	..	..	5.0	6.0	..	..
Union Pacific: East of Green River	104.7	45.1	..	—	149.8	—	—	—		—	149.8	2,751.9	5.5
West of Green River	115.2	..	..	..	115.2	..	..	..	..	..	115.2	203.6	56.6
Vandalia	..	..	..	..	..	219.6	18.9	..	..	238.5	238.5	804.9	29.6
Wabash	..	7.2	..	..	7.2	1,965.9	71.6	—	..	2,037.5	2,044.7	2,044.7	..
Wabash-Pittsburg Terminal	..	4.8	..	..	4.8	..	..	..	..	..	4.8	59.9	8.0
Washington Southern	..	..	..	..	..	3.6	28.9	..	..	32.5	32.5	32.5	100.0
West Jersey & Sea Shore	..	83.5	9.9	—	94.2	47.8	28.4	..	—	76.2	170.4	321.6	53.0
Wisconsin Central	..	..	..	..	..	..	6.1	..	..	6.1	6.1	838.8	..
Yazoo & Mississippi Valley	4.2	..	..	..	4.2	c 15.4	..	..	..	15.4	19.6	1,239.1	1.6
Total[37]	2,032.4	4,143.9	178.1	472.5	6,826.9	33,585.1	7,567.7	89.9	673.6	41,916.3	48,743.2	143,615.8	.....

system the views of the officers of these roads are in substantial agreement. With two or three exceptions, all companies doing what may be called a heavy passenger business are represented here. On 29 roads which have no block signals (all but five of them operating, each, less than 500 miles of line) the passenger traffic is comparatively light. Only two of these reported for the year ending June 30, 1905, passenger earnings of over $2,500 per mile.

Final Report of the Pennsylvania Railroad Special Investigating Committee.

II.

In regard to bituminous coal car distribution on the Eastern lines, the committee reports as follows:

On January 1, 1900, there were in operation 272 bituminous coal mines. On January 1, 1906, that number had increased to 504, of which 97 were new operations not controlled by companies theretofore operating. In 1900 there were moved 25,944,018 tons, of which 20,183,802 tons originated on the line and 5,760,216 tons originated on other lines. In 1906 there were moved, in 39,882 Pennsylvania cars, and in 21,042 individual cars, and in a large and unascertained number of foreign cars, 35,701,742 tons, of which 32,398,081 tons originated on the line, and 3,303,881 tons originated on other lines. These figures for both years include all company coal bought for leased, or operated lines, and, therefore, paying freight revenue, but do not include the coal bought by the Pennsylvania Railroad for its own use, which does not pay freight revenue. The general traffic of the road also, as has been stated, increases year by year. There are, therefore, year by year, more tons of bituminous coal to be moved to market over lines which are more and more congested by a growing traffic. In 1906 the movement of coal represented 52 per cent. of the total tonnage. Notwithstanding the heavy expenditure made for new equipment, the number of cars available for that movement does not keep pace with the demand, because of the detention of cars on other lines, because of the necessity of providing more cars for general traffic, and because of the increased number of cars required to move the coal for the greater number of engines which the growing traffic of the road makes necessary. Some system of pro rata car distribution is, therefore, necessary. The basis of any such system is the determination of the shipping capacity, or rating, of each mine. Prior to January 1, 1906, this determination was made by the superintendent, within whose jurisdiction the mine is situated, with the approval of the general superintendent, and was based upon the superintendent's finding as to the maximum output of the mine during a given period. If a shipper complained that the rating of his mine was too low when made, or that it should

be increased by reason of facilities subsequently added, a test was was made by furnishing, without previous notice, an ample supply of cars to that mine for a limited number of days, and report was then made as to the number of cars actually loaded for movement. That system was open to the objection that it operated in favor of the more persistent and clamorous of the shippers, and, so far as regarded the testing for pro rating, that, unless that testing was continued for a considerable period, it was liable to be affected by accidental and temporary causes, such as a lack of miners, or a breakdown of machinery, etc. Therefore, after careful consideration and inquiry, on January 1, 1906, a system was adopted of fixing the rating of each mine by a determination of its probable shipping capacity; the possible physical capacity of each mine in tons being first ascertained by mining engineers appointed by the railroad, those engineers taking into consideration in each case the thickness of the veins, the number of openings, the extent of the workings, the capacity of the tipples, the facilities for putting coal on the cars, the average tonnage mined per man, assuming a full supply of labor, and all other conditions affecting the physical capacity of the mine. Then, in order that a mine opened and worked to supply a constant commercial demand might receive greater consideration than one which was only worked in periods of high prices, and for purposes of speculative profits, the tons actually shipped by the mine during the year preceding were reported by the railroad's Auditor of Coal Freight Receipts. The figures from these two sources were then added together and divided by two, and the result taken as the maximum rating of the mine in tons, or, when divided by 35, in cars of 35 tons capacity. The uncontradicted testimony taken before the Interstate Commerce Commission shows that as a preliminary to the determination of the physical capacity of the mines, a circular was issued in June, 1905, and sent to every bituminous coal operator, requesting information as to his coal acreage, the number of openings, the number of miners employed, the capacity of his mines, wagons, tipples and sidings, the average number of miners working per month during the year preceding, etc. To those who did not reply promptly a second circular was issued, requesting a reply. A large number of the operators did not reply to either circular.

On February 1, 1906, and, therefore, before the Interstate Commerce Commission began its investigation into this subject, another circular was issued and sent to every bituminous mine operator, advising him that "the ratings assigned will be shown on the distribution sheets on file in the office of the Division Superintendents and Car Distributors." The practice stated, in that circular, has been, since its issue, consistently adhered to.

The change in the system of rating the mines, and the successive modifications in regulations affecting car distribution were made only in the desire to meet changed conditions and to do impartial justice to all shippers. From January 1, 1900, distribution was made of all home and foreign railroad cars, there being excluded from distribution cars placed for fuel for the company, and individual cars, whether or not owned by the mine to which distribution was made. Because of the anthracite strike in 1902 and the consequent increased demand for bituminous coal, individual cars not owned by the shipper were from February 1, 1903, subjected to distribution. On March 28, 1905, cars consigned by other railroads for their own coal supply were excepted from distribution. From April 25, 1905, box cars distributed for shipment of coal east and west were not counted against the operators' pro rata supply of open cars for coal, for the reason that box cars were mainly used for the shipment of smithing coal to points west, and were more expensive to load because special arrangements had to be made for them at the mine tipples. The operators desired the exclusion of box cars from general distribution because, in addition to the reasons before stated, counting them in the allotment reduced the supply of hopper cars for shipment of coal to the eastern markets. The railroad desired the exclusion because, while aiding the development of the movement of smithing coal to the West, it also furnished a back loading for foreign box cars homeward bound to the West, which otherwise would have had to be moved empty. On October 20, 1905, individual cars loaded for or on account of the owner of the cars were excluded from distribution because it had been found to be impossible for the car distributors to know who actually owned individual cars, and because colorable transfers of ownership of individual cars were made. From and after January 1, 1906, all cars for the coal supply of any railroads, and all individual cars assigned by the owner for loading at specified mines, have been charged against the mine at which such cars are placed and treated as part of its pro rata distribution. Prior to January 1, 1906, the distribution was made on the basis of wooden cars of 25 tons capacity, a steel car being counted as equivalent to two 25-ton wooden cars. After that date steel cars of 80,000 pounds capacity and less have been counted in the distribution as equivalent to wooden cars of 35 net tons and steel cars of 100,000 pounds capacity are counted as the equivalent of 1½ wooden cars of 35 net tons each. Before June, 1903, the General Superintendent of Transportation, and since that date the Superintendent of Freight Transportation has had charge of the distribution of cars between the general divisions, and the General Superintendent of each general division has had charge of the distribution between his divisions, and the Superintendent of each division has had charge of the distribution on his division. Each distributing officer is provided with a sheet showing the name of each mine, with that mine's rating in tons and in cars of 35 tons capacity, but excluding from the rating all mines whose whole output is taken for company coal. Each mine daily gives notice of the number of cars needed for the next day's shipments. The daily rating of particular mines, and therefore the aggregate daily rating of any one district, as shown on the rate sheets, are at all times liable to be affected by changed conditions. Therefore the officer having direct charge of the distribution makes on each day an adjusted rating to meet actual conditions, such as a mine's order for cars less in number than its rating, or a mine's idleness by reason of an accident to machinery, or its lack of miners. The distributing officer reports daily to the Superintendent of his division the distribution as made, and each Superintendent reports the distribution weekly to the General Superintendent. It has been at all times the duty of the supervising officers to carefully scrutinize those reports in order to see that the distribution has been fairly and accurately made.

In order that it might be advised whether the distribution of cars as between shippers had been in fact fairly and impartially made by the distributing officers and in accordance with the rules, the committee employed the Audit Company of New York to investigate the facts. The Audit Company, in a report of 2,678 pages, states:

"We have compared the facts set forth in the mine sheets and special orders, with the testimony taken before the Interstate Commerce Commission in Philadelphia in the late spring of the present year. We have carefully read and considered so much of that testimony as relates to the distribution of cars, and consider that few, if any, of the matters alleged before the Commission to the prejudice of the officers of the railroad company are borne out by the results of our examination, as set forth in this report. Many of the cases of seeming preferences and discriminations—both those attended by special orders and not so attended—have been examined into by us with the result of finding that the officers of the railroad company have fair operating or other reasons to present in explanation of such seeming preferences and discriminations. Our company is of opinion, therefore, and reports as its best judgment that in general the distribution of cars was controlled and administered by the officers of the railroad company in good faith and without showing continued preferences and discriminations as toward the owners of bituminous coal mines."

In connection with the subject of car distribution, the committee has carefully investigated the relations of the Berwind-White Coal Mining Co. to the railroad company. The lease of Harsimus Pier, in New York harbor, is an arrangement by which the railroad secures a profitable traffic of great magnitude; so handles that traffic that cars can be unloaded with the minimum of delay, and returned to the mines for reloading; has performed, at a cost reasonable to the railroad, the railroad's duty of transferring coal from pier to boat; obtains, without cost to the railroad, an adequate coaling wharf for its large fleet of tugs and lighters plying in the port of New York; receives an income at the rate of 4 per cent. on the assessed valuation of the ground leased; has received reimbursement for the cost of building the pier; gives to the railroad company full use of its facilities at South Amboy Coal Terminal for handling the business of general and smaller shippers; and does not in any respect constitute a preference to the Berwind-White Company.

The non-weighing at certain periods of the cars for Harsimus, and the billing of those cars for freight at estimated weights, were shown by the testimony taken by the Interstate Commerce Commission to have been ordered only to relieve freight congestion, existing at the time because of the reconstruction of yards then in progress, and, therefore, to have been beneficial to other shippers, and did not result in any loss to the railroad, because the estimated weights exceeded the actual weights of other similarly loaded cars, and did not constitute a preference in favor of the Berwind-White Company.

The sales to the Berwind-White Company in July, 1902, of 727 steel hopper cars from the railroad equipment, and of 272 like cars, which were being built by the Pressed Steel Car Co. on the order of the railroad, and of 500 cars then building, to the Keystone Coal & Coke Co., were at a time when the congestion on the line was so great that it became a question of how best to meet the demands of the consumer, and the executive officers, after most careful consideration, ordered the sale of these cars, and the taking of space in the shops at a later date to replace them.

Among individual complaints investigated, concerning various departments, were the following:

A complaint was made with regard to the abandonment of Snyder Station between Social Hall and Blairsville on the West Penn division. The committee investigated and found that the

station had been abandoned, because there were only five families living within a radius of two miles therefrom, and because a public road is under construction which will give those families better facilities to and from Blairsville than they had to and from Snyder's Station; and that several of the officers of the company had, upon receipt of letters from the complainant, written him courteously, fully explaining the reasons for the abandonment of the station.

A complaint was made as to insufficient wages paid at the Kensington freight station, the allegation being that the employees at that station can make only from 85 cents to $1 per day. The committee investigated and found that the force at that station is paid on the tonnage basis, and that the average earnings of the men, assuming that they work full time, is: for shipping clerks, $65 to $70 per month; and for truckers, loaders, and packers, from $55 to $60 per month.

An anonymous complaint was made as to mismanagement and corrupt practices at the docks at Erie, and as to certain unfair treatment alleged to have been given to a yardmaster at Erie some years ago The committee investigated the matter thoroughly and found nothing to sustain the charges.

A complaint was made as to unfair discriminations made by S. W. Dunlap, Yardmaster of the Philadelphia Terminal division, in the distribution and movement of loaded coal cars as between the coal yards in the neighborhood, it being alleged that Mr. Dunlap had received presents of coal from one of the dealers. The committee investigated the matter, examined Mr. Dunlap, and found the charges unsupported by facts.

A complaint was made against G. M. Sexauer, Piecework Inspector at the Pitcairn Shops, the allegation being that Mr. Sexauer had misappropriated the company's tin for roofing his house, and for the manufacture of tin boxes sold for his individual account, and that Mr. Sexauer takes part of the employees' pay. The committee investigated the matter and found that the charges were unfounded. Mr. Sexauer produced the receipted bills for the tin purchased for roofing, which was furnished by a Pittsburg dealer.

A complaint was made against M. W. Mansfield, late Superintendent of the Vincennes division of the Vandalia. The committee investigated and found that the charges related to matters which had happened in, or about, the year 1889; that they had some years ago been brought to the attention of, and fully investigated by, the officers of the Western Lines, and had been found to be unsubstantiated.

The committee has thoroughly investigated the relations, howsoever made, of the officers and employees of the several railroad companies to corporations, firms, and individuals, selling materials, or supplies, to any of the several companies, or shipping freight over any of the lines of the several companies. In its consideration of this subject, the committee has strictly applied the principles, stated in its preliminary report, and prescribed in the by-laws of the company that "the duty of an officer, or employee, to the railroad company, which he has undertaken to serve, forbids him to gain a personal profit at the expense of the railroad company by his participation in contracts with, or sales to, the railroad company; and that that same duty equally forbids an officer, or employee, to unduly favor any customer, to the disadvantage of any other customer, of the railroad company; or to place himself under such personal obligations to any customer of the railroad company as may possibly interfere with the officer's, or employee's full and faithful discharge of his plain duty." When it is remembered that the several companies have in their services almost 200,000 officers and employees, it is not surprising that some few of that large number have been found to have erred.

In its preliminary report the committee also said: "In its early history the great problem for the company was the development of industrial enterprises in the territory through which its lines ran, in such a manner as to create and secure traffic for the company. To-day the problem is that of providing adequate facilities in line, rolling stock and movement for the business of the country, which rapidly outgrows such facilities. While under former conditions it was right that officers and employees should have been encouraged to invest their own money in or to personally assume financial obligations for the purpose of developing industrial enterprises on the line of the road, for the practical reason that if officers and employees did not so invest it would have been difficult to induce other people to make such investments; it nevertheless has been always understood that no such investment of money or assumption of financial obligation was permissible if it affected the officer's or employee's performance of his duty.

"Under the conditions of to-day, as they have been stated, it is essential that all officers and employees should be absolutely free to discharge their duties impartially. Applying this principle to the coal trade as an illustration, the keen competition of to-day requires every officer and employee of the Pennsylvania to part with any investments which he has in the shares of any coal producing company, and also to part with any interest which he has in or with any firm or individual mining coal, on any of the lines of the Pennsylvania System; and every officer and employee should be required to refrain from any investment whatsoever which may possibly prejudice or affect the interests of the company or interfere with the company's full discharge of its duty to the public."

Following that preliminary report orders were at once issued by the President to carry into effect its recommendations. A reasonable length of time has been given for compliance with this order, and it is recommended that any officer or employee who has disobeyed it be dismissed from the service.

A mistaken public opinion, misinformed as to the facts, because of the publication of portions, and not the whole, of the testimony of the witnesses before the Interstate Commerce Commission, and therefore basing its conclusions upon insufficient premises, has done grave injustice to the whole service of the Pennsylvania Railroad Company. That service is of more than 60 years' growth; it is constituted in the main of educated, trained and self-respecting men, whose honorable lives have won the esteem of those who know them best; it has its traditions of loyalty; and it has had, in its successive officers, examples of unselfish devotion to duty and steadfast adherence to the right.

Only 51 of the 198,930 officers and employees of the companies constituting the Pennsylvania Railroad System were examined as witnesses before the Interstate Commerce Commission, and of this number 21 officers and employees were shown to have acquired by investment, and in a few cases by gift, any interest in coal companies or properties. This committee has interrogated 2,505 officers and employees, there being included in that number every officer of the several companies whose individual action, or whose order to any subordinate, could effect any undue and unreasonable discrimination for or against any customer of the railroads or could prejudice the interests of the company in any way. Of the 2,505 officers and employees, 266 were found to have interests in coal or other corporations or firms or with individuals. The majority of those interests are in corporations whose shares are dealt in on the open market. Of those 266 officers and employees, 251 had acquired their interests by purchase. The few remaining officers and employees received gifts of shares, or interests, in various corporations. The committee regrets that any officer or employee of the Pennsylvania should have so far forgotten that which was due to the service, and that which was also due to his own character, as to accept a gift whose acceptance might bring a suspicion of conflict between his official duty and his personal interest. The committee has reported to the Presidents of the several railroad companies, for appropriate action, the names of those officers and employees who have, in the judgment of the committee, been found to have failed in the performance of their duty. As the final result of its examination of the whole subject committed to it, the committee reports that, with few exceptions, the officers and employees of the companies constituting the Pennsylvania system have been faithful to duty.

Details of Pacific Locomotive for National Railroad of Mexico.

In the description of the Pacific (4-6-2) locomotive built for the National Railroad of Mexico by the Baldwin Locomotive Works, published in the *Railroad Gazette* of Feb. 1, 1907, attention was called to the bifurcated connecting rod and the fastening between the rear and main frames. Through the courtesy of the builder illustrations are given here of these parts. The connecting rod is a steel casting open or bifurcated at the crosshead end with a gap wide enough to span the forward axle at the crosshead end and webbed at the crankpin end in order to obtain the rigidity needed to withstand the vertical stresses that are set up at that point. The opening at the axle has a clear space of 27 in. by 38¼ in. with bars 3 in. wide and 3½ in. deep at the top and bottom. The stub end at the crosshead is cut with shoulders at the front and back so as to relieve the bolts of all shearing stress, and into this space the head is fitted and held by three 1¼ in. bolts that pass through from the top to the bottom, and two of the same size that take the lips at the rear. This head is thus made to serve the double purpose of binding the ends of the connecting rod frame together and carrying the wristpin brass. For the latter purpose, the head is fitted with a keyway and adjusting screws, which serve to fix the position of the brass; the oil cup, for which, is cut in the upper strap of the connecting rod. The wristpin has a diameter of 4½ in. and a length of 3½ in.

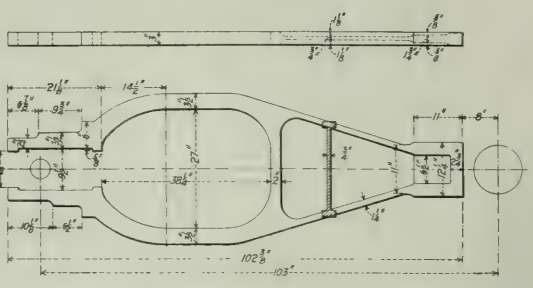
At the crankpin end, there is a heavy U strap bolted to the stub of the connecting rod by three 1⅛ in. bolts that are relieved of shear by two keys that are driven in between the strap and the stub end at the top and bottom, respectively. The brasses are fitted in this strap in the usual manner and are adjusted by a key with a keeper at the bottom. The cranked axle offers a bearing for the rod 11 in. in diameter and 5 in. long.

The frame for such an engine must necessarily be very rigid in itself, not only on account of the power of the engine, but because of the difficulty of introducing cross-bracing at the front. Each side is made in three sections. The main portion includes the pedestals for the three pair of driving wheels. At the front there

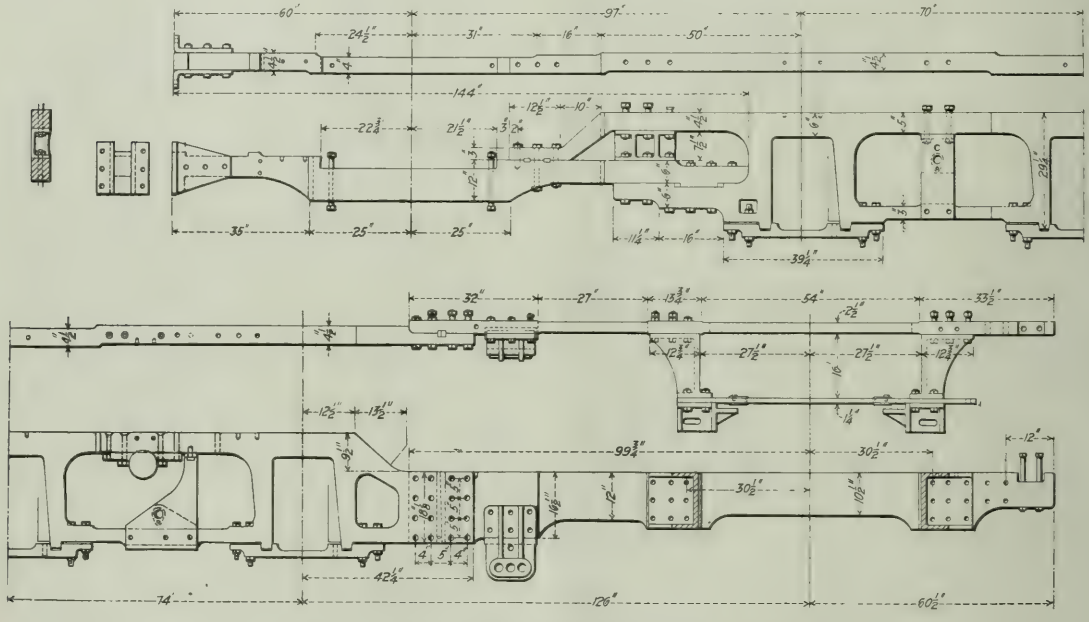
is a single bar that is fastened to the upper and lower rails of the main frames, as shown in the illustration. These rails or tongues are each bolted to the front rail and in addition a steel casting is inserted with three 1¾-in. bolts at the top and bottom. The three at the top take the upper rail or tongue of the main frame, and those at the bottom pass through both the front rail and the main frame. In addition to these there are three bolts holding the front bar to the top and bottom bars each. At the back end the front rail is lipped down into the lower tongue and keyed with two keys, besides which two keys are used for fastening to the upper tongue. With this design the opening of the jaws is prevented from spreading and the working of the keys avoided.

The rear frame is held to the slab section of the main frame by sixteen 1¼-in. bolts spaced 4 in. and 5 in. between centers, in addition to which a vertical key is inserted between the two parts.

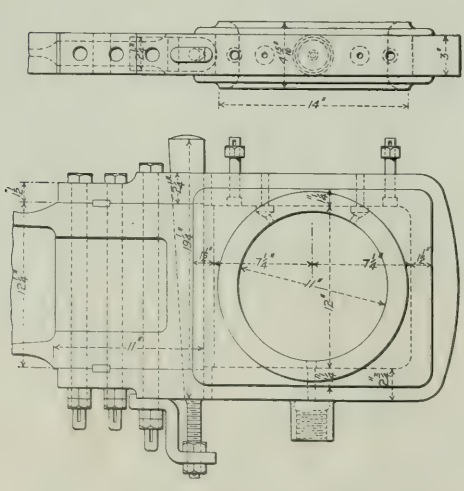
Back of this the auxiliary frame for the trailing truck pedestals, is held by two cast steel brackets, bolted to the rear section of the frame. These brackets are each held by nine 1⅛-in. bolts and stand out 15¾ in. and thus hold the auxiliary frame of 1¼ in. by 10¾ in. steel in place.



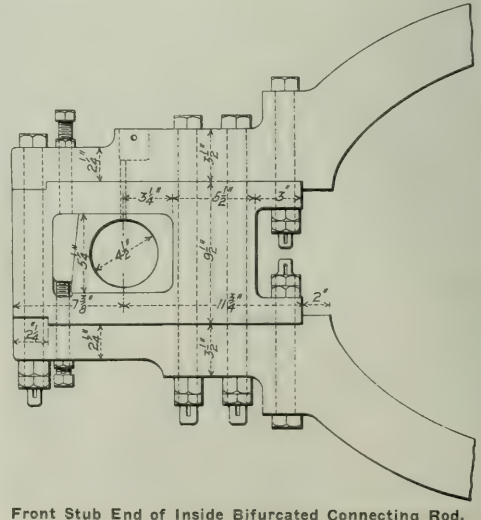
Bifurcated Inside Connecting Rod for Pacific Locomotive for National of Mexico.



Frame of Pacific Locomotive for National Railroad of Mexico.



Rear Stub End of Inside Bifurcated Connecting Rod.



Front Stub End of Inside Bifurcated Connecting Rod.

GENERAL NEWS SECTION

NOTES.

The Texas legislature has passed a bill giving interurban electric railways the right of eminent domain.

The Louisville & Nashville has made an increase of 10 per cent. in the wages of locomotive engineers, together with more favorable rates for overtime.

The Supreme Court of the United States has decided the case of the Gulf, Colorado & Santa Fe vs. the Railroad Commission of Texas, involving state freight rates, favorably to the state.

At Milwaukee, Wis., the Post Office Department has put in use automobile mail wagons, 15 ft. long and 5 ft. wide, for the collection of mails, in which there are racks for letters and space for a man to sort them while on the road.

According to consular reports, the net tonnage of coastwise freight carrying steamships entering the port of New York during 1906 was 5,589,090 tons, and the tonnage of vessels clearing from New York was 6,102,974 tons. The freight traffic of these steamship companies increased 25 per cent. during 1906, and the permanent carrying capacity, it is estimated, increased an equal percentage.

The legislature of Montana has passed a stringent railroad law, creating a commission with extensive powers. The law is said to be a combination of the Federal, the Wisconsin, the Iowa and the Texas railroad laws, which seems to be understood as meaning that it includes the most radical features of these several laws. The Montana commission is empowered to make changes in rates on its own motion.

Everybody is in favor of having something done to do away with the shortage of freight cars, but, as in other things, it is difficult to find the individual who wishes to have the pressure of any ameliorating measure applied to himself. The city of Chicago is the birthplace of many reforms on paper, but Board of Trade men just now are demanding that seven days' time be allowed free for the unloading of grain cars. If this is not done, say the complainants, serious harm will result to the Chicago market.

What is said to be the largest settlement ever made by a railroad corporation in a suit for damages for personal injuries was announced at White Plains, N. Y., last week, when the action of Edward Kleist, of New Rochelle, for $200,000 damages against the New York Central had been settled. The company gave a check for $50,000 to settle the suit. Mr. Kleist, who is 50 years old, on December 19, 1905, was riding in a New Haven coach when a Harlem train crashed into it at 105th street, Manhattan. He is still suffering from his injuries.

The Interstate Commerce Commission has canceled its Tariff Circulars 8A and 9A and promulgated Tariff Circulars 10A and 11A, containing regulations governing the construction and filing of tariffs. The freight tariff regulations are to become effective on May 1 and the passenger tariff regulations on June 1, 1907. To give ample time for consideration of points raised in objections to Rule 15 of Circular 8A and Rule 17 of Circular 9A, those paragraphs have been omitted from the revised regulations; but in so doing the Commission does not express any opinion or make any decision upon the points involved in the omitted paragraphs.

The cases of the Union Pacific and the Chicago, Burlington & Quincy against the various county treasurers of the state of Nebraska, involving the tax rate on the property of the railroads and calling into question the administration of the Nebraska state tax law, have been decided adversely to the railroads by the Supreme Court of the United States. The decision was announced by Justice Holmes. This decision of the Supreme Court means that the railroads parties to the suit must pay into the treasuries of the sixty-one counties interested an aggregate of about $3,100,000 of taxes now due, including penalties. This includes the taxes for 1904, 1905 and 1906. The railroads had offered about $2,200,000, so that the amount really involved was about $900,000.

American Locomotive Company Changes.

J. E. Sague, M.E., Vice-President of the American Locomotive Company, has resigned. Herman F. Ball, Vice-President of the American Locomotive Automobile Company, has been appointed Vice-President in charge of Engineering of the American Locomotive Company, and David Van Alstyne, Manager of the Brooks Works of the company at Dunkirk, N. Y., has been made Vice-President in charge of Manufacturing. All these appointments take effect March 1. Mr. Sague has been identified with the locomotive building industry since 1892, when he became Mechanical Engineer of the Schenectady Locomotive Works, which office he held until the formation of the American Locomotive Company. He is a graduate of Stevens Institute, and was engaged in railroad work from 1883 until 1892. As Vice-President of the American Locomotive Company since June, 1904, Mr. Sague was in charge of the engineering and manufacturing branches. His ability is acknowledged by his associates in the American Locomotive Company and recognized by all those with whom he has been brought in contact in the discharge of his duties. Mr. Ball, Vice-President in charge of Engineering, was until June last Superintendent of Motive Power of the Lake Shore & Michigan Southern. Mr. Ball was born at Altoona, Pa., Dec. 17, 1867, and entered railroad service in 1884, and from that time until 1890 was identified with the mechanical department of the Pennsylvania, leaving there to go with the Lake Shore & Michigan Southern. Mr. Van Alstyne was born June 14, 1865, at Louisville, Ky., and educated at the Massachusetts Institute of Technology. In 1886 he was employed as machinist apprentice on the Louisville & Nashville and served eight years on that same road in the machine shops and as locomotive fireman and as roundhouse foreman. For some four years Mr. Van Alstyne was Superintendent of Motive Power of the Chicago Great Western, resigning there in May, 1904, to become Mechanical Superintendent of the Northern Pacific. On October 1, 1906, he became Manager of the Brooks Works of the American Locomotive Company.

Pennsylvania Increases Station Agents' Pay.

Station agents and their helpers on the Pennsylvania Railroad have received increases averaging 12.8 and 13.7 per cent. in their wages. The increase amounts to $446,736 annually. The order applies over all of the company's lines east of Pittsburg and Erie, and is to date from Feb. 1. In the readjustment 5,471 employees will be affected. Of these 745 are station agents and 4,726 are employees in what is known as station forces. The total wages paid monthly under the old scale was $275,562, and the revision brings it up to $312,790, an increase of $37,228 a month.

In announcing the raise, the management makes the following statement:

"Freight and passenger agents are classed among our most faithful and trustworthy employees, and on their intelligence and efficiency, as well as that of the forces under their charge, largely depends the successful conduct of the company's business interests intrusted to their care. The adjustment was ordered to better equalize their rates of pay with those of other classes of employees on the system at large; that they might compare favorably with positions of corresponding importance in the commercial world, and to show material appreciation of the earnest efforts of these employees in the past."

New York State Rules for Drawbridges.

The New York State Railroad Commission, having examined the conditions existing at drawbridges on the railroads of the state, has adopted rules for greater safety. The rules provide for protection by home and distant signals, 50 and 1,500 ft. respectively, and derails not less than 500 ft. from end of draw, where possible, all interlocked, so that the first movement to open the draw will set both signals. The movable rails on ends of drawbridges must extend beyond the end of the bridge and connect with shore rails by a mitre joint, the ends to meet in a trough and be governed by levers suitably interlocked with the signals.

The Paramount Duty.

Honest and impartial men are convinced that stock-watering, manipulation and speculation by "insiders" have been carried on unscrupulously. So long as this belief exists, and there are so many facts to sustain it, railroad men cannot say that the mur murings against them are causeless, or that a duty is not laid upon them to restore public confidence by adopting and enforcing honorable and open financial methods. But an even more grievous reproach lies in the bad reputation of American railroads for safety. The lamentable accumulation of disasters, with great loss of life, during the past six months can but heighten the common feeling, both at home and abroad, that our railroad management is marked by lack of foresight and by something like recklessness. So long as this sentiment prevails, and has so much to base itself upon, it is of no use to boast about our vast mileage and low freight rates. To make operation safer is the first obligation. It is well to stop rebating; it is desirable to enforce publicity; it is necessary to make the greatest railroad magnates obey the law—but the chief demand of the people just now is that every known safeguard be employed, every consequent outlay be faced—even if surpluses and dividends have to be cut—every form of vigilance be observed, every method of discipline enforced that can free Americans from

the haunting fear of accident whenever they set out on a railroad journey.—*Evening Post, New York.*

A New Car Seal.

A new car seal is shown in the accompanying engraving. It is made of tinplate, is 8½ in. long over all, and the tin band is $^{11}/_{32}$ in. wide. The upper end of the band for ½ in. is bent backward and down against the band and has a semi-elliptical hole near its end, forming a snap or catch like that on a bracelet. The lower or enlarged portion of the seal is a pocket into which the upper end is thrust, the small corrugation seen near the upper end sliding in a groove in the pocket wall, guiding the end to place. Once inserted the end cannot be withdrawn without destroying the seal.

Several advantages over the old style seal are claimed. The first and most important is that sealing can be done much faster. At night, especially, with the lead seals, press, book and lantern a



Estell Car Seal.

man has his hands full and spends much more time applying the seals than by use of the device here described. The numbering is put on the tin band and may be easily read. On lead seals the numbering is too often quite indistinct. The tin seals are numbered consecutively and the agent is required to account for every one issued to him; a record being kept of all sent him, and his reports being expected to show what becomes of each one.

The price of the seal in small lots is $3 a thousand, f.o.b. destination in the United States. For larger quantities, or where sold under contract, the price would be less. They are made and sold by the Estell Car Seal & Equipment Co., Denver, Colo.

Reductions of Passenger Fares.

The State Railroad Commission of Wisconsin has issued orders to the Chicago & North-Western, the Chicago, St. Paul, Minneapolis & Omaha and the Chicago, Milwaukee & St. Paul to reduce passenger fares from 3 to 2½ cents within twenty days. It is said that the orders will not be contested. As a result of the decision of the Commission it is expected that various bills now in the Legislature providing for a two-cent fare will be withdrawn or killed. In the opinion of the Commission the North-Western will still earn 6½ per cent. on its property used for intrastate passenger traffic, and the Omaha 5½ per cent.

At Jefferson City, Mo., the Senate has passed the House two-cent rate bill, after amending it to conform to the Senate bill and adding a penalty of a fine of $100 to $500 for each violation. The bill is now in the House for concurrence in the amendments.

In West Virginia last week the Conference Committee agreed to the Senate two-cent bill with a limitation exempting lines of fifty miles or less. It is considered certain that the Senate measure will become a law.

In Indiana the Senate two-cent fare bill, amended so as to provide for 2½-cent cash fares when tickets are not bought, and for the rebate of this extra amount at any ticket office, has passed the House, 87 to 7, and is now a law.

In Minnesota the House has passed the two-cent fare bill and sent it to the Senate.

In Nebraska, by a vote of 90 to 0, the House passed the two-cent fare bill and it has gone to the Governor.

A Welcome.

"Shonts, wha hae wi' Wallace fled,
Shonts, wham Taft pats on the head,
Welcome, Interborough's head,
Wi' more salary!

"Wha said aught of 'traitor knave,'
Wha remarked on 'cowards' grave,
Wha said, 'Base as is a slave,'
When you quit, T. P.?"

—*Charles S. Putnam, in the New York Sun.*

TRADE CATALOGUES.

Forgings.—The Cleveland City Forge & Iron Co., Cleveland, Ohio, has prepared a hand-book or manual of information concerning the round and square bars, turnbuckles, clevis nuts and other forgings made by the company. It is intended for engineers, architects, mechanics and car builders. Besides the detailed information concerning these products it gives some useful tables. It is 4¼ x 7, bound in flexible leather, has 56 pages of printed matter and 24 blank pages for memoranda.

Rhodes, Curry & Co.—This car building company, Amherst, N. S., is distributing an unusually neat and convenient card-case with memorandum book attached.

Manufacturing and Business.

John McKinnon has been appointed General Manager of the Kalamazoo Railway Supply Co., Kalamazoo, Mich.

The Kennicott Water Softener Co., Chicago, has received an order from the Baltimore & Ohio R. R. for a softener having an hourly capacity of 40,000 gals., to be installed at East Side, Philadelphia, Pa.

W. W. Hoit, who for a number of years has been general yardmaster of the New York Central & Hudson River at West Albany, has gone to the Quincy, Manchester, Sargent Company, with office at New York.

The Universal Portland Cement Co., Chicago, announces the appointment of F. G. Bentley as Western Traffic Manager, with office at Chicago, and L. C. Bihler as Eastern Traffic Manager, with office at Pittsburg.

The Electric Storage Battery Company has opened a sales office in the Candler Building, Atlanta, Ga., in charge of Harold H. Seaman, formerly engineer of the Cleveland sales office of the company. His present territory consists of Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama and Mississippi.

The annual report of the Chicago Pneumatic Tool Company for the year ended December 31, 1906, shows net earnings of $1,001,550; the amount available for dividends was $686,469, out of which 4 per cent. on the $6,108,800 capital stock was paid, leaving $442,117 surplus for the year. During the year $195,000 was borrowed to acquire the business of the Philadelphia Pneumatic Tool Company and for the organization and extension of subsidiary companies in foreign countries.

A large addition to the steel plate fan shop of the American Blower Co., Detroit, Mich., is about completed and will be ready for occupancy in about 30 days. Plans are now being prepared for a large addition to the power plant and to the engine building department. So rapidly has the plant grown that all available space on the present site has been used up. As a sample of this growth, a few years ago the engine department was almost a side line, but now, since the new vertical, self-oiling engine has been developed, this department is taking first place and is forcing an entire re-arrangement of the plant.

Col. John T. Dickinson, who was recently elected Vice-President of the Bliss Electric Car Lighting Company, of Milwaukee, was born in Houston, Texas, June 18, 1858, and was educated at the University of Virginia, where he graduated in the law department in June, 1879. From 1882 to 1888 he served in Texas as Secretary of the state board in building the Texas state capitol at Austin, and from 1889 to 1894 was Secretary of the World's Columbian Commission in Chicago. Soon after the close of the World's Fair, Col. Dickinson went to New York City, and since that time, as Second Vice-President of the Consolidated Railway Electric Lighting & Equipment Company, has given his attention to the exploitation and sale of electric car lighting equipment for railway passenger cars. He enjoys a wide circle of friends covering the entire railroad field. As Vice-President of the Bliss Electric Car Lighting Company, he will be in charge of the eastern territory, making his headquarters at the new offices in the Night and Day Bank Building, Fifth avenue and Forty-fourth street, New York City.



Col. John T. Dickinson.

Iron and Steel.

The Kansas City, Mexico & Orient has ordered 40,000 tons of 70-lb. and 80-lb. rails from the United States Steel Corporation.

The Norfolk & Southern has ordered 1,500 tons of rails; the Detroit, Jackson & Chicago, 1,600 tons and miscellaneous orders for other electric roads aggregate 2,000 tons.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered 1,100 tons of steel for bridges; the St. Louis & San Francisco 300 tons, and the Chicago, Lake Shore & Eastern 300 tons.

The South Manchuria Railway, which is being built by the Japanese Government, has ordered 50,000 tons of 60-lb. rails from the United States Steel Corporation, and 8,500 tons of bridge material.

The Grand Trunk has ordered from the American Bridge Co. 3,000 tons of steel for new shops. The New York, New Haven & Hartford has ordered about 3,500 tons of bridge material.

OBITUARY NOTICES.

W. L. Smith, General Agent of the Illinois Central at Memphis, Tenn., was drowned on February 22, while duck hunting. Mr. Smith was about 45 years old, and had been on the Illinois Central for the last 20 years.

William A. Thrall, formerly and for many years General Passenger and Ticket Agent of the Chicago & North-Western, died last week at his home in Chicago, after several months' illness. Mr. Thrall was 72 years old. He was born at Sharon, N. Y., and began railroad work in 1858 on the Galena & Chicago Union, now part of the Chicago & North-Western. After a few years he was made Assistant General Passenger Agent of the Illinois Central, where he remained until 1872; he was then appointed General Ticket Agent of the Chicago & North-Western, and in 1873 was appointed General Passenger and Ticket Agent, which position he held until he retired from railroad work 10 years ago. Mr. Thrall originated the simplex ticket, the present mileage ticket and the credential system. He was a Director of the Columbus Safe Deposit Company, President of the American Railway Guide Company and a member of many Chicago clubs.



William A. Thrall.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Canadian Society of Civil Engineers.

At a meeting of the mechanical section held on Feb. 28, a paper on "Gas, Gas Engines and Gas Producers," by J. Seton Gray, was read.

Railway Signal Association.

The regular March meeting of this association will be held at the Great Northern Hotel, Chicago, on Monday, the 18th. The subjects for discussion are: 10 a.m., General Specifications for Electric Interlocking; 12 m., Installation and Maintenance of Storage Batteries; 2.30 p.m., Signal Lamps; 3.30 p.m., Special Committee Report on Interlocking and Block Signals.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Denver & Rio Grande.—D. E. Cain, Assistant to the Vice-President in charge of operation, has resigned.

Isthmian Canal Commission.—John F. Stevens, Chief Engineer of the Panama Canal and Vice-President of the Panama Railroad, has resigned. Major G. W. Goethals, of the United States Engineers, has been appointed Chairman of the Commission, succeeding T. P. Shonts, resigned, and also Chief Engineer, succeeding Mr. Stevens. Major D. D. Gaillard and Major W. L. Sibert, both of the United States Engineers, and Senator J. C. S. Blackburn, of Kentucky, have been appointed Commissioners. All appointments are effective March 4.

Seaboard Air Line.—W. A. Garrett, First Vice-President and General Manager, has been elected President, succeeding Alfred Walter, deceased.

Western Pacific.—F. W. M. Cutcheon has been appointed General Counsel, with office at New York, effective March 1.

Operating Officers.

Canadian Pacific.—G. J. Bury, General Superintendent at Winnipeg, Man., has been appointed General Manager in charge of maintenance and operation of western lines, with office at Winnipeg, Man., effective March 1. Mr. Bury was born in Montreal in 1866 and, after graduating from Montreal College, began railroad work in 1883 as a junior clerk in the purchasing department of the Canadian Pacific. After being made secretary to the General Manager, he was, in 1890, appointed Assistant Superintendent at North Bay, Ont.; he was later made Superintendent at that place, and in 1899 was transferred to Fort William, Ont., and two years later to Cranbrook, B. C. In 1902 he was promoted to be Assistant General Superintendent at North Bay and later in the same year was made General Superintendent at that place. In 1904 he was appointed General Superintendent of the Central division, with office at Winnipeg, where he has been until his present promotion.

R. Marpole, General Superintendent at Vancouver, B. C., has been appointed General Executive Assistant, with office at that place.

Central of Georgia.—See Georgia, Florida & Alabama.

Cincinnati, New Orleans & Texas Pacific.—See Seaboard Air Line.

Georgia, Florida & Alabama.—J. C. O'Dell, Superintendent of the Central of Georgia at Savannah, Ga., has been appointed General Manager of the Georgia, Florida & Alabama, succeeding W. B. Denham, resigned.

Mobile, Jackson & Kansas City.—T. F. Whittelsey, Second Vice-President and General Manager, has resigned. H. S. Jones, Chief Engineer, has been appointed to the new office of General Superintendent, reporting to the President, with office at Mobile, Ala., effective March 1, and heads of all departments heretofore reporting to the General Manager will hereafter report to the General Superintendent.

Northwestern Pacific.—James Agler, General Manager of the California North-Western, has been appointed General Manager of the Northwestern Pacific, with office at San Francisco, Cal. B. F. Porter, Second Vice-President and General Manager of the San Francisco & Northwestern, has been appointed Assistant General Manager of the Northwestern Pacific, in charge of operated lines north of Shively tunnel, with office at Eureka, Cal.

St. Louis Southwestern.—F. J. Hahn, chief despatcher at Pine Bluff, Ark., has been appointed Superintendent of Transportation, with office at Tyler, Tex., succeeding A. B. Liggett, deceased.

Seaboard Air Line.—H. M. Waite, Superintendent of the Chattanooga division of the Cincinnati, New Orleans & Texas Pacific, has been appointed Superintendent of the Atlantic & Birmingham division of the Seaboard Air Line.

Southern Pacific.—D. Urquhart, Superintendent of the Commissary Department, has been appointed to the new office of Superintendent of Dining Cars, Hotels and Restaurants.

Tavares & Gulf.—A. W. Brittain has been appointed General Manager, with office at Clermont, Fla., succeeding, as General Manager, R. H. England, Vice-President and General Manager, resigned on account of ill health, effective March 1.

Traffic Officers.

Chicago, Burlington & Quincy.—A. C. Ballach, Assistant to the Passenger Traffic Manager, has resigned.

Delaware & Hudson.—W. J. Mullin, Assistant to the Second Vice-President, has been appointed to the new office of General Traffic Manager, with office at Albany, N. Y.

Marcellus & Otisco Lake.—R. L. Scott, Superintendent, has been appointed also Traffic Manager, with office at Marcellus, N. Y.

Northwestern Pacific.—R. X. Ryan, General Passenger and Freight Agent of the California North-Western, has been appointed General Passenger and Freight Agent of the Northwestern Pacific, with office at San Francisco, Cal.

Southern.—The passenger and freight agency at Havana, Cuba, heretofore in charge of C. E. Gay, General Agent, has been abolished.

Engineering and Rolling Stock Officers.

Baltimore & Ohio.—L. E. Haislip has been appointed Assistant Division Engineer at Pittsburg, Pa., succeeding E. D. Jackson, transferred.

Cleveland, Cincinnati, Chicago & St. Louis.—F. W. Smith, Principal Assistant Engineer, has been appointed to the new office of Construction Engineer. O. E. Selby, Bridge Engineer, has been appointed Engineer of Bridges and Structures. A. L. Kuehn, Superintendent of Maintenance, has been appointed to the new office of Engineer of Track and Roadway.

Mobile, Jackson & Kansas City.—See Mobile, Jackson & Kansas City under Operating Officers.

Northwestern Pacific.—F. K. Zook, Chief Engineer of the California North-Western, has been appointed Engineer of Maintenance of the Northwestern Pacific, in charge also of such new construction as may hereafter be assigned to him.

Oregon Short Line.—W. F. Easton, roadmaster of the Southern Pacific at Ogden, Utah, has been appointed General Track Inspector of the Oregon Short Line, of the Southern Pacific lines east

of Sparks and of the Union Pacific lines west of Green river, with office at Ogden, Utah.

Southern Pacific.—See Oregon Short Line.

Union Pacific.—See Oregon Short Line.

Purchasing Agents.

Northwestern Pacific.—H. W. Ellicott, Assistant General Purchasing Agent of the Southern Pacific, has been appointed Purchasing Agent of the Northwestern Pacific.

Southern Pacific.—See Northwestern Pacific.

LOCOMOTIVE BUILDING.

The Mobile, Jackson & Kansas City has ordered five locomotives.

The Chicago & Milwaukee Electric is reported in the market for four switching locomotives.

The Chicago & Milwaukee Electric has ordered two electric locomotives from the General Electric Company.

The South & Western denies having ordered 120 locomotives, as reported in the *Railroad Gazette* of February 22.

The Norfolk & Western denies having ordered 25 additional locomotives, as reported in the *Railroad Gazette* of February 22.

The Lester Mill Company, Lester, Ark., has ordered one 40-ton mogul locomotive from the East St. Louis Locomotive & Machine Shops.

The Wisconsin & Northern, which is under construction, will ask bids for locomotives about April 1. C. H. Hartley is General Manager, Oshkosh, Wis.

The Schneider Granite Company, Middlebrook, Mo., has ordered one 40-ton saddle tank, six-wheel, switching locomotive from the East St. Louis Locomotive & Machine Shops.

The Williamsville, Greenville & St. Louis has ordered one 54-ton, 10-wheel locomotive from the East St. Louis Locomotive & Machine Shops exactly like the one previously ordered and reported in the *Railroad Gazette* of February 8.

The North Shore Railroad, Cuba, will shortly be in the market for six 85-ton freight locomotives. The contract will be placed through the New York offices of the company, 106 Wall street. C. D. Gibbons is President.

The St. Louis & San Francisco is about to order 25 consolidation (2-8-0), 10 ten-wheel passenger (4-6-0), and 10 switching locomotives. The consolidation locomotives will be the same as the last 45 ordered from the Baldwin Locomotive Works, and the ten-wheel and switching locomotives will be the same as they purchased last year.

CAR BUILDING.

Dolese & Shepard, Chicago, are remodeling 150 wooden gondola cars.

The Atlantic Coast Line is in the market for 2,000 additional cars.

The Duluth & Northern Minnesota is in the market for one private car.

The Mexican International will shortly be in the market for coal cars.

The Iroquois Iron Co., South Chicago, Ill., is in the market for four flat cars.

The Eastern Kentucky, it is reported, is figuring on 50 steel underframe gondola cars.

The Tremont & Gulf is asking prices on from 100 to 200 logging cars of 80,000 lbs. capacity.

The Metropolitan West Side Elevated, Chicago, has ordered 20 motor cars from the Pullman Company.

The Camden Interstate Railways, Huntington, W. Va., will shortly be in the market for several electric cars.

The Hecla & Torch Lake is reported to have ordered 150 underframe ore cars from the American Car & Foundry Co.

The Chicago, Milwaukee & St. Paul denies that it will build 3,000 steel cars, as reported in the *Railroad Gazette* of February 22.

The South Manchuria Railway, which is being built by the Japanese Government, will, it is said, order cars in the United States.

The Bolivia Railway is in the market for 10 passenger coaches. The contract will be placed through W. R. Grace & Co., New York.

The Interborough Rapid Transit Co., New York, has ordered 200 cars for its elevated roads and 50 all-steel cars for the subway division.

The South & Western denies having ordered 5,000 hopper bottom coal cars and 25 passenger coaches, as reported in the *Railroad Gazette* of February 22.

The Cleveland, Cincinnati, Chicago & St. Louis, as reported in the *Railroad Gazette* of February 8, is about to order some express cars from Barney & Smith.

The Atlantic Coast Line, as reported in the *Railroad Gazette* of February 15, has ordered 50 flat and 20 express cars from the Hicks Locomotive & Car Works.

The Western Live Stock Express, Chicago, has ordered 100 36-ft. stock cars from the Ryan Car Co. in addition to the 100 reported in the *Railroad Gazette* of February 22.

The Wisconsin & Northern, which is under construction, will ask bids for cars about April 1. C. H. Hartley is General Manager, Oshkosh, Wis.

The Chicago, Burlington & Quincy, as reported in the *Railroad Gazette* of February 1, has ordered 2,000 steel gondola cars of 100,000 lbs. capacity from the Standard Steel Car Co., for September, October and November delivery.

The North Shore Railroad, Cuba, will shortly be in the market for 400 gondola and 50 box cars. The contracts will be placed through the New York offices of the company, 106 Wall street. C. D. Gibbons is President.

The St. Louis & San Francisco has ordered 40 coaches, 15 chair cars, six combination mail, baggage and express cars, all 70 ft. long over end sills, and 25 baggage and express cars 60 ft. long over end sills from the Pullman Co., all for October and November delivery.

The Solvay Process Company, Syracuse, N. Y., has ordered 25 steel tank cars of 80,000 lbs. capacity from the Bettendorf Axle Company for April delivery. These cars will measure 38 ft. long and 9 ft. wide, over all. The special equipment includes:

Bolsters	Bettendorf
Brake-beams	Damascus
Brakes	Westinghouse
Draft rigging	Miner
Dust guards	Harrison
Trucks	Bettendorf

The United Zinc & Chemical Company, Kansas City, Mo., has ordered eight steel tank cars of 80,000 lbs. capacity from the Bettendorf Axle Company for May delivery. These cars will measure 25 ft. 7 in. long, 9 ft. wide and 11 ft. 11⅜ in. high, over all. The special equipment includes:

Bolsters	Bettendorf
Brake-beams	Monarch
Brake-shoes	Walsh
Brakes	Westinghouse
Brasses	Camel
Couplers	Major
Draft rigging	Miner
Dust guards	Harrison
Trucks	Bettendorf

The United Railways & Electric Co., of Baltimore, as reported in the *Railroad Gazette* of February 22, has ordered from the J. G. Brill Co. 40 semi-convertible street cars. These cars will seat 44 persons, and will measure 30 ft. 8 in. long, inside measurement, and 43 ft. 4 in. long and 8 ft. 5 in. wide, over all. Bodies and underframes will be of wood. Each will be equipped with four Westinghouse motors, multiple unit control. The special equipment includes:

Air brakes	Westinghouse
Brakes	Peacock
Trucks	Brill
Tires	Midvale
Wheels	National Car Wheel Co.

The Bolivia Railway, as reported in the *Railroad Gazette* of February 22, has ordered from the Middletown Car Works fifty 30-ton, meter gage, flat cars, and twenty 30-ton, meter gage, stock cars, for June and July delivery. The flat cars will measure 34 ft. 4 in. long and 7 ft. 9 in. wide, inside measurements, 2 ft. 6¾ in. high from top of rail to center of drawbar, and 36 ft. 9 in. long, over all. The stock cars will measure 32 ft. 9 in. long, inside measurement; 2 ft. 6¾ in. high from top of rail to center of drawbar, and 36 ft. 9 in. long, and 8 ft. 8 in. wide, over all. Underframes of all cars will be of steel. The special equipment includes:

Brakes	Westinghouse
Brasses	Brady
Couplers	Janney
Springs	Pittsburg Steel & Spring Co.
Trucks	Diamond Arch bar

The Charleston & Western Carolina, instead of the Atlantic Coast Line, as reported in the *Railroad Gazette* of February 15, has ordered 200 double felt-lined ventilated box cars of 60,000 lbs. capacity from the Western Steel Car & Foundry Company, and 50 flat cars of 60,000 lbs. capacity from the Hicks Locomotive & Car Works. The flat cars will measure 40 ft. 8¾ in. long, 10 ft. wide and 4 ft. 4¼ in. high, over all. The box cars will measure 35 ft. 11 in. long,

8 ft. 6 in. wide and 7 ft. 5⅛ in. high, inside measurements, and 36 ft. 6⅝ in. long, 9 ft. ⅝ in. wide and 12 ft. 9¼ in. high, over all. Bodies and underframes of all cars will be of wood. The special equipment for both includes:

Bolsters	Truck, built up I beam and cover plate
Brake-beams	Pennsylvania deck
Brake-shoes	Christie
Brakes	Westinghouse
Couplers	Tower, slotted for Farlow key
Door fastenings	National Mall. Castings Co.
Draft rigging	Farlow twin spring
Dust guards	Harrison
Journal boxes	Symington
Paint	A. C. L. standard
Roofs	Murphy outside
Springs	A. C. L. standard
Trucks	A. C. L. standard

The Great Northern, as reported in the *Railroad Gazette* of February 8, has ordered 30 first class coaches, four dining cars, five second class coaches, ten 14-section tourist sleeping cars, twelve 12-section sleeping cars, three 16-section sleeping cars, 25 baggage cars of 60,000 lbs. capacity, 15 baggage and mail cars and 10 mail cars from Barney & Smith, for July and August delivery. The first class coaches will weigh 111,000 lbs. and measure 80 ft. 11 in. long, 10 ft. 2 in. wide and 14 ft. 1 in. high, over all. The dining cars will weigh 118,000 lbs., and measure 75 ft. 6 in. long, 10 ft. 2 in. wide and 14 ft. 2 in. high, over all. The second class coaches will weigh 93,000 lbs. and the tourist sleeping cars will weigh 90,000 lbs.; both the second class coaches and the tourist sleeping cars will measure 68 ft. 5 in. long, 10 ft. 2 in. wide and 14 ft. 1 in. high, over all. The 12-section sleeping cars will weigh 122,000 lbs., and measure 82 ft. 2 in. long, 10 ft. 2 in. wide and 14 ft. 2½ in. high, over all. The 16-section sleeping cars will weigh 121,000 lbs., and measure 73 ft. 3 in. long, 9 ft. 8 in. wide and 11 ft. 3½ in. high, inside measurements. The baggage cars will weigh 98,000 lbs., and measure 68 ft. 8½ in. long, 10 ft. 2¾ in. wide and 14 ft. 4 in. high, over all. The baggage and mail cars will weigh 106,000 lbs., and measure 69 ft. 9 in. long, 9 ft. 10 in. wide and 11 ft. 2¼ in. high, inside measurements. The mail cars will weigh 99,000 lbs., and measure 60 ft. ¾ in. long, 9 ft. 10 in. wide and 11 ft. 2½ in. high, inside measurements. The special equipment for all is as follows:

Brake-beams	Diamond special
Brake-shoes	Great Northern
Brasses	Great Northern
Couplers	Tower
Curtain fixtures (for all but baggage and mail cars)	Forsyth
Curtain material (for all but baggage and mail cars)	Pantasote
Door fastenings (for all but baggage, baggage and mail and mail cars)	Dayton
Door fastenings (for baggage cars)	Barney & Smith
Doors	Barney & Smith
Draft rigging	Great Northern
Dust guards	Harrison
Heating system	Gould
Journal boxes	Great Northern
Paint	Flood & Conklin
Roofs (all but baggage, baggage and mail and mail cars)	Empire
Seats (all but baggage, baggage and mail and mail cars)	Barney & Smith
Springs	Simplex
Trucks	Great Northern
Vestibules (all but baggage and mail and mail cars)	Pullman

RAILROAD STRUCTURES.

ALLIANCE, OHIO.—It is understood that the Pennsylvania will soon begin work on a large roundhouse to cost about $80,000.

HARRISBURG, PA.—Applications have been made to the City Council for permission to build the Philadelphia & Reading bridges at Thirteenth street and at Fifteenth street.

HOBOKEN, N. J.—The new terminal station of the Delaware, Lackawanna & Western at this place was opened for traffic February 25.

JERSEY CITY, N. J.—The Pennsylvania, it is reported, has authorized additions and extensions to its passenger terminal here to cost about $300,000, to include a new building 120 x 620 ft. to be built north of the slip now used by the boats to Twenty-third street, New York. Pier D, now occupying the space to be used as a site for the new building, will be rebuilt. At the north end of the present lobby in the passenger station an addition of 60 ft. will be added to connect with the new section. The new portion will include a large immigrants' waiting room, 120 ft. wide and 160 ft. long.

MEXICO CITY, MEX.—The Mexican Central, it is said, will build many new bridges on its main line and branches during 1907.

MONCTON, N. B.—An officer writes that this company will rebuild about six bridges and replace 12 short spans with new structures; also put up a new passenger station at Amherst, N. S., new machine shop at Riviere du Loup, and several smaller buildings.

TALLADEGA, ALA.—The Atlanta, Birmingham & Atlantic will shortly start work on a concrete freight house 50 ft. x 120 ft. on East street.

WILLIAMSPORT, PA.—An ordinance is to be submitted to the City Council authorizing the acceptance of the bid of Rogers Bros., of Albion, Pa., to build a bridge at the Campbell street under grade crossing for $39,900, of which the Pennsylvania Railroad is to pay $18,700, and the city the balance.

WINNIPEG, MAN.—Canadian Pacific improvements include the following: Steel bridge on the line from Lethbridge to Macleod, to cost $1,000,000; new station at Port Arthur, some other buildings at Ignace, Ont., and a new yard at Coalridge, Alb.

RAILROAD CONSTRUCTION.

BOSTON & ALBANY.—This company has promised to Boston merchants who complained of inadequate facilities that $1,000,000 shall be spent in improving the road, largely by putting in additional tracks near Boston and making terminal improvements in that city.

BALTIMORE & OHIO.—A preliminary survey has been made and rights of way secured for a new line from Johnstown, Pa., to Somerset, designed to relieve the congestion of traffic on the Somerset & Cambria branch. It will be almost a direct line south from Johnstown and will traverse the western end of Somerset County. The road will branch from the present Somerset and Cambria line, in Stoney Creek township, at Hogback tunnel, and will run through Johnstown, Boswell, Connors Postoffice and other small points. It will tap the Jerome, Boswell and Quemahoning coal fields, which are now connected with the Somerset & Cambria branch by poorly equipped branch lines with steep grades. The Somerset & Cambria branch is a single-track line and is crowded with freight.

BUFFALO & SUSQUEHANNA.—The company has decided to tunnel the mountain between Corbett, Pa., and Hull and also Newfield mountain, beginning work in March. Each tunnel will be about one mile long. This arrangement will give the company an eastern connection from the Clearfield region by way of the Erie at Hornell, N. Y.

BURR'S FERRY, BROWNDEL & CHESTER.—Contract has been given by this company to the Womack Construction Co. for building its proposed line from 10 miles east of Rockland, Tex., to Browndel, 25 miles.

CANADIAN NORTHERN.—MacKenzie & Mann have petitioned the Government for a guarantee of $20,000 a mile on a proposed line from a point nine miles above Parry Sound, Ont., on the Toronto-Sudbury section of the James Bay Railway, to North Bay, 75 miles. At North Bay the proposed line is to connect with the Temiskaming & Northern Ontario, which is being extended to a connection with the National Transcontinental near Lake Abitibi.

CINCINNATI, BLUFFTON & CHICAGO.—Contracts are reported let by this company for extending its road from Bluffton, Ind., northwest to Huntington, 23 miles; also from Portland south to Union City. The line, in connection with the Dayton & Union forms one side of a triangle controlled by the Erie.

COLUMBIA RIVER, OUTLOOK & NORTHWESTERN.—Application has been made for a charter by William Stewart and M. C. Stewart, with $3,000,000 capital. The company is being organized to build from Spokane, Wash., over the Cascade mountains, through the Yakima Indian Reservation to Vancouver, Wash. The office of the company is at Outlook, Wash.

CULLMAN SOUTHWESTERN.—Work has been started on the first section of this proposed line from Cullman, Ala., to Bremen, 20 miles. The contract for this work, which has been let, amounts to about $600,000.

GRAND TRUNK PACIFIC.—The Dominion Government, according to reports from Ottawa, on February 25 let contracts for building 450 miles on five sections of the National Transcontinental Railroad as follows: From Moncton west 60 miles to a point near Chipman; Grand Falls, N. B., west to the Quebec boundary, about 62 miles; from the Quebec bridge east about 150 miles; from La Tuque, Que., west to Weymontachene, about 45 miles; from a point eight miles west of the Abitibi river, easterly about 150 miles. The amount of the five bids was about $13,000,000, equal to about $30,000 a mile. Three of the sections are to be built by the Grand Trunk Pacific, one by M. T. & J. T. Davis, of Ottawa, and the remaining section by Lyons & White, of Ottawa.

INDIANAPOLIS, HUNTINGTON, COLUMBIA & NORTH-WESTERN.—An officer writes that this company, which proposes to eventually use electricity, but for the present will use steam as a motive power, commenced grading in September, 1906, from Indianapolis, Ind., via Huntington and Wawasee Lake to Goshen, 155 miles. Contracts let to M. V. Ryan, of Syracuse, Ind., for building from Huntington to Goshen, 60 miles. Grading completed from Wawasee Lake to Benton, 11 miles, and tracklaying is to be started early in March. Denver L. Horner, of Syracuse, Ind., Chief Engineer.

LOUISVILLE & NASHVILLE.—Under the name of the Pine Mountain, this company is reported building a line between Pineville and Williamsburg, Ky., 35 miles, to new coal fields.

MEXICAN CENTRAL.—On the Tuxpan extension of this road, according to Lewis Kingman, Chief Engineer, who has recently in-

spected the work, there are 4,000 men at work building the line, and it is expected to have the work completed by the first of next year. Some heavy work remains to be done between Colima and the Port of Manzanillo. The old narrow gage road, which was bought by the Mexican Central, will be rebuilt and used as part of the through line. Two tunnels are now being driven through mountains between these two points.

MEXICAN ROADS.—Walter C. Palmer, Zacatecas, Mex., who was recently granted a concession by the Mexican Government for a line from Gutierrez, state of Sonora, on the Mexican Central, to Durango, where a connection is to be made with the Mexican International, is now in the United States making arrangements to begin work on the line. It is reported that the American Smelting & Refining Co., which owns extensive mining properties at Sombrete, which will be reached by the new line, is back of the project.

NORTH SHORE.—Incorporation has been granted this company under the Cuban laws, with a capital of $2,500,000. The company, which is backed by New York capitalists, with C. D. Gibbons, 106 Wall street, as President, is said to have made financial arrangements with a French syndicate, and construction work will be started soon. The company proposes to build from a point on Mayanabo Bay, north of Nuevitas, in the Province of Puerto Principe, west through Cubitas Valley to Caibarien, a port in the Province of Santa Clara, about 250 miles. A 50-mile branch is to be built from Senada to iron mines south of the Cubitas mountains.

OCEAN SHORE.—An officer writes that this company, which will use electric power for its passenger service and steam for its freight, has been under construction for the past year, from San Francisco, Cal., south to Santa Cruz, 83 miles. Contracts for building the line, which is to be double-track, have been let to the Rialto Construction Co. from San Francisco to Ocean View, eight miles; to Willitt & Burr, the Ransome Construction Co. and Mahoney Bros. from Ocean View to Mussel Rock, 4¾ miles; to the Ransome Construction Co., Lewis Moring and Antonelli & Bandman from Mussel Rock to San Pedro Mountain, eight miles; to the Ransome Construction Co. from San Pedro Mountain to Wadse Beach, 41 miles, and to Shattuck & Desmond and Pratchner & Chadwick from Wadse Beach to Santa Cruz, 21 miles. Grading is about completed on the entire line, and track is laid for 10 miles between San Francisco and Mussel Rock; also for 12 miles from Santa Cruz to Davenport. Franchises and land has been secured for terminals at both San Francisco and Santa Cruz. J. Downey Harvey, President; Burke Corbet, Secretary and Treasurer, and J. B. Rogers, Chief Engineer, San Francisco.

OREGON EASTERN.—See Southern Pacific.

PHILADELPHIA, NORRISTOWN & NORTHERN.—Incorporated, with a capital of $85,000, in Pennsylvania, to build from Villa Nova, Pa., to Norristown, 8½ miles, with a branch from West Conococheague. Morris Bernheimer is President. G. B. Staples, E. H. Weeks, I. Pratt, C. H. Richardson, S. E. Staples and W. S. Huntington, all of Philadelphia, are directors.

PUYALLUP VALLEY NORTHERN RAPID TRANSIT.—Contracts are reported let to the Engineering Construction Company, of New York, to build this proposed line. The project is said to be allied with the Puget Sound, Chelan & Spokane.

ST. JOSEPH VALLEY TRACTION.—This company has given a mortgage to secure funds to extend its road from Middlebury, Ind., west to Elkhart or Goshen.

SEBASTICOOK & MOOSEHEAD.—A bill has been introduced in the Maine Legislature to authorize this company to extend its lines to connect with the Canadian Pacific and the Wiscassett, Waterville & Farmington. If the proposed extensions are built they will make a connection from the Canadian Pacific to tidewater at Wiscassett. The Canadian Pacific at present has an outlet on the Maine sea coast. The proposed extension aggregates about 72 miles of track.

SOUTHERN PACIFIC.—According to reports from Portland, Ore., final location for the Oregon Eastern from Natron, Ore., southeast to Ontario, 240 miles, has been made, and it is expected that construction work will be started early this summer.

SPOKANE & INLAND EMPIRE.—Surveys are being made for piercing a tunnel in the business district of Spokane to connect this company's freight stations. The tunnel is to be three-fourths of a mile long and will cost about $1,000,000.

SPOKANE FALLS & NORTHERN.—This company, it is said, has located the route for a new cut-off to leave the main line at Denton's spur and rejoin it near Chewelah, 22 miles. Work is to be started this month.

TEXAS ROADS (ELECTRIC).—Recent favorable legislation will permit the Stone & Webster Syndicate to at once build its proposed electric line between Houston and Galveston, about 51 miles. The company proposes to build branches to points on Galveston Bay.

TONOPAH & GREENWATER.—Incorporated in California with $500,000 capital by F. M. Smith, of Oakland, Cal.; C. B. Zabriskie, of New York; De Witt Van Buskirk, of Bayonne, N. J., and others, to build a line from Amargosa Borax Works in Inyo County, Cal., to Greenwater.

RAILROAD CORPORATION NEWS.

ATCHISON, TOPEKA & SANTA FE.—Gross earnings for January, 1907, were $7,695,254, an increase of $930,287; net earnings $2,489,502, an increase of $93,508.

BALTIMORE & OHIO.—Gross earnings of this system, including the Baltimore & Ohio Southwestern, for January, 1907, were $6,365,559, a decrease of $207,907; net earnings $2,000,434, a decrease of $447,473.

CHICAGO & ALTON.—See Peoria Terminal Railway.

CHICAGO, CINCINNATI & LOUISVILLE.—It is announced that the $4,602,000 capital stock of this company will be returned to W. A. Bradford, President of the road, and associates, who owned the road prior to July, 1904, when all the capital stock was sold to the Pere Marquette for $3,500,000 Pere Marquette 4 per cent. 10-year collateral trust bonds; these bonds are now to be returned. The terms of the agreement, it is said, also include the turning over to Mr. Bradford and associates $400,000 receiver's certificates of the C., H. & D. and the Pere Marquette; the ratification of the agreement for the entrance of the C., C. & L. into Chicago over the Illinois Central tracks; a second entrance for the C., C. & L. into Cincinnati over the C., H. & D. tracks; and the waiving by the C., H. & D. of all claims to expenditures amounting to about $1,500,000, which the last named company made in improving the C., C. & L. when the C., H. & D. was in control through its ownership of the Pere Marquette.

CHICAGO, ROCK ISLAND & PACIFIC.—See Peoria Terminal Railway.

CHICAGO TERMINAL TRANSFER.—A decree of foreclosure has been granted against this company under a judgment for $16,824,690. The company has been in the hands of a receiver since April, 1906, and the property, consisting of a belt line around Chicago, several branch lines and the Grand Central Station, which is used by the Baltimore & Ohio, the Chicago Great Western, the Chicago Junction and the Pere Marquette, is to be sold, on a date to be fixed later, for a sum not less than $15,140,000, which is the amount of first mortgage, 4 per cent. bonds of 1947 outstanding.

CINCINNATI, HAMILTON & DAYTON.—See Chicago, Cincinnati & Louisville.

COLORADO & SOUTHERN.—This company has sold to the Guarantee Trust Co. and to Hallgarten & Co. $1,026,000 five per cent. 10-year equipment trust bonds, dated April 1, 1907. One subsidiary, the Fort Worth & Denver City, has sold $376,000 bonds, and another, the Trinity & Brazos Valley, has sold $500,000 bonds, the last named securities being guaranteed principal and interest by the Colorado & Southern and the Rock Island Company, which jointly control the road. The proceeds of these three issues are to pay in part for equipment costing $2,250,000 and consisting of 54 locomotives, 1,085 freight cars and 14 cabooses.

HOCKING VALLEY.—See Kanawha & Michigan.

ILLINOIS CENTRAL.—See Chicago, Cincinnati & Louisville.

KANAWHA & MICHIGAN.—The committee recently appointed to formulate a plan for refunding present indebtedness and beginning dividend payments has agreed on a plan, which will be submitted to the Directors at their next meeting, probably early in March. The plan will be operative only in case the proposed consolidation with the Hocking Valley does not go through. This merger is now being held up by the Attorney-General of Ohio on the ground that the roads are parallel and competing. (Jan. 11, p. 62.)

KANSAS CITY SOUTHERN.—Gross earnings for January, 1907, were $783,456, an increase of $118,501; net earnings $335,761, an increase of $165,309.

PEORIA & PEKIN TERMINAL.—See Peoria Terminal Railway.

PEORIA TERMINAL RAILWAY.—The property of the Peoria & Pekin Terminal has been sold under foreclosure for $600,000 to the Peoria Terminal Railway, which was recently organized as the successor. The Chicago & Alton and the Chicago, Rock Island & Pacific, which jointly own the $1,000,000 capital stock of the new company, have agreed on a plan of reorganization providing for the refunding of the $697,000 P. & P. T. first mortgage 5 per cent. bonds by an issue of Peoria Terminal 4 per cent. first mortgage bonds guaranteed by the two controlling companies, and for the refunding of the $280,000 refunding mortgage 5 per cent. bonds with new income bonds. The P. & P. T. operated 29 miles of road by steam and electricity between Peoria and Pekin, Ill., and went into the hands of a receiver in November, 1906.

PERE MARQUETTE.—See Chicago, Cincinnati & Louisville.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- New Railroad Legislation 291
- Hours of Labor Law 291
- The N. Y. Central Electric Train Wreck. 292
- Drawbridge and Signal Practice in New York 292
- Notable Commendation of Employees 292
- Reciprocal Demurrage 292
- Proposed Valuation of Railroad Property 293
- London Traffic Problems 294
- Interstate Overcharges not Collectible under Common-Law Rights 294
- Prussian Tests of Superstructure 295
- New Publications 295

ILLUSTRATED:
- Consolidation Locomotive for the Nippon Tetsudo Kwaisha Railroad. 296
- The British System of Cartage and Delivery of Freight at Terminals 300
- Motor-Driven Rotary Slotting Machine ... 304
- New Hoboken Terminal of Lackawanna 304
- Handling Immigrant Traffic at the Port of New York 307
- William A. Garrett 311
- Cars for the Electric Lines of the Erie .. 313

CONTRIBUTIONS:
- The Profitable Weight and Speed of Freight Trains 295

MISCELLANEOUS:
- Carnegie Steel Ties on Bess. & Lake Erie 297
- The Harriman Investigation 298
- Lake Superior Iron Ore Shipments 299
- Law Regulating Trainmen's and Operators' Hours of Labor 303
- Railroad Decisions in February 306
- New York State Drawbridge Rules 310
- New York State Block Signal Recommendations 310
- Some Railroad Problems 311
- Close of Congress 313
- Passenger Rate Regulation and the Canadian Parliament 313
- Foreign Railroad Notes. 297, 306, 314

GENERAL NEWS SECTION:
- Notes 315
- Obituary 317
- Trade Catalogues 317
- Meetings and Announcements 318
- Elections and Appointments 318
- Locomotive Building 319
- Car Building 320
- Railroad Structures 320
- Railroad Construction 320
- Railroad Corporation News 322

VOL. XLII., No. 10. FRIDAY, MARCH 8, 1907.

The two most important railroad measures passed by Congress just before adjournment—the hours-of-labor bill and the appropriation for investigating automatic train stops—go into effect only after the lapse of one year in the first-mentioned case and four months in the other; the labor law March 4, 1908, and the other at the beginning of the next fiscal year. Both are radical innovations. To regulate the hours of labor on trains effectively throughout 200,000 miles of railroad lines, through a bureau managed in Washington would be almost out of the question; and, as was pointed out in our editorial of January 4, the worst cases of overwork are not touched by the law, nor, indeed, can be. Statutory regulation must be crude at best. Still, the law may be useful as an instrument for indirect coercion, and it must be confessed that there is need of something of the kind. The wise railroad manager will set his house in order long before next March. The cases of overwork which have been published are not so exceptional as they may seem. For many of the large roads the cost will be severe; but it is a desperate disease that has to be dealt with. For trainmen's rest-periods to alternate between 36 hours or longer at one end of a 150-mile trip and only four hours at the other end, may please the men, and economize engines, but the practice is at variance with all of our fine professions about alertness, level-headedness and reliability in the men who manage trains. This law is an innovation because of the unparalleled extent of its operation, for an act which goes into so much detail. The granting of power to investigate automatic stops is novel, at least in the field of interstate commerce, in that it goes to the extreme in trying to forestall private enterprise. To inspect every pail of lard sold in the United States is a rather novel function for the government to undertake, but it is in line with a need which has long existed and is generally recognized. The automatic stop, however, is a refinement in which only a small part of the people have any present interest, while at the same time it is a device which has been fairly developed by private enterprise. Publicity is beneficial in all matters pertaining to safety on railroads, and it will be a good thing for the Government to set forth the present state of this art, even, perhaps, to the extent of encouraging meritorious ideas which have not yet been made practical; but the supposed devices with merit which have remained unknown because of the unfriendly attitude of the railroads or of the signal manufacturers will not materialize.

In its details the hours-of-labor bill is somewhat confused; but it seems to mean that except in emergencies trainmen (1) must not work more than 16 hours continuously; (2) after working 16 hours continuously must lie off 10 hours; (3) after working 16 hours within 24 hours, even if not continuously, must lie off 8 hours; that despatchers and operators in important offices must not work over 9 hours, and other operators not over 13. The definition of "emergency" is somewhat limited in the last part of Section 3. The employee who works till he falls asleep is not punished at all. One of the humors at the last Committee hearing at the capitol was a complaint from the trainmen's representative that Secretary Moseley, who, probably, was the father of the original bill, was trying to emasculate it; and the words of the President of the United States were once more brought in question. Whatever Mr. Moseley was trying to do, the net result of his suggestions appears to have been the rejection of some of the most mischievous clauses of the bill, as, for example, the provision allowing three years in which to bring suit for violation of the law. Unfortunately, he failed in his effort to kill the provision making a difference between 12-hour and 24-hour telegraph offices, which will tend to retard the introduction and extension of the block system and encourage the employment of boys. As observed in the preceding paragraph, the law, as affecting trainmen, will be useful mainly as a club, for it can touch only a small part of the bad practice now existing. Taking the "24-hour period" as from 12 to 12, a trainman can work from 8.30 Monday morning to 12 o'clock Monday night, 15½ hours; rest three hours, and then work from 3 a.m. to 6.30 p.m. Tuesday; lie off 5½ hours and then after lying off—not necessarily resting—for 2½ hours more, or eight hours in all, can begin another similar process,

with no law to hinder. The railroad superintendent is the man to whom we must look for the safe management of trains.

In his testimony before the New York State Railroad Commission, Mr. A. H. Smith gives, as his opinion, the following explanation of the derailment of the electric train on the New York Central tracks near Williamsbridge on February 16 last: One of the trailing wheels of the leading locomotive was the first to leave the track. Something struck it and wedged between the flange of that wheel and the rail. All the bolts on the outside of the left-hand trailing wheel, the westerly wheel, were sheared off by the westerly rail so that that wheel must have been locked in tightly and the easterly wheel must have been wedged on the other side against the easterly rail. Mr. Smith testified that they had not had a derailment due to the rails spreading, in the ordinary sense of the word, which he could recall. His examination, on the evidence which led him to the conclusion which is summarized above, lasted two hours, and the exhibits and proofs submitted seem to support his opinion at every point. The shearing of the spikes was fully accounted for by the spreading force of the trailing truck when it was pinched in between the rails. The cause of the overturning of the four rear coaches was shown plainly to be due to the tearing loose from the car body of the trucks, and their bunching, followed by the sliding of the car bodies up on these trucks and tipping over on their sides. The coroner's investigation was quite as farcical as has been predicted. The railroad company was not allowed to submit rebutting evidence. The jury retired for consultation on Monday of this week. It is said that seven jurymen were in favor of a verdict to the effect that the track was safe and that the speed was not excessive, while five of the jurymen were insistent on severe condemnation. The result was a compromise verdict to the effect that the train "was running at a speed in excess of what has been proved to be safe," and that the company "did not take all the necessary safe and proper precautions to guard its passengers at this point, and consequently was culpably negligent." The coroner announced that the board of directors and the operating officers would be held for examination by the Grand Jury, but since this announcement he has caused no arrest or taken further action that has been reported.

The New York State Railroad Commission has issued two recommendations (printed in another column) which, if merit could atone for mistakes, would go far to offset some of the unwise things that the board has done. It has notified the railroads that their diverse and behind-the-times drawbridge practice should be brought up to date and has recommended that the block system be used everywhere. It does not appear that the drawbridge practice in the state is markedly dangerous, but it may fairly be called behind the times, because the remedy is so simple. Most railroad dangers are relative. With good discipline and low speed a drawbridge may be managed safely without any signals or interlocking at all; but when signals and interlocking make such a comparatively small addition to the expense of maintaining a bridge it is illogical not to have them. After the Atlantic City drawbridge disaster of last October, we sent inquiries concerning drawbridge floors and drawbridge locking practice to 40 of the principal railroads of the country; and the silence of a large part of these roads seems very eloquent; it seems to indicate in a striking way that, concerning their drawbridge practice, they have nothing to say for publication. In the matter of derailing switches at draws the New York Commission leaves the railroads with a dilemma on their hands. Where there is a long trestle approach to a draw the question of the location of the derail may be hard to settle. A sand track might keep a derailed train from tumbling into the water, but most railroad men have had so little experience with sand tracks that they would hesitate to use one in such a place. Setting the derail at a point back on the shore might seriously delay traffic; so that in any event it might be found that a regular reduction of speed would be the only rational course at such a bridge. Perhaps it would be well for speed to be made moderate at drawbridges everywhere. One prominent road has enforced a 30-mile-an-hour limit without suffering any marked unhappiness therefrom. It is to be confessed, however, that in the case of bridges which are opened only once a month—or once in six months—such a limit tends to make a fellow mad. The block system order, in spite of its crudities, is commendable in three important features: it calls for the use of the space interval on all lines; it calls upon the roads to say what they are going to do about it; and it condemns permissive blocking. Concentrating attention and appropriations on busy lines while continuing bad practice on those less busy is a finance-committee notion which has been allowed far too much influence. With a number of roads operating 20-mile blocks, and some 40-mile, there is no longer any force in the claim that thin lines cannot afford to use the space interval. The commissioners' condemnation of permissive blocking is only what the railroads should expect. Given a superintendent with enough strength of character, and a force of enginemen trained by such a superintendent for, say, five years, it is imaginable that permissive blocking of freight trains could be managed with a reasonable degree of safety, but the fact remains that the railroads do not do it. They have had opportunity enough, and have not made good. The next thing is to shorten the blocks and make permissive signaling unnecessary. This circular is also commendable for what it does not say. The commissioners might have pleased some very good people by making more specific and detailed recommendations in certain directions; but they in so doing would have gone outside the legitimate function of government.

We had occasion last week to call attention to a novel occurrence in the railroad world—the action of General Manager Atterbury of the Pennsylvania Railroad in giving to the public a full statement of the results of his investigation of the derailment of a fast passenger train, which had occurred on his road. Scarcely less notable was another thing done by the same company, and noticed also in our last week's issue—a communication conveying a warmly appreciative utterance from the officers of the road, addressed to the station agents of the company, in connection with the announcement of a substantial advance in the agents' pay. Freight and passenger agents are indeed among the most faithful and trustworthy of any railroad's employees, and it is pleasing to see such an expression of approval of men who do not have a grievance committee. Grievance committees—or their spokesmen "higher up"—sometimes seem to extort commendatory words from railroad managers. One of the best things that a railroad manager can do for himself and his company is to confer a benefit on employees before they ask for it. Usually it is very difficult to do this, but it was done in this case. Another fine thing on the Pennsylvania was Mr. Pugh's commendation of Engineman Mattingly and Fireman Barteman for preventing a wreck in one of the tunnels at Baltimore, Md. These men did not perform an unheard-of feat, nor was their commendation by the vice-president so very exceptional; but the incident is striking because of the terrible possibilities of the situation which these men encountered. Two cars of the passenger train which their locomotive was drawing February 25 were derailed in the tunnel, blocking both tracks. At the moment of the derailment Engineer Mattingly blew his whistle to attract the attention of any train which might be coming down in the opposite direction, and Fireman Barteman went forward with an engine torch and tried to flag a passenger train carrying 112 passengers, which came rushing into the tunnel at the moment, running at full speed. The engineer of the train did not see the torch, and as the rapidly moving locomotive came alongside of him Barteman threw his torch into the cab window. This unusual action caused the engineer to stop his train three car lengths from the derailed train ahead of him. A double wreck, in a long tunnel, with a live firebox in the midst of it, is one of the best things in the world to be delivered from.

RECIPROCAL DEMURRAGE.

The essential and fatal objection to reciprocal demurrage from the shipper's standpoint—it is ticklish business at the present time to mention any other standpoint—is that the plan could not be worked with even an approach to fairness. The complication of verbal and written requests for cars, of present and future needs; of the relative rights of small and large dealers, of carriers' derelictions as offsetting shippers' blunders, and a dozen other details, would make up a confusing problem which could be effectively dealt with only by a force of state inspectors large enough to duplicate the forces of superintendents, trainmasters and station agents which now manage the freight car distribution of the country. When it comes to fundamental economic laws, the case against these crude legislative propositions—now reported in a dozen different states, including New York—is unanswerable. The very first law—that the most selfish railroad has all possible incentive to move freight promptly and to use its cars with the greatest possible efficiency, nearly covers the case. The things wherein the railroads violate this law are too obscure and difficult to deal with by statute, even

if the railroads were to ask for and encourage such regulation. The ease with which demurrage payments could be made to cover unlawful rebates to shippers is a point which seems to appeal even to short-sighted shippers, and it is to be hoped that enough of them will be informed of this truth to put the brakes on this legislative machinery that is now buzzing so furiously.

One argument which railroad men do not sufficiently emphasize, is that the present demurrage regulations of the railroads are tolerable only because the burden on the shipper is so light. No one claims that demurrage charges are assessed with entire fairness and no one has found any way in which it could be done. But as no one is defrauded the system merits support because, though confessedly a half way measure, it does mitigate the freight car abuse. To penalize the railroads, on the other hand, would be both unsound theoretically and grossly unequal in practice.

The principal arguments on this subject have already been published in many places, and most of the readers of the *Railroad Gazette* are already familiar with them; but for a really strong setting forth of the matter, the argument made on Feb. 15 by Mr. J. M. Daly, of the Illinois Central, before the committee of the legislature of Iowa, deserves a wide reading. Mr. Daly began by reminding the legislators that the subject was in no respect unfamiliar to him, as he and other men in his position in the railroad service, were called upon to make about the same statement before officers of their own railroads nearly every week. Whatever the freight-car distributors of American railroads may have done within the past year or two, they have not been able to do anything that impaired the efficiency of the service, or that even looked like it, without being called upon by their superiors to defend their course. Moreover, Mr. Daly had to make the same defense before another committee of the legislature a year ago. He convinced that committee of the radical injustice of the bill then proposed; and he called upon the present committee to see if any better reason could be found now than then for passing a radical and drastic law. He has also had to testify this year for two hours before the Interstate Commerce Commission.

Mr. Daly made a succinct statement of the situation on the Illinois Central. The company owns 12.7 cars per mile of track while no other road in Iowa owns more than 7.1 cars per mile of track. New cars ordered in November, 1905, are yet to be delivered. The company is paying freight on new cars from Pittsburg to Chicago, about $30 each, when it could have them brought free if it would run the risk of their being diverted. About 25,000 Illinois Central cars are now on foreign roads, while only 15,000 foreign cars are on the Illinois Central. The I. C. originates traffic and its industries cannot live unless the road furnishes cars to enable them to reach distant markets. The road has 6,000 cars standing on the tracks waiting to be repaired. This delay is due to inability to get material, although agents are sent to factories to promote prompt shipment; and inability to get repair men, even at high wages. Much of this work cannot be done at night, and for Sunday work the company is paying the men double time.

Among the specific reasons for the present scarcity of cars are the great crops of the past two years, unusual damage done to small cars by running them in trains with large cars, and the bituminous coal strike, which suspended coal shipments for three months last summer. The railroads were prevented from stocking up with coal when traffic was dull. Bituminous coal shrinks 4 per cent. by exposure to the air and traders on this account will not order coal in advance of their needs, but the Illinois Central does supply itself beforehand, in spite of the depreciation in value of the coal due to exposure to the weather.

Mr. Daly said that Messrs. Lane and Harlan, of the Interstate Commerce Commission, in their report on the car shortage in the Northwest, had clearly set forth the situation in its true light. They declared that a combination of coal dealers in the Northwest boycotted those who did not agree with them, and helped to bring on the coal shortage; and that the railroads were not parties to this conspiracy. Mr. Daly called upon the bituminous coal men to graduate their prices to the season, as is done by the anthracite shippers, thus tending to prevent congestion in the autumn.

The Iowa bill requires railroads to move cars 80 miles a day, but makes no distinction between short and long hauls, a very unjust feature. Under the proposed bill railroads might rebate to their hearts' content. If a large grain shipper orders 20 cars a day for the shipments of a month, the company can use its cars elsewhere until the statutory penalty has accrued, and yet get the shipper's corn to Chicago in time to meet the market; thus the demurrage paid to the shipper say $10 a car will be clear profit to him. Small railroads, owning no cars, can, in the same way, agree with large roads for an undue share of the profits of prospective business. If a road is blocked, as by a washout, shippers at competitive points can throw all their orders for cars to that road and force it to pay demurrage.

The claims that railroads had refused cars to certain shippers, and that large numbers of empty cars were standing now at Omaha and elsewhere, were denied by Mr. Daly, and he called upon those who had made the statements to produce their evidence. He showed how the railroads, if they had furnished cars to Iowa shippers during the past month, would have simply aggravated a congestion of grain which exists in Chicago.

The Interstate Commerce Commission handled the car shortage question in a rational way. It called upon the railroads for the facts, and, in dealing with reciprocal demurrage, spoke first of the need of correcting the greatest present evil, which is that railroads do not promptly return each others' cars. The commission advocated laws to compel railroads to furnish a reasonable supply of cars, but recognized that this would necessitate also a compulsory law to get cars returned from foreign roads.

Reciprocal demurrage in one state and not in another would produce endless confusion. The proposed bill exempts perishable freight, and this would produce much injustice. It allows ten days to fill an order for 25 cars, but great injustice might be done by shippers putting in unreasonable orders for 24 cars each. The railroads would be required to fill ordinary orders for cars, but would have no redress when the shipper presented an extraordinary volume of freight. The law relieves the consignee when his shipments are bunched in transit, but the railroad has no remedy when shippers bunch their orders.

Mr. Daly is to be congratulated on going straight to the point and on the entire candor and lucidity of his statements. Verily, the present era of free discussion is producing a tremendous amount of instruction, but at what an enormous cost in the way of teaching these hundreds of solons simple things that they ought to have known before!

PROPOSED VALUATION OF RAILROAD PROPERTY.

An official valuation of railroad property has now taken first place in the program of those who, viewing industry from the outside, would reconstruct its methods to suit their economic and ethical ideals, as the one thing needful to effect a perfect reconciliation between the conflicting interests of the traveling and shipping public and the railroad corporations. Last year it was official rate-making which occupied that position, but provision for officially-made rates having now been a part of the statute law of the land for some eight months no rates have been officially promulgated, and the country is advised, semi-officially at least, that the official rate-makers can make little headway until the value of the railroad facilities used has been officially ascertained. This is a plausible suggestion and appeals at once to those who hold that profits are out of place in the railroad industry. Railroads are common carriers, and, as such, have been restricted by the common law since railroad development began, to charges that are just and reasonable. "Why, then," cries the superficial observer, "should not the value of the railroads be ascertained and the rates be fixed so as to afford merely a reasonable return upon that value?" In other words, why not treat an investment in railroad property the same as a loan upon the security of a farm mortgage and provide for a fair and reasonable rate of interest? But that is precisely where the difficulty enters. The public is willing to restrict profits but extremely reluctant about restricting losses. The farm mortgagor fixes a certain rate which is no more subject to diminution than to enlargement. The man who proposes to base railroad rates strictly upon value always has in mind the determination of a maximum rate of return on railroad investments, a return so low as to exclude profits, but he never contemplates fixing a minimum return or guaranteeing the investor against losses. The owner of railroad property, however, insists that if he must assume extensive risk of loss there must be a compensatory chance of profit, and, what is of much more importance, the prospective investor flatly insists that unless this compensatory chance is given he will invest his capital elsewhere. Therefore a perfectly ascertained valuation undertaken as a basis for official rate-making would be either fatuous or futile; it would either be used as a basis of rates and would act as a deterrent to natural railroad construction and im-

provement or these imminent dangers would be realized in time and it would not be utilized at all.

The foregoing discussion assumes that the practical difficulties can be overcome and that a valuation can be officially made and rates can be based upon it with some degree of accuracy. These assumptions, although they may be permitted, for the sake of argument, are not, however, consistent with the facts. It is of the essential nature of value that its accurate measurement must forever elude the most intelligently directed inquiry and that if once discovered its rapid variations would make the discovery worthless for the ends suggested. And it is equally true that even if correctly ascertained it would afford no basis for the activities of the official rate-makers. Value is a relation between one commodity and another commodity or group of commodities. As commonly expressed in terms of money it is a relation betwen a unit of one commodity and the unit of the circulating medium stated in terms of the number of the latter units which will exchange for one of the former. And, to adopt a rather sketchy definition, the unit of the circulating medium has itself a composite value derived from its exchangeable relation to all other commodities, including the commodity which constitutes the monetary standard. The value of railroad property is, in theory and in practice, determined in precisely the same manner as that of any other commodity. But the values in exchange pertaining to capital goods, that is commodities used to produce other commodities, are the resultant of earning power transmitted into commodities. Railroad value is, therefore, a derivation of railroad earnings. How, then, can it be possible to derive rates from value when value itself is actually and finally a consequence of rates? The idea is absurd, and its absurdity will certainly extend to any attempt to put it into execution. Doubtless, however, those who advocate an official valuation, really mean an official estimate of cost of reproduction less current depreciation. To make such an estimate is very different from ascertaining values, and there should be no confusion of the terms, for such confusion only serves to give a fictitious plausibility to a project which would have few real friends if advanced strictly on its own merits. No business man would enter upon an industrial undertaking that involved large investments of fixed capital if notified at the outset that any future reduction in the cost of producing the machinery or facilities used by him would become an enforced loss which he would be compelled by law to charge off from his capital. Hundreds of thousands of tons of steel rails have lately been laid which have cost $28 per ton. The price per ton was formerly $17. If the price should again decrease to the latter figure would any honest American citizen want to be a party to telling the railroads that had paid $28 per ton that they could, thereafter, be allowed earnings on only $17 per ton? Yet the cost-of-reproduction principle demands exactly that course. Similarly, the application of such a principle would compel the continued use of antiquated facilities, for no corporation could charge-off at one stroke all that depreciation due to progress which is necessary in order to maintain the highest condition of efficiency which scientific progress permits. These difficulties and objections are insurmountable. If they were not, and a really accurate valuation could be obtained, it would be useless in connection with the problem of rate-making. For it is the determination of the portions of the aggregate income of a particular carrier which shall be derived from each of the multitude of varying services it performs, not that of the aggregate itself, which constitutes the problem of rate-making. The Interstate Commerce Commission is not asked to say whether the total receipts of the New York Central & Hudson River Railroad, for example, are reasonable and just in relation to the value of the property or otherwise, but, on the other hand, whether (let us say) the rate on wheat from Buffalo to Albany is a fair and proper rate. Now the value of the property, or the cost of reproducing it, would aid just as much in solving this question as information concerning the amount of food consumed by a deceased sheep would aid in fixing a fair price for its pelt—and no more. Stripped of every speculative suggestion, students of transportation have always known and always will know, just one proper and possible way of adjusting railroad rates to the demands of industry. That is to charge "what the traffic will bear," not, as President Hadley has wisely said, "What it will not bear," but in the words of the eminent English authority, W. M. Acworth, "tempering the wind to the shorn lamb." That is, fixing rates so as to move the business with a profit to the shipper and to the railroad and its employees. The Interstate Commerce Commission may amuse itself with the idea of an official valuation, but in so doing it will only confuse the question and will not at all lighten its labors or augment its usefulness.

London Traffic Problems.

One of the main difficulties hampering the transport system of London is the fact that no clearly marked flow of traffic, as a whole exists. It is true that towards the city and the West End certain definite routes converge from north, south, east and west, but these are chiefly utilized during the morning and evening hours only, and do little towards a thorough solution of the transit problem. With the possible exception of the Central London Railway, which occupies what a high transportation authority has described as the most ideal route for short-distance traffic in the world, there is no one route traversing the entire central district of the city, and even if a sufficient number of east-to-west and north-to-south lines had been laid out, they would still be inadequate for the purpose of conveying the vast amount of traffic that requires to be taken from north to west or from south to east. The peculiar situation has thus arisen that while it is a comparatively easy matter to effect a short and direct journey from any suburban or outlying point to the heart of the city, it is in most cases a difficult matter to travel between a point to the east, for instance, and another in the south. London is, of course, not one city, but an agglommeration of self-contained towns. Places such as Ealing, Finsbury Park or Croydon, each with its own theaters, banks and modern shops, contain within them everything to satisfy their inhabitants, who, unless their daily occupations take them up to commercial London, do not require to travel frequently towards the center of the Metropolitan area. When suburban lines were first planned, this development of the suburbs was entirely unforeseen. One result is that no main line entering London makes a profit on its short-distance suburban traffic to-day, and at the same time much-needed facilities for short-distance journeys are lacking. This is one of the reasons explaining the popularity of the omnibus, in itself a somewhat objectionable and distinctly antiquated vehicle, that in no small degree contributes towards the existing congestion of the main thoroughfares. Sooner or later the railroads will have to realize that a vast proportion of traffic in London will not utilize a railroad station unless compelled, but will prefer to travel by means of lines of communication running through the principal streets. As the existing road vehicles, even including the motor omnibus, are inadequate for the purpose, the only possible solution is that the tramways, which are already to be found within the extremities of the most crowded area, be extended to traverse that area centrally. This would mean nothing more than bringing London up to the standard not only of all foreign cities of importance, but also of every town in the provinces.

Interstate Overcharges Not Collectible Under Common-Law Rights.

In the case of Texas & Pacific, plaintiff in error, against the Abilene Cotton Oil Company the Supreme Court of the United States has announced a decision holding that the Interstate Commerce law has repealed the common law right of a shipper to sue in the courts for the recovery of damages resulting from the payment of unjust and unreasonable charges to a common carrier subject to the provisions of that act.

Mr. Justice White, announcing the opinion of the court, said that it could not be doubted that at common law the shipper had a right of action in damages; that the act to regulate commerce did not expressly abrogate this right, and that the contention that it was abrogated rests on the proposition that this result was accomplished by implication. Continuing he said: "In testing the correctness of this proposition we concede that we must be guided by the principle that repeals by implication are not favored, and indeed that a statute will not be construed as taking away a common law right existing at the date of its enactment, unless that result is imperatively required; that is to say, unless it be found that the pre-existing right is so repugnant to the statute that the survival of such right would in effect deprive the subsequent statute of its efficacy; in other words, render its provisions nugatory." He finds that this would be the effect of the survival of the right. The opinion points out that if a shipper could go into court and obtain relief he would receive a preference not enjoyed by those against whom the schedule of rates was continued to be enforced, as a judgment in favor of a single shipper would not compel a change in the schedule rate filed with the commission and posted in conformity with the law. It is pointed out further that different courts might reach different conclusions as to the reasonableness of the same rate and that the standard would differ in different jurisdictions; and that if the power to originally hear complaints existed in both the courts and the commission there might be a divergence between the action of the commission and the decision of the court. The court, therefore, held "that a shipper seeking reparation predicated upon the unreasonableness of the established rate must, under the act to regulate commerce, primarily invoke redress through the Interstate Commerce Commission, which body alone is vested with power originally to entertain proceedings for

the alteration of an established schedule because the rates therein are unreasonable."

The judgment of the court below, the Court of Civil Appeals for the Second Supreme Judicial District of Texas, is reversed and the case remanded for a new trial.

Prussian Tests of Superstructure.

The Prussian State Railroads have recently established permanent testing tracks for the purpose of testing matters relating to superstructure—rails, joints, ties, spikes, bolts, super-elevation, kinds of ballast, etc., at various speeds and with different kinds of rolling stock. The tracks consist of two parallel tracks 400 meters apart and 250 meters long, connected at the two ends by semi-circles of 200 meters radius, making a total length of 1,756 meters, or 1.09 miles. On this track for the present electric locomotives supply the motive power, and provision is made for running trains around the track 20 hours per day, which at certain speeds will make possible 570 passages of a train per day. The trains are run without a motorman, there being but one train on the track at a time, from which the current can be cut off from without; and the highest speeds can thus be ventured with danger only to road and rolling stock, though the purpose is not to test speeds higher than now practiced, but simply the behavior of the different kinds of superstructure. The experiments began with four kinds of superstructure, three rail profiles and four kinds of rail joints, each kind extending from the middle of a tangent to the middle of the adjacent curve; the rails lie alternately on wood and on metal ties, and different woods and different patterns of steel ties are used. The first tests have chiefly in view to determine: 1. The effect of ballast material and form of ties on proper inclination of the track. 2. The testing of the different kinds of joints. 3. The wear of rail heads. The tests of each kind of superstructure are to be made successively on five different kinds of ballast: pit gravel, river gravel, basalt, graymacke and granite broken stone.

The railroad authorities say there is greater uncertainty as to the best methods of construction and maintenance of superstructure than in anything else relating to railroads, and they purpose to do what seems possible—settle such questions. Doubtless the tests will be made with German thoroughness, and the results recorded fully and clearly and published for the information of the world. It is to be hoped that they will be followed and studied by those responsible for track in this country, where there certainly is need of knowledge if anywhere. Probably one-half of the cost of a single recent accident due to failure of track would pay for all these Prussian experiments for some years to come. It may be humiliating for a country with more than 200,000 miles of railroad to look to a country with less than 20,000 for the settlement of matters so tremendously important; but it will be disgraceful if we do not take advantage of the knowledge so attained and freely offered.

NEW PUBLICATIONS.

Railway Signal Association; Proceedings for January, 1907. C. C. Rosenberg, Secretary, Bethlehem, Pa.

The proceedings of the meetings of the Railway Signal Association, which are held in January, March, May, September and October, are henceforth to be printed and published in their final form immediately following each meeting, so that the proceedings of the early part of the year will not appear in the pamphlet issued after the annual meeting in October. The number for the January meeting of this year has now been issued. It is made up of 54 pages of reading matter and 44 pages of advertisements. The March meeting is to be held at the Great Northern Hotel, Chicago, on Monday, the 18th, as before announced.

CONTRIBUTIONS

The Profitable Weight and Speed of Freight Trains.

Sacramento, Cal., Feb. 23, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with much interest Mr. Wild's article appearing recently in the *Railroad Gazette*, relative to the profitable weight and speed of freight trains. It is of more than usual interest to me as it illustrates the problem in a somewhat different way, and also tends to uphold the stand I took in an article entitled "What Should Be the Maximum Economical Load for a Locomotive?" written for the Pacific Coast Railway Club, and published in their Proceedings of December, 1903.

Admitting that conditions of track, power, etc., will to some extent govern the train that can be hauled, at the same time, under the present conditions of traffic prevailing throughout the country, the essential point is to get the cars over the road in the shortest possible time, and incidentally to do it in the most economical manner. In the article mentioned above the writer says: "In determining the economical load for a locomotive, one of the most important factors to be considered is time. For instance, if we simply compare the performance of two single trips, one with the maximum load, and the other with a lighter load, the maximum load may be the more economical, revenue and all cost of transportation considered, notwithstanding the locomotive may burn double the amount of the fuel and the wages of trainmen be twice as much as with a lighter load." This will also hold good if any number of single trips is considered.

As a rule it would seem that most operating officers base their loading and movement of trains on the showing a single train can make between any two terminals. There is hardly a doubt that a single train will show the greatest net revenue when the maximum tonnage is taken that can be hauled over the road, regardless of fuel, wages or time consumed in making the trip, granted, of course, that the run is made within reasonable limits.

Using Mr. Wild's figures and assuming an engine run of 100 miles between terminals, the 40-car train would show a net revenue of $325 as against $279 for the 35-car train, and $214 for the 28-car train, etc. But in cases of congested traffic, where a large number of cars are to be moved in the shortest possible time, it will be found that a speed of from 20 to 25 miles per hour will move the greatest number of cars in a given time. Our theoretical figures not only show this, but I think actual service conditions will verify these figures. To explain why a speed from 20 to 25 miles per hour is better than speeds higher or lower, we need to consider the fact that the hauling power of a locomotive is at its maximum from starting, up to a piston speed corresponding to a train speed of from six to eight miles per hour, after which its power falls quite rapidly as the speed increases. This decrease in hauling power when taken in conjunction with speed and time gives us comparative figures which show the critical speed as being about 20 miles per hour.

As to the feasibility of running freight trains at their most profitable speed, there should be no doubt, that is, when roads are equipped with heavy rails and otherwise fitted for heavy traffic. We may except cases, however, where a large number of trains have to be moved over a single-track line, with the problem of meetings and delays on sidings for opposite trains, will to some extent govern and limit the average speed at which the trains can be gotten over the road.

So the all-important question seems to be, not whether lighter load and faster train is the most economical, but why operating officers who know this still insist on loading an engine until it has to simply drag over the road.

As the figures shown in table prepared by Mr. Wild for the different train speeds are based on an even number of hours, without reference to any particular type of locomotive or actual conditions in service, I thought it might be interesting to have figures that would show results under these conditions, and I have prepared a table (printed herewith). While it practically corroborates conclusions that Mr. Wild makes in his article, it shows the result in a little different way.

Speed, mls. pr. hr...	A	10	15	20	25	30	35	40	45
Tractive power.....	B	32,500	28,200	24,000	20,300	17,000	14,000	113,000	9,266
No. cars in train...	C	40	34	29	25	21	17	14	11
Pr. ct. of decrease	D	..	15	27½	37½	47½	57½	65	72½
Pr.ct. increase speed	E	..	50	100	150	200	250	300	350
Hrs. per round trip.	F	30	22	18	15.6	14	12.8	12	11.3
No. cars hauled ...	G	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Time consumed, hrs.	H	3,750	3,234	3,096	3,120	3,332	3,763	4,284	6,130
Additional time for lay over	I	93	80	72	78	82	93	106	152
Total hrs. consumed	J	3,843	3,314	3,168	3,198	3,414	3,856	4,390	6,282

I have taken an average type of heavy freight engine weighing 173,000 lbs., 22-in. x 26-in. cylinders, and have supposed a case where 5,000 loaded cars are at both terminals, the engine run distance being 120 miles between terminals. Have allowed four hours lay over at home terminal, two hours at the other, and 10 hours lay over every 10 days for washing boiler. The problem is to show the shortest number of hours in which the cars could be moved by one locomotive under above conditions. The table shows these conditions for speeds of 10 up to 45 miles per hour, also tractive or hauling power of the engine at these several speeds. Line "C" shows the number of cars that could be hauled by this engine at the corresponding speed. To show the relative difference between the percentage of decrease in the number of cars and corresponding increase in speed, I have added lines "D" and "E." It will be noted that by a 27½ per cent. reduction in the number of cars the speed of the train may be doubled. This very closely compares with figures given by Mr. Wild.

This table based on the actual hauling power of the locomotive at the various speeds gives results showing that 5,000 cars could be moved from each terminal in the shortest number of hours at a train speed of about 20 miles per hour.

As to whether the net revenue accruing from the train hauled would show figures corresponding to results shown in number of hours that a given number of cars could be moved, or not, I am

not prepared to say. However, there is no doubt that a reduction in the load will also result in a reduction in cost of operating, principally through the consumption of less fuel. We may theorize and make figures to show what a locomotive ought to do, but somehow under actual service conditions these figures are seldom realized. This is because it is almost impossible to calculate on the varying conditions under which locomotives and trains have to be moved.

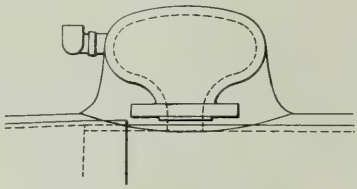
While it is no doubt true that cars are in many instances held too long for loading and unloading, it is also true that trains are overloaded and much valuable time wasted in getting over the road. A certain amount of time is necessary for the placing and unloading of the cars after arrival, and the more expeditiously the cars can be gotten over the road the less delay should be experienced in getting the cars loaded for further movement.

In conclusion would say that I think there is hardly a doubt that the lighter train would be not only the more economical, but would handle the cars in a shorter time. This, however, is not the only advantage to be obtained with the lighter train: the liability of engine failures would be lessened, locomotives would give more continuous service, cost of repairs to locomotive would be lessened, and there would be fewer car failures, and not the least important, the power required to handle the traffic would not be as much as with the heaviest trains.

C. F. NOYES,
Supt. S. P. Co. Sacramento Shops.

Consolidation Locomotive for the Nippon Tetsudo Kwaisha Railroad.

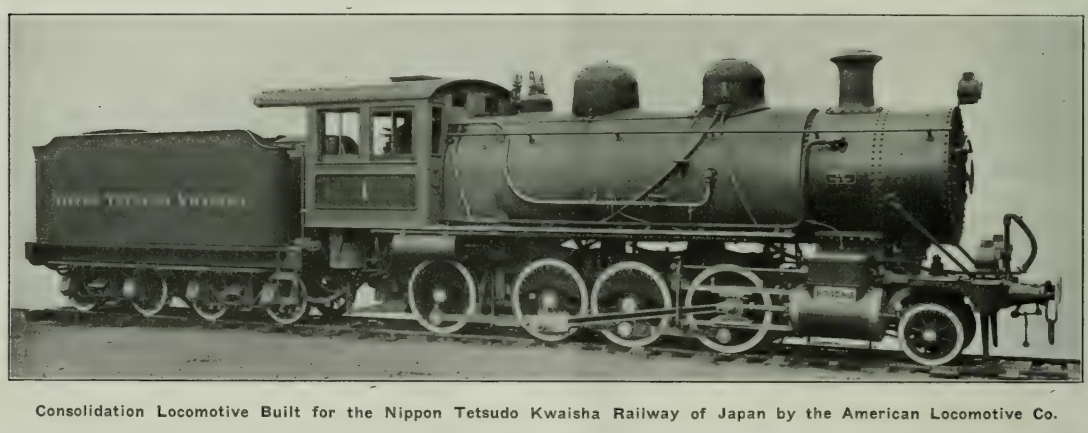
The American observer is inclined to believe that transportation facilities in Japan are somewhat handicapped by the narrowness of the railroad gage. Yet despite this drawback it is apparently possible to design engines of considerable weight and power to run on these roads; engines that would have been considered quite up to all of the demands of American railroads a few years ago. An example of work of this character is to be found in an order for twelve consolidation locomotives that has recently been filled for the Nippon Tetsudo Kwaisha Railroad by the American Locomotive Co. The limitations were fixed at a height of 12 ft. 5 in. and a width of 8 ft. 5 in. Within these sectional dimensions and on a gage of 3 ft. 6 in. the designers have built an engine with a total weight of 114,600 lbs., with a boiler of 62½ in. diameter inside the smallest ring. The driving wheels are but 44 in. in diameter and the counterbalancing of the heavy rods and reciprocating parts has necessitated the use of exceedingly large weights that are crescent shaped and reach from the inside of the tire nearly to the hub.



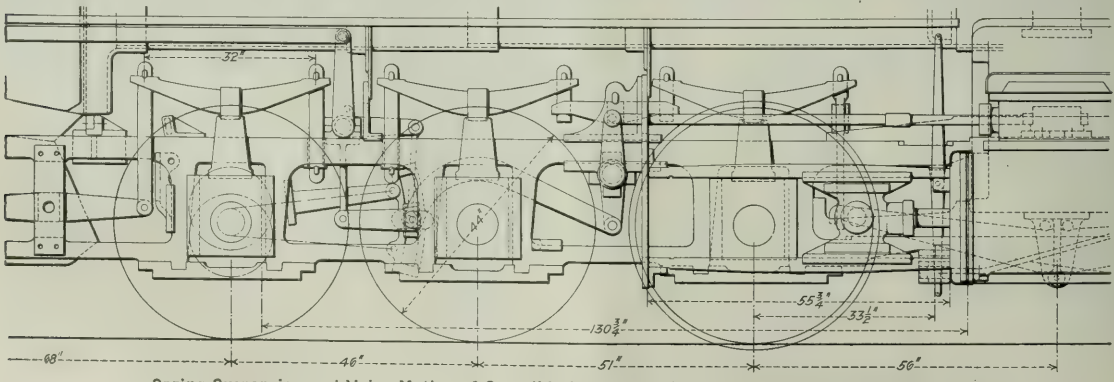
Whistle and Safety Valve Dome.

In general arrangement and design the engines are distinctively American, with some features of interest in detail. The spring suspension, for example, follows the practice of equalization, but in this case the truck equalizer has the short end in front, thus throwing somewhat more than half as much weight on these wheels as there is upon the drivers, the two forward pair being equalized with the truck and the rear two pair separately, a modification of an earlier practice of equalizing only the front pair of drivers with the truck. The valve motion is of the Stephenson type with short eccentric rods and the link just back of the second driving axle, with a transmission bar to carry the motion on to the rocker set between the first and second drivers. This transmission bar is bent to span the second axle and is carried at the rear end by a hanger with a broad foot, as shown, that is bolted to a box having a long bearing on the lifting shaft.

The whistle and safety valve dome, while having the external appearance, with its casing, of a low small dome of conventional shape is really a pear-shaped casting bolted to a flange over a small opening in the top of the boiler. This avoids the use of any reinforcement and simplifies construction. The regular steam dome

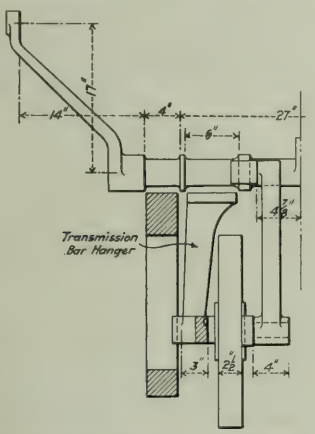


Consolidation Locomotive Built for the Nippon Tetsudo Kwaisha Railway of Japan by the American Locomotive Co.



Spring Suspension and Valve Motion of Consolidation Locomotive of Nippon Tetsudo Kwaisha R. R.

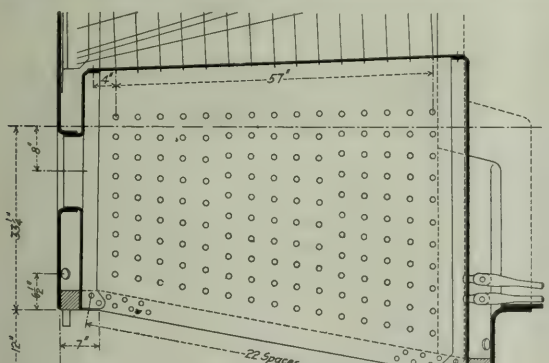
is also without any reinforcing plate about the opening, but is provided with a very heavy stamped base 1 in. thick, held to the shell by 1⅛ in. rivets. The dome cap is also stamped, as usual, and is of the same thickness as the base. The same idea of ample weight appears in other parts of the boiler structure. The shells, of 63⅞ in. diameter for a pressure of 180 lbs., are $^{11}/_{16}$ in. thick, which puts a stress of 8,360 lbs. per sq. in. on the metal. The tube-sheets are also heavier than usual in that they each have a thickness of ⅞ in. The seams of double-welted sextuple riveted butt joints for the horizontal seams and double riveted for the circumferential seams with



Section of Valve Motion Showing Transmission Bar Hanger.

1⅛-in. rivets spaced 3⅝ in. between centers or practically three times the rivet diameter, a rule that has prevailed for time out of mind. The firebox staybolts are 1 in. in diameter and instead of being spaced and set in straight lines are in three vertical groups, whose inclined lines break connections with the next group. This at the front as compared with the rear, there being a difference of arrangement was brought about by the greater depth of the firebox 12 in. in the slope of the foundation ring in 67½ in.

The valves are of the Richardson type with outside admission. Cast steel is used for the wheel centers of all wheels on both engine



Firebox of Consolidation Locomotive for Nippon Tetsudo Kwaisha Railroad Showing Arrangement of Staybolts.

and tenders. In the case of the driving wheels the tires are shrunk on and then held in addition by set screws.

The following are some of the principal dimensions of these engines:

Cylinders, diameter	18 in.
Piston, stroke	24 "
Wheels, diameter, driving	44 "
" " truck	28 "
" " tender	33 "
Wheel base, driving	13 ft. 9 "
" total engine	21 " 7 "
" engine and tender	45 " 2½ "
Boiler, diameter	63⅞ "
Boiler, material	Steel
Firebox, length	69 in.
" width	54 "
" thickness, crown, side and back sheets	⅜ in.
" thickness, tube sheet	⅞ in.
" material	Steel
Tubes, number	250
" diameter	2 in.
" length	13 ft. 1 in.
" material	Charcoal iron
Heating surface, tubes	1,702 sq. ft.
" " firebox	166 "
" " arch tubes	18 "
" " total	1,810 "
Grate area	25.8 "
Steam pressure	180 lbs.
Weight on drivers	101,600 "
" truck	13,000 "
" total of engine	114,600 "
" tender	78,000 "
Tank capacity, water	3,600 gals.
Tank capacity, coal	5 tons
Fuel	Soft coal
Tractive power	27,040 lbs.

$$\frac{\text{Weight on drivers}}{\text{Tractive power}} = 3.73$$

$$\frac{\text{Total weight}}{\text{Tractive power}} = 4.24$$

$$\frac{\text{Tractive power x diam. drivers}}{\text{Heating surface}} = 584.4$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 70.16$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = .06$$

$$\frac{\text{Weight on drivers}}{\text{Total heating surface}} = 56.13$$

$$\frac{\text{Total weight}}{\text{Total heating surface}} = 63.31$$

Volume of 2 cylinders = 7.2 cu. ft.

$$\frac{\text{Total heating surface}}{\text{Volume of 2 cylinders}} = 25.14$$

$$\frac{\text{Grate area}}{\text{Volume of 2 cylinders}} = 3.58$$

Equivalent of tube heating surface in firebox heating surface = 471.4 sq. ft.

Total equated heating surface in firebox heating surface (Vaughan formula) = 579.4 sq. ft.

$$\frac{\text{Equated heating surface}}{\text{Grate area}} = 23.15$$

$$\frac{\text{Weight on drivers}}{\text{Equated heating surface}} = 170.05$$

Carnegie Steel Ties on the Bessemer & Lake Erie.

We have received the following information from H. T. Porter, Chief Engineer of the Bessemer & Lake Erie. The company placed an order last fall, for 1907 delivery, for 140,000 Carnegie I-beam steel ties. At present there are more than 100,000 steel ties in the track, some of them on 6 deg. curves. Between Albion and North Bessemer, Pa., the company is working engines with about 183,000 lbs. on the drivers. Between Albion and Conneaut Harbor, where there are stretches of steel ties on 4 deg. curves, the company is operating engines with 225,000 lbs. on the drivers. The ties are giving very satisfactory service, and the company considers the steel tie track very much more stable than the wooden tie track. There has been no trouble from broken rails. In answer to a question about the comparative ease or difficulty of shimming the track where steel ties are used, Mr. Porter replies that the company is not much troubled by track heaving from frost.

A Berlin newspaper, organ of the most conservative and religious classes, and which therefore must be speaking the truth, describes some methods of car-heating observed in this country which are perhaps not very familiar to readers of the *Railroad Gazette*. The writer says that on the "Big Four" the cars are made with hollow walls, in which asbestos plates inclosed in platinum wires are introduced in winter. A dynamo sends a current through the wires and heats the car evenly and beautifully. In the summer, on the other hand, cold water is circulated through these hollow walls, and the interior of the car rendered to a balmy, spring-like temperature, highly agreeable in the dog days. The heating apparatus, however, fails when a train is stalled, and the writer calls to mind how in the Royal Gorge on the Denver & Rio Grande he was once blockaded for three days. When the passengers were nearly frozen, with that readiness of resource so common among Americans, they organized themselves into three shifts, and ran the dynamo by hand night and day, and so preserved their lives, and among them that of this contributor to the *Journal of the Cross*.

The Harriman Investigation.

The following are further extracts from the testimony of witnesses before the Interstate Commerce Commission at New York in its investigation of the Harriman roads. An abstract of most of Mr. Harriman's testimony was published last week:

THE ST. JOSEPH & GRAND ISLAND.

By Mr. Kellogg:

Q. Mr. Harriman, you are familiar with the St. Joseph & Grand Island Railroad? A. Fairly well so; yes, sir.

Q. I notice by the statement that the Union Pacific Railroad purchased the stock of the St. Joseph & Grand Island since July 1, 1906? A. Yes, sir; that is right.

Q. Of whom were those stocks purchased? A. Purchased from me, and so stated in the record.

Q. When did you acquire those stocks? A. I decline to answer.

Q. Is not the St. Joseph & Grand Island a parallel and competing line to the Union Pacific? A. I should say not.

Q. It starts from St. Joseph—— A. It was part of the old system of the Union Pacific originally.

Q. And it starts from St. Joseph and runs to a point on the Union Pacific at Grand Island? A. Yes.

Q. Prior to the reorganization of the Union Pacific the St. Joseph & Grand Island was owned, or at least operated, by the Union Pacific, was it not? A. I believe it was.

Q. During the reorganization or prior to the reorganization, is it not a fact that the receivers of the Union Pacific road refused to assume the obligations and burden of operating the St. Joseph & Grand Island? A. That I don't know. I know very little about the Union Pacific prior to the reorganization.

Q. And for a number of years after the Union Pacific was reorganized the St. Joseph & Grand Island was an independent line? A. Absolutely.

Q. Who were the interests in the board that had the direction of its affairs prior to the acquisition by you? A. Prior to the acquisition by the Union Pacific?

Q. Yes. A. Well, it was, I thnk, very largely I that had an influence, or through some of my associates.

Q. That was after your purchase or prior to your purchase? A. That I don't know.

Q. You don't know? A. I don't remember.

THE PURCHASE OF SOUTHERN PACIFIC.

By Mr. Severance to Otto H. Kahn, managing partner of Kuhn, Loeb & Co.:

Q. The first large financial transaction in which the Union Pacific embarked after its reorganization, was the acquisition of the Southern Pacific stock, was it not? A. Correct.

Q. Who conducted the negotiations for the acquisition of that stock? A. Those negotiations were conducted by us as fiscal agents for the company, and Mr. Harriman.

Q. With whom were the negotiations had? A. With A. G. Huntington and Speyer & Co.

Q. They represented a large block of Southern Pacific stock which controlled the property? A. Yes.

Q. At whose instance did you undertake those negotiations? A. Largely at our own instance, and, of course, in conference with Mr. Harriman.

Q. Well, you did not undertake the purchase of those securities as an investment for your house, but you undertook the purchase with the intention of turning them over to the Union Pacific, didn't you, after conversing with Mr. Harriman? A. If the Union Pacific wanted them, after mature deliberation by its board. If they did not want them, we would have been perfectly willing to keep them and sell them to somebody else, and it would have been very easy to sell them to somebody else.

Q. Now, Mr. Kahn, before you bought those securities or entered into any contract to buy them, didn't you have a thorough understanding with Mr. Harriman that the Union Pacific would take them, of course subject to the approval of the board? A. We had this understanding: That we were bound to offer to the Union Pacific. If the Union Pacific did not want them or for any reason could not buy them, then we were stuck with them.

Q. Didn't you have an understanding with Mr. Harriman that he would take them? A. Mr. Harriman certainly was in favor of taking them, provided they could legally be bought, and providing the remaining members of the board were of the same opinion.

Q. Did you not consult other members of the board prior to the acquisition of the securities, besides Mr. Harriman? A. Prior to the contract for the acquisition, I don't believe so. It is a matter of seven years back, and I cannot remember every single step that was taken in that connection, but in a general way we undertook to take the risk of buying that stock. I remember the executors of the Huntington estate wanted a bankers' obligation, and were not satisfied with a corporation obligation; they wanted a bankers' obligation to protect them, and there was a question when a certain amount of cash down had to be paid at once before the Union Pacific or any other railroad company could act or get together, and we simply stood in the breach and took the risk.

Q. You wrote a communication to the board, didn't you? A. Yes.

Q. In which you said: "We have purchased 432,700 shares of the Southern Pacific Company of Kentucky, to be paid for as follows: 144,233 shares on February 11, 288,467 shares on or at our option before July 10, with interest at 4 per cent. per annum from February 11, all said shares to be deposited with a trust company until entire payment is completed. We have further purchased the following shares: 200,000 shares to be paid for on or at our option before March 4, 45,000 shares to be paid for, one-half on February 5 and one-half on February 8. The average prices at which we have made the above purchases, exclusive of interest accruing, is $50.6146 per share." That is an accurate statement, isn't it? A. Certainly.

Q. That is stock you bought from Speyer & Co. and had arranged to buy from Speyer & Co. and Mr. Huntington? A. Yes.

Q. And then you further add: "In order that your holdings of Southern Pacific stock may aggregate 750,000 shares, we agree to sell to you on March 4, 1901, 72,300 additional shares at the same price—viz., $50.6146 per share, plus interest at the rate of 4 per cent. from February 11, 1901." From whom did you buy that stock? A. We bought it in the market.

Q. What were the ruling prices of Southern Pacific stock at that time? A. At the time that letter was written, I believe about 49—between 48 and 49.

Q. So you took the chance of its going up above $50 a share? A. Which it did.

Q. Upon that purchase price, you say you were "also to be paid by the company $2.50 a share upon said 750,000 shares, of profit to us for the risk assumed in making these purchases"? A. That is right.

Q. The risk you assumed was the risk that the Union Pacific board would not approve of Mr. Harriman's provision relative to the acquirement of this stock, was it? A. No; that was only one of the risks. There was an additional risk.

Q. What was it? A. The other risk, to which our attention was called by our counsel, was a legal risk. At that time it was not certain whether the Union Pacific or the Oregon Short Line could legally acquire the Southern Pacific stock.

Q. Why? A. Because the Southern Pacific Co. was a holding company and not a railroad company, and that defect, if it existed, was later on cured by appropriate legislation, I believe. But at that time that risk existed and was forcibly called to our attention by our counsel, and we were told that we were incurring a very substantial risk in standing in the breach.

Q. You were a member of the executive committee at that time. What was the purpose of the Union Pacific in acquiring this stock? A. As I said to you before, I am a pretty poor witness on railroad questions, and while I was a director of the Union Pacific, of course I am not an expert on railroad matters; but I understood in a general way that the main purpose of the Union Pacific in acquiring the Southern Pacific was to be certain of not being shut off at Ogden from reaching San Francisco. At that time it had become quite apparent that the Southern Pacific would not remain an independent line, that one or another of the large systems would get control of it. Reports had come to all of us of negotiations which were being carried on by other large systems to acquire the Southern Pacific. It was, as I understood it, of vital importance to the Union Pacific not to shut off at Ogden, and to continue to be able to use the line from Ogden to San Francisco. Naturally I also understood that the north and south lines in California were valuable feeders. I always understood also that the Southern Pacific was bought by the Union Pacific for advantages which it offered as a connecting line, and it never entered our minds at that time that it could be in any sense considered a competing line.

Q. That never entered your head? A. That never entered our heads at the time.

Q. You did not know that traffic moved to California both ways, both over the Union Pacific and over the Southern Pacific's Sunset Route? A. I was not generally posted on these questions. I only know we bought the Southern Pacific because it was represented to us that it was a necessary supplement to the Union Pacific, and if we did not buy it the Union Pacific would be bottled up at Ogden.

Q. The Union Pacific owned the line to Portland? A. The Union Pacific owned the line to Portland, to northern California, yes.

Q. So that they could not shut you off from access to the Pacific Ocean? A. But they could have shut us off from access to San Francisco by the Southern Pacific, which we had always used theretofore, I believe.

Q. And so, for the sake of getting a line 800 miles long, which you regarded as essential to the Union Pacific, you bought six or

seven thousand miles. Is that the idea? A. No; I said the lines in California were doubtless an additional inducement.

Q. Was not the Southern Pacific any inducement, the Sunset Route? A. I don't believe it was. I understood at that time that it was a nuisance. It certainly was not an inducement at that time.

Q. You regarded it as a nuisance? A. As a nuisance.

Q. Do you still regard it as a nuisance? A. I don't know.

Q. I do not think there is any question, from what we have learned in the examination in the West, that Mr. Stubbs had made that quite a nuisance to the Union Pacific. A. I don't know.

Q. I think you are right. That had been made a nuisance. And because it was a nuisance, and because you wanted a connection into San Francisco for the other reasons you have given—— A. Excuse me. You put it just the other way on. I said that the necessity of acquiring with the Southern Pacific the line which you call the Sunset Route was the very opposite to an inducement. The Union Pacific did not buy the Southern Pacific because the Southern Pacific contained that Southern line, but it bought it in spite of that.

Q. That is, the southern line was forced on you? A. I think if at that time the southern line could have been cut off from the Southern Pacific, it would have been preferable to all of us.

Q. Up to a year ago, when you retired from the board, were you still of the same mind that you would be glad to have the Southern Pacific's Sunset Route cut off from the rest of your system? A. I believe under the present management that it would have been much improved and made valuable.

Q. Then, as I understand it, there is something that transpired in the four years from 1901 to 1905, when you retired from the board, that made you change your mind about the desirability of divorcing the Sunset Route from the rest of the Southern Pacific system? A. I never had any opinion about it.

Q. Do you know whether the balance of your executive committee, so long as you were a member of that committee, were of the opinion that it would be a good thing for the Union Pacific to lop off the Sunset Route? A. That question never came up, because it was not a practical question.

Q. That feeling that the Sunset Route was a nuisance was never discussed after that time? A. I want to make clear that it was not a nuisance to the Southern Pacific, but I want to bring out again that in my mind, and from what I then heard from those more competent to judge than I, the Southern Pacific was acquired because of its connecting features, and not because of that Sunset Route, which at that time was, I believe, not a profitable part of the system.

Q. And that situation changed, did it, after the new management came into control, so that you ceased to regret having to take in the competing line to the south? A. I have no doubt the new management greatly improved that road.

THE PURCHASE OF NORTHERN PACIFIC.

Q. Mr. Kahn, when was the idea of acquiring Northern Pacific stock first taken up by the Union Pacific? A. That idea started with the purchase by the Northern Pacific and Great Northern of the Burlington. Mr. Harriman and we, in April, 1901, owing to the acquisition by the Northern Pacific and Great Northern of the Burlington, became convinced that it was very desirable that a controlling interest, or at least an influential holding, of Northern Pacific, should be concentrated in friendly hands, pending decision of the question. It was not a matter that could be decided in a day or a week, or four weeks, or six weeks, pending the decision of the question of the action, if any, the Union Pacific intended to take in the matter; and it was in pursuance of that idea, and in pursuance of the necessity which we saw for having such a concentrated holding, and knowing also at the same time that the Northern Pacific was selling at a very cheap price; knowing, also, as we did, of certain plans which were on foot for increasing the value of Northern Pacific; being certain that the purchase of Northern Pacific at the then prevailing prices was an advantageous purchase under any circumstances; being perfectly willing to hold the stock for ourselves if the Union Pacific did not want it; in fact, preferring to hold the stock for ourselves if the Union Pacific did not want it, but at the same time feeling morally bound to give the Union Pacific opportunity to buy it from us if they wanted it—taking all those things into consideration, we started buying Northern Pacific stock.

Q. What advantage to the system did you think it would be to acquire the Northern Pacific shares of stock? A. That is again a railroad question. In a general way, it is quite apparent that it was of great importance to the Union Pacific to acquire a holding in Northern Pacific, so as to enable it to get its connection into Idaho, Washington, and other states and territories in the Northwest. The acquisition of the Burlington by the Northern Pacific and the Great Northern tended, as I understood it, to shut out the Union Pacific from that territory in the Northwest, and we considered that if it were possible for the Union Pacific to have a substantial holding, and possibly a controlling holding, in Northern Pacific, the Northern Pacific in its turn having half of the control of the Burlington, it would be a very beneficial thing for the Union Pacific. At the same time we were convinced that the stock was selling far below its real value, and the result has shown that our judgment was correct.

THE CHICAGO & ALTON BOND ISSUE.

By Mr. Kellogg to C. W. Hillard, Comptroller of the Chicago & Alton since October last:

Q. In what condition did you find the Chicago & Alton—the consolidated company? A. Money was absolutely necessary. There were some current funds, but they had contemplated the construction or completion of a 34-mile road between a point near Springfield, Ill., and Murrayville, and we found that there were not sufficient funds to build this line. I found that there was a large sum required for its completion, and in looking for ways and means I began to examine their mortgages. I discovered that that road, which was not constructed at all, had been already mortgaged, and that therefore there was no possibility of getting any bonds on it, unless we could float a second mortgage, which was very poor security.

Commissioner Lane: Do I understand they had already placed a mortgage on a road that had not been built? A. Yes. The Alton had conveyed to a trustee a line of railroad which they had not constructed and which they had provided no funds to construct.

Mr. Kellogg: It simply mortgaged a road which it proposed to build and issued all the bonds, leaving no bonds to build the road. Isn't that true? A. That is right.

THE 30 PER CENT. ALTON DIVIDEND.

In regard to the dividend of 30 per cent. paid on Chicago & Alton stock to make up for amounts spent by the management of the road during a long period of years before its reorganization by the Harriman syndicate, Mr. Hilliard said: It seems to me I have never known a case like this, where they have gone back from 1898 to 1863 and capitalized moneys which have been appropriated. Each Board of Directors has a perfect right to appropriate surplus earnings. They have the option to pay it in dividends or set it aside, and when they have exercised that option it is final. No subsequent Board of Directors can revoke it. If they did, the principle would be just the same in regard to the appropriation for dividends. Why could not a subsequent board revoke an appropriation for dividends, and why could we not revoke that 30 per cent. special dividend now?

Commissioner Lane: That is just my point exactly. They could have said, "Instead of a 5 per cent. dividend, that dividend was unreasonably low, and we should have declared a 10 per cent. dividend. We should have declared a 10 per cent. dividend for 10 years preceding, and had a 50 per cent. dividend for the accumulation of those 10 years of dividends that were not paid."

Mr. Hilliard: I think there is another factor that would enter into that. I don't think a railroad company, having appropriated its money and absolutely disposed of it, would have a right again to pay a dividend without any money and sell bonds to get the money for the dividend.

Mr. Kellogg: Of course, the same principle applies as to operating expenses, does it not? A. I think the same principle, but to a larger degree, if anything, because the charges which railroad auditors and accountants make to operating expenses are generally closely watched by the management, for their own credit; the management does not allow any doubtful charges to be made to operating expenses because of the increases of the percentage they operate on. When they get through operating, the surplus belongs to the directors, and the management does not care how they appropriate it. So that it is more important that operating expenses should be carefully watched than it is that surplus income should be carefully watched.

Q. If those things could be done and revoked from time to time, as the directorate changes, would not a practice of that sort destroy the integrity and uniformity of railroad accounts generally? A. It would upset the whole system.

Lake Superior Iron Ore Shipments.

The *Iron Trade Review* gives the following figures of iron ore shipments from the Lake Superior region:

	1906.	1905.	1904.
Mesabi Range, tons	23,792,882	20,153,699	12,156,008
Gogebic Range	3,641,985	3,705,207	2,398,287
Menominee Range	5,109,088	4,495,451	3,074,848
Marquette Range	4,057,187	4,210,522	2,843,703
Vermillion Range	1,792,355	1,677,186	1,282,513
Miscellaneous	128,742	111,391	67,480
Total	38,522,239	34,353,456	21,822,839

The heaviest individual producer was the Mountain Iron mine in the Mesabi range, with an output of 2,536,249 tons in 1906. Ninety-seven mines are listed as active producers in the Mesabi range, 34 in the Gogebic, 50 in the Menominee, 35 in the Marquette and six in the Vermillion. Only two miscellaneous mines, both in Wisconsin, are listed. The total number of active mines thus appears as 224.

The British System of Cartage and Delivery of Freight at Terminals.*

II.

HANDLING SMALL PARCELS BY PASSENGER TRAINS.

During the year ended December, 1905, according to the Board of Trade returns, the railroads of the United Kingdom accumulated, from purely traffic sources, as distinguished from hotels, rents and other "side shows," an income of $510,940,062. Of this, $41,131,152, or rather more than 8 per cent. of the whole, was derived from the carriage of merchandise, mails, etc., in passenger trains. It will be seen from this that the conveyance of parcels, passengers' baggage, newspapers, perishable foodstuffs, horses, dogs, and so forth by the passenger services plays a by no means insignificant part in the living earned by the roads. More important still is the fact that this substantial addition to their revenues is the reward for numerous invaluable services rendered to the British public, at whose disposal are thus placed advantages in the matter of quick collection, conveyance and delivery of small parcels unequaled by those of any other nation. The object of the present paper is to briefly set out the nature and the manner of operating some of these facilities.



Parcel-Sorting Car.

The paper published in the *Railroad Gazette* on November 23d last, with reference to merchandise conveyed in freight trains, shows that the British roads go a great deal further than the provision of cars and haulage, and that usually their obligations are not fulfilled unless and until collection, loading, transport, unloading, delivery and sometimes warehousing have been performed. The same rule applies to at least an equal extent in the case of merchandise carried in passenger trains, while the speed and frequency of the services are, of course, superior to those for freight traffic, all the passenger trains, even to the "crack" expresses being utilized.

No better example than the London & North-Western Railway can be taken, the resources of this road having placed it in the position of being both the largest carrier of this class of traffic and the largest contractor for the Government mails. Exclusive of passengers and mails, the receipts from the company's passenger train traffic during the year 1906 amounted to $5,693,257, or 7¾ per cent. of its total traffic income of $73,155,281. This is represented by the charges on 14,800,000 parcels, as well as passengers' excess baggage, foodstuffs, newspapers, horses, dogs, carriages, etc. To such an extent has the parcels traffic of this road developed in recent years, that, in addition to making use of all its passenger trains in the 24 hours, it also runs regular trains, consisting entirely of parcels vans equipped to run at passenger speed. The 5,500 cartage vehicles provided chiefly for dealing with freight traffic, but which also freely assist the passenger department—which as freely reciprocates—in the work of collection and delivery, are augmented by 200 two-wheeled carts, 350 vans, and about 40 horse vehicles of other descriptions, which are employed in connection with the passenger train traffic. At the smaller country places deliveries and collections are made by means of carrier-tricycles, hand carts, and by hand. In many districts, again, where the company places its own horse and motor omnibuses at the service of its passengers, they act as parcel carriers as well. Free collection is undertaken, whether the request is received at a depot or receiving office or is intimated by the exhibition of a card, supplied for the purpose, in the sender's window. Many parcels are also tendered at the company's depots and receiving offices. The North-Western has 90 of these places in London alone, together with 34 other firms who are appointed auxiliaries and allowed a small commission by the company without any extra charge being made to the public. The public can also tender their parcels for conveyance over the North-Western to the vanmen, or at the offices of any other railroad company, which will accept them and hand them over to the North-Western at the nearest point, this arrangement being reciprocal.

Arrived at the depot, each parcel is weighed by the railroad staff, the charges are assessed, and the railroad stamps to the required value, similar to those of the postoffice, but larger, are affixed in all cases where the sender pays carriage, and where this has not already been done at the receiving office. When sender does not pay carriage, a "to pay" label, showing the amount to be collected on delivery, is attached. This system, which was adopted by the North-Western on May 1, 1898, for parcels conveyed solely over their own lines, is found to be a great saving in time and labor and a distinct advance on the old method which has, however, still to be pursued in the case of parcels destined for places on other roads. A record is kept at both ends of the parcels dealt with through each depot. The old method is to make out a waybill, giving details of each parcel, for the information of the guard or checker on the train, and to assist the staff at the receiving station in checking its safe arrival. It serves, too, as a record of the charges collected or collectible. This document accompanies the parcel, a duplicate being retained at the forwarding station for accounts purposes and purposes of reference in case of miscarriage or damage.

After the stamps on the parcels going to stations on the North-Western have been canceled by an india rubber stamp bearing the name of the station and the date, all the parcels are loaded for despatch to their various destinations in the guards' (brake) vans of the passenger trains, or in the case of traffic for large centers, in cars specially built for speed and fitted to enable sorting to be performed en route. A good deal is done by the company in the way of placing parcels in hampers, both at forwarding depots and en route, especially in the case of parcels crossing the Channel to Ireland. The obvious advantages are preservation from damage and speedier handling, particularly at Holyhead, where the hampers are very quickly transferred from trains to steamers, and vice versa, by means of cranes.



Two-Wheel Van for Collection and Delivery.

On arrival at receiving station they are unloaded by the depot staff, and particulars of each parcel are entered on a sheet which is taken out by the vanman or other individual when delivering, for the signature of the consignee to be obtained. If the package has not been prepaid, the money is collected now, or the outstand-

*A previous article appeared in the *Railroad Gazette*, Nov. 23, 1906.

ing amount debited to the consignee's account for collection periodically.

Parcels addressed "till called for" are warehoused for one day. If delivered on the second day following receipt, a charge of 2d. is made, if on the third day or any of the six following days, 4d. Beyond the ninth day an additional charge of 2d. per week or fraction of a week is imposed.

It may have occurred to the reader that the fact of being large carriers of mails for the Government has not precluded the North-Western from, at the same time, competing with the Post-office Parcels Post scheme. And, indeed, from the senders' point of view, the company's arrangements are preferable, because the Government will neither collect parcels, except in large quantities, nor accept them at the postoffices without prepayment. Again, the Government will neither collect parcels, except in large quantities, have not. Competition with the postoffice is, however, limited to packets up to 11 lbs. in weight, beyond which the railroads have a monopoly of the business, with the exception of that small portion of it retained by highway carriers. The general scale of rates for conveyance and collection and delivery within the usual limits is as follows:

Parcels weighing.	Parcels for stations in England, Wales and Ireland								Parcels for stations in Scotland							
	Not exceeding 30 miles.		Above 30 and not exceeding 50 miles.		Above 50 and not exceeding 100 miles.		Above 100 miles.		Not exceeding 30 miles.		Above 30 and not exceeding 50 miles.		Above 50 and not exceeding 100 miles.		Above 100 and not exceeding 200 miles.		Above 200 miles.	
Lbs.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1.....	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4
2.....	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4
3.....	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5
4.....	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6
5.....	0	6	0	6	0	7	0	7	0	6	0	6	0	7	0	7	0	7
6.....	0	6	0	6	0	8	0	8	0	6	0	6	0	8	0	8	0	8
7.....	0	6	0	8	0	9	0	9	0	6	0	8	0	9	0	9	0	9
8.....	0	6	0	8	0	10	0	10	0	6	0	8	0	10	0	10	0	10
9.....	0	6	0	8	0	11	0	11	0	6	0	8	0	11	0	11	0	11
10.....	0	6	0	8	1	0	1	0	0	6	0	8	1	0	1	0	1	0
11.....	0	6	0	8	1	0	1	0	0	6	0	8	1	0	1	0	1	0
12.....	0	6	0	8	1	0	1	1	0	6	0	8	1	0	1	2	1	2
13.....	0	6	0	9	1	1	1	2	0	6	0	9	1	1	1	4	1	4
14.....	0	6	0	9	1	1	1	3	0	6	0	9	1	1	1	6	1	6
15.....	0	6	0	9	1	2	1	4	0	6	0	9	1	2	1	7	1	8
16.....	0	6	0	10	1	2	1	5	0	6	0	10	1	2	1	8	1	10
17.....	0	6	0	10	1	3	1	6	0	6	0	10	1	3	1	9	2	0
18.....	0	6	0	10	1	3	1	7	0	6	0	10	1	3	1	9	2	1
19.....	0	6	0	11	1	4	1	8	0	6	0	11	1	4	1	10	2	2
20.....	0	6	0	11	1	4	1	9	0	6	0	11	1	4	1	10	2	3
21.....	0	6	0	11	1	5	1	10	0	6	0	11	1	5	1	11	2	4
22.....	0	6	1	0	1	5	1	11	0	6	1	0	1	5	1	11	2	5
23.....	0	6	1	0	1	6	2	0	0	6	1	0	1	6	2	0	2	5
24.....	0	6	1	0	1	6	2	0	0	6	1	0	1	6	2	0	2	6
Above 24, per lb....	0	0¼	0	0½	0	0¾	0	1	0	0¼	0	0½	0	0¾	0	1	0	1¼

Insurance covering the entire journey is undertaken on payment of small premiums, varying according to the value and nature of the package. Insured parcels are signed for from hand to hand throughout, lockups being provided for them at the depots and in the cars.

At the above rates the company is ordinarily liable without insurance for the full value of the packages in the event of loss in transit; but in the case of gold, silver, banknotes, deeds, silk, lace, china, glass and other exceptionally fragile or valuable articles, their responsibility, unless a declaration of greater value is made at the time of tendering, and insurance effected accordingly, is limited to £10 by an act of Parliament, known as the "Carriers Act" of 1830. Cheaper rates (about one-half the above scale) are available, if the owner is willing to assume the risk, for agricultural, farm and dairy produce and other special classes of traffic as distinct from general parcels.

These rates are all specially designed to cover the passenger train parcels, which are carried up to any weight. As the weight increases, however, the charges get proportionately heavier, until, except in cases where the more expensive means of transit is justified by the necessity for very prompt delivery, it becomes prohibitive. When this happens the sender has recourse to the freight train services; but, as the minimum weight charged for a package transported by freight train is 28 lbs., light packages go more cheaply, as well as more expeditiously, by passenger trains. In either case they are, whenever required, collected from the sender's and delivered to the reciver's premises by, or on behalf of, the railroad company without extra charge. And it is not the public alone that benefits by the cartage arrangements being in the company's own hands. As nearly as circumstances permit, the teams work to time tables and the work is done with far greater regularity than would otherwise be the case. The flow of traffic through the depots is rendered more uniform, so that the moments of idleness and undue bustle on the part of the operating staff are



Van for Parcel Collection and Delivery.

minimized at the despatching point, while deliveries can be made with equal uniformity, thus avoiding congestion at the receiving end.

When it is realized that, in addition to the parcels post, the millions of other single parcels by passenger trains, and those by highway carriers, who still have their uses, vast quantities are also collected by the numerous packed parcel carriers, bulked by them, and transported over the railroads in freight trains at the cheaper rates, some idea will be gained of the extent to which the tendency to small shipments has grown in the United Kingdom. The facilities reviewed here perhaps afford some indication of a few contributory factors in this remarkable development.

Reciprocal Demurrage.

Mr. Milton H. Smith, President of the Louisville & Nashville, contributes the following lucid statement of the demurrage principle and the reasons why reciprocal demurrage is unfair, in the form of a statement before a committee of the Alabama Legislature:

The regulations proposed by the bill* are sometimes termed reciprocal demurrage, the meaning of which seems to be that because a carrier is permitted to charge a consignee, or owner of property, storage on property which the consignee does not receive and remove with reasonable promptness, a shipper is entitled to exact a penalty when a carrier is unable, or for any reason fails, to furnish, with reasonable promptness, transportation for property



Typical Brake Van, with Accommodation for Parcels and Baggage on Either Side of Guard's Compartment.

*An act to require railroad companies and any person, firm or corporation engaging in the business of a common carrier or any commodity, freight or material of any kind, to furnish cars: and to provide a penalty for failing or refusing to do so.

which the owner may desire to ship. Due consideration will show that the conditions and obligations are unlike, and that the term "reciprocal demurrage" erroneously designates two entirely distinct obligations. I think all the states have enacted statutes which provide that the obligations of a common carrier cease after the property has reached destination and is ready for delivery to the consignee, and that thereafter the responsibility of the carrier is limited to that of a warehouseman, that after a reasonable time the carrier may store the property in an ordinary freight warehouse and make a reasonable charge therefor, and, if deemed prudent, insure the property sufficient to secure the carrier against loss of freight and other legal charges, or may place the property on storage with a public warehouseman, said warehouseman being responsible for the safeguarding of the property and responsible to the carrier for the accumulated freight or charges. The statutes also provide that after the expiration of a certain period the property may be sold and the proceeds applied to the payment of the freight and charges of the carrier and warehouseman, the excess received belonging to the owner of the property, or in case the owner is unknown, or does not claim the amount, in some of the states the surplus goes to the state, and, I think, in some cases, is credited to the school fund.

There is no difficulty in applying the statutes to miscellaneous merchandise, or property handled through warehouses, or in less than car-load quantities. There are some classes of property, however, shipped in car-load quantities, which under the contract between the owner and the carrier is to be unloaded by the consignee, that it is impracticable for the carrier to unload and store in its warehouse, or to place on storage in a public warehouse when the consignee fails to promptly unload. This applies especially to bulky articles of low value, such as coal and lumber. At points where there are elevators, or grain storage warehouses, the carrier may store the grain. To some extent, this may be, and is, done with bulky articles like hay.

It is evident that if a carrier has the right to charge storage on merchandise left in its warehouse, or to place such property in a public warehouse, it has the right to make a reasonable charge for storing the car-load property left in its cars which the consignee is under contract to unload.

From these conditions, the carriers adopted the rule of making a small charge, seldom more than one dollar per day for each car not unloaded within a reasonable time, usually 48 hours, after the same had arrived at destination, and was placed at a point where the consignee could unload the same. In practice, however, this charge was not uniformly enforced. During periods when the facilities of the rail carriers were in excess of requirements, they could, and oftentimes did, permit consignees to store property in cars for indefinite periods. Under such conditions, the strife between the carriers was often acute, and shippers availed of the circumstances to secure unreasonable concessions, or permission to store the property in cars indefinitely. The result was that in many cases brokers, or commission men, would order large quantities of property shipped, taking the chances of selling the same. If they failed to do so promptly, they secured valuable concessions in the way of free storage. Under these circumstances, when the demand for transportation increased, the carriers were oftentimes greatly embarrassed by their inability to secure the prompt unloading of cars, and endeavored to obtain relief by reinstating the storage charge. Unregulated competition rendered the practice irregular, and, some years ago, what are called car service associations were formed, to prevent discrimination and insure the treatment of all alike, or enforce like regulations upon all. A common agent was employed to represent all of the carriers in specified districts, who collects the storage, or what is termed demurrage.

The object of collecting the storage charge is to induce the owner of the property to unload and remove it. The amount collected in no way reimburses the carrier for the loss of the use of the equipment, and this is especially true at the present time when the demands for transportation are largely in excess of the facilities.

The cost of maintaining the bureaus and collecting the storage or demurrage charge absorbs a large part, and in some cases all of, or more than the amount collected.

Notwithstanding the owners of property are, as a whole, interested in having cars promptly unloaded, so that they may be utilized to the advantage of all concerned, yet, many consignees selfishly resist the payment of the so-called demurrage, or if they pay, do so unwillingly. I believe that in every instance where the payment has been resisted in the courts, the result of the contention has been in favor of the carriers.

Notwithstanding the interests of the shipper and consignee seem to be identical, they do not always co-operate to promote the interests of both. As an illustration, a manufacturer of lumber ships a car to a customer, possibly a commission merchant, which is not unloaded, and for that reason the manufacturer is unable to secure additional cars and is oftentimes greatly embarrassed and suffers a heavy loss. This in no way seems to concern the party at fault, although he may be directly affected by the failure of the millman to secure cars in which to make additional shipments. In cases where the shipper and consignee are the same, as in the case of a shipment of ore, limestone, coal or coke to a furnace, the carrier is in a position to enforce the prompt unloading because, if the owner fails to promptly unload, he does not secure cars in which to load additional material, which brings operations to a standstill, and he will, therefore, arrange to promptly unload the cars.

As an illustration of the difficulties under which the carrier labors, take the conditions that have existed for several months past at Mobile, which is a large export shipping port, especially of lumber. Lumber sold for export to be reshipped at a somewhat indefinite date, depending upon the arrival of a vessel, the consignee, to avoid the expense of unloading and storing, desires to keep the property on cars until the vessel arrives. The accumulation during the month of July and August, 1906, was very great. This was aggravated by the storm in September, 1906, and the conditions became desperate. The facilities of the Louisville & Nashville Company were so overtaxed that it became almost impossible to place cars to be unloaded for consignees who were prepared to promptly unload, and, in fact, materially interfered with the movement of through freight traffic—threatened paralysis or stoppage. At the same time, the manufacturers of lumber were in great distress because of the inability of the company to furnish cars for other shipments, not only to Mobile, but to all other points.

A statement was prepared showing the numbers of the loaded cars on hand at 7 o'clock a.m., December 15, 1906, and the length of time they had been on hand. It was found that of the total of 193 cars of lumber, 52 had been on hand prior to December 1, 1906, some of which were received in October, or had been on hand 52 days. Of all classes of property, there were 524 car-loads that had been held from three to 60 days. On December 29, 1906, another check was made of loaded cars that were on hand on December 15, 1906, which showed that 33 of such cars were still on hand undelivered. To relieve the situation, the management was compelled to adopt arbitrary measures—temporarily stop the shipment of some classes of property to Mobile, and, in some cases, to unload and store oil cake and lumber. During all this time, many shippers were in distress because of the inability of the company to furnish cars to be loaded. This is especially applicable to manufacturers of lumber.

The conditions that have prevailed at Mobile are typical of those over the entire Louisville & Nashville system. The business of many consignees has outgrown their facilities for promptly receiving and handling all of the property the increased business requires, and thus renders it difficult for them to promptly relieve the cars.

The reasonableness of making a just and lawful charge for the storage of property in cars which the consignee fails to promptly unload is so manifestly in the interest, not only of the carrier, but of its patrons, that it is conceded—is not denied.

Let us now consider the relations between common carriers and shippers. It is the duty of a common carrier to transport property to the extent of its facilities, for all who may desire to have property transported, upon equal terms. It must provide facilities for receiving, caring for and forwarding property to destination. When, by the terms of the transportation contract, the shipper is to load the property, cars must be furnished to enable him to do so; but a carrier can only be equitably, and, I think, lawfully required to provide facilities for normal traffic—cannot be required or compelled to furnish facilities beyond its ability or capacity. A carrier having equipped himself with a vehicle moved by one horse for the movement of a limited traffic, cannot be required to handle traffic requiring a vehicle moved by four horses. A railroad constructed and equipped for handling a limited local traffic, with a single track, adverse grades and curves, cannot be required to furnish two; four or more tracks, or the facilities furnished by railroads in some parts of the country operating four, and sometimes eight tracks, over grades where a single locomotive may move 3,000 tons against the inferior single-track road 300 tons.

The traffic conditions prevailing in the territory served by the Louisville & Nashville and affiliated roads have for some time been abnormal. Notwithstanding the strenuous efforts that have been made by the management, and the very large expenditures incurred and large additions to equipment, construction of additional sidetracks, second tracks, efforts to reduce grades, and in many ways increase its facilities, the traffic is, at present, largely in excess of such facilities.

As indicative of the efforts made, will say that the expenditures during the 13 years ending June, 1906, for equipment, were $14,367,852, and the total expenditures during the same period for equipment, additions to property, betterments, etc., were $74,723,320.

During the four years ending June, 1906, the number of locomotives was increased from 605 to 745, or 23 per cent.; and in tractive power from 13,872,700 to 18,477,700 lbs., or 33⅓ per cent.

During the six months ending December 31, 1906, the number

of locomotives was increased from 745 to 818, or nearly 10 per cent., and in tractive power was increased from 18,477,700 to 20,972,800 lbs., or 13 per cent.

During the four years ending June, 1906, the number of freight cars was increased from 27,699 to 36,158, or 31 per cent., and the capacity 41 per cent.

During the six months ending December 31, 1906, the number of freight cars was increased by 1,548, equal to .043 per cent., and the capacity increased .052 per cent.

Contracts have been made, and construction authorized, for 71 locomotives to be placed in service during the current calendar year at an estimated cost of $976,058, and the construction of 4,075 freight cars and 25 passenger car equipment during the same period, at an estimated cost of $3,082,150, or a total of $4,058,208.

Take the South & North Alabama Railroad as an illustration. It is a road originally constructed with limited capital, through a rugged country, across drainage, and when opened for traffic there was not a community of 100 persons on the line between Montgomery and Decatur. The alinement is crooked and the grades excessive, equivalent to more than 80 ft. to the mile. The heaviest locomotive in use, having a tractive power of 35,000 lbs., can move but 740 train tons.

A double-track has been constructed from Black Creek to Oxmoor, a distance of 14.6 miles; from Decatur to Flint, 5.4 miles; from Calera to Hardy, 12.6 miles, and numerous passing tracks have been created. In addition, large expenditures have been made to provide increased terminal facilities at Decatur, Birmingham (Boyles), Montgomery, etc. Nevertheless, the traffic now pressing is greater than can be moved, and if the present volume of traffic is to be continued and increase, it will be necessary to reconstruct the line, reducing grades and curvature, creating second tracks, increase the equipment, and construct shops and other facilities. The cost will be very great. The work of reducing grades and constructing second track between Oxmoor, Ala., and Hardy, Ala., 14.41 miles, has been entered upon, at an estimated cost of $1,010,500. I roughly estimate that to reduce grades and curvature, and construct second track over the entire line, Montgomery to Decatur, with the necessary increase in equipment, shops and terminal facilities, will cost not less than 15 millions of dollars, and, under existing conditions, the work could not be completed in less than five years. Under the existing financial conditions, the money cannot be provided, and after the expenditure of the money already provided, and the work undertaken is completed, the remainder of the work cannot be entered upon unless there is a favorable change in financial conditions. At the present time, neither the South & North Alabama Railroad Company, nor the Louisville & Nashville Railroad Company can obtain the capital necessary to prosecute the work. It, therefore, follows that in this case, the carrier must restrict its traffic to existing facilities—must refuse to undertake to move traffic in excess of its facilities.

It is known of all that the railroads were organized to transport persons and property, and that that being the object of their creation, the managements are eager to secure all of the traffic they can possibly handle, and they solicit and importune shippers, and do all they can to create and promote traffic. Circumstances have seemingly conspired to overdo the business. Traffic, at least for the time being, is in excess of the capacity of the carriers. The South & North Alabama Railroad cannot now move all of the property offered it. Under these circumstances, can the state of Alabama equitably and lawfully enforce penalties for failure to accomplish the impossible? A penalty of two, or a thousand dollars per day for failure to furnish cars upon the demand of shippers will not in any way add to the facilities. On the contrary, it may render it impossible for the company to increase such facilities. Keep in mind the distinction that when a carrier, having performed its duty and is responsible only for property as a warehouseman, makes a reasonable charge for caring for the property as a warehouseman, it is only doing what it is legally entitled to do, and what it should do from a business standpoint, while the bill under consideration proposes to enforce a penalty because the conditions are such that it is unable to assume the contract obligations of a common carrier for certain specified property.

Will the existing abnormal conditions continue, and if so, for what period? In my opinion, they may continue for 12 or 18 months, after which I believe the existing facilities will be adequate to the transportation requirements. This opinion is based upon the fact that a large proportion of the existing traffic is the result of the enormous expenditures that have for a number of years past been made by the railroads of the country, in adding to their facilities. The expenditures already made, and those authorized and under way, amounting to many hundreds of millions of dollars, in addition to giving employment to many millions of people, have created, directly and indirectly, a very large traffic which the railroads have been moving. The action of the United States government and state legislatures, combined with personal damage claim lawyers and labor unions, in conspiring to take the control of the property of the railroads from their owners—bind them hand and foot that they may be the more readily plucked—has caused, and will, I fear, continue to cause, investors to refrain from loaning the capital required to make further additions. If the railroad companies cannot obtain additional capital, it follows that as soon as the capital already provided has been expended—the improvements, additions, etc., now under way completed—the employment and traffic that has resulted from construction expenditures by the railroad companies will cease, and the existing facilities will, therefor, be equal to the requirements.

I hope I have made it clear that designating the bill under consideration "reciprocal demurrage" is a misnomer; that the making of a storage charge for caring for property as a warehouseman, after the duty as a common carrier has ceased, is one thing, and the proposition to penalize the carrier for inability to receive property for transportation, is another. The first is equitable and business-like—the other, an attempt to enforce punitive damages for a failure to accomplish the impossible.

Law Regulating Trainmen's and Operators' Hours of Labor.

The much amended hours of labor law, originally presented in the Senate a year ago, was finally passed on Monday of this week in form as follows (Senate bill No. 5133):

Be it enacted, etc., that the provisions of this act shall apply to any common carrier or carriers, their officers, agents, and employees, engaged in the transportation of passengers or property by railroad in the District of Columbia or any territory of the United States, or from one state or territory of the United States or the District of Columbia to any other state or territory of the United States or the District of Columbia, or from any place in the United States to an adjacent foreign country, or from any place in the United States through a foreign country to any other place in the United States. The term "railroad" as used in this act shall include all bridges and ferries used or operated in connection with any railroad, and also all the road in use by any common carrier operating a railroad, whether owned or operated under a contract, agreement, or lease; and the term "employees" as used in this act shall be held to mean persons actually engaged in or connected with the movement of any train.

Sec. 2. That it shall be unlawful for any common carrier, its officers or agents, subject to this act to require or permit any employee subject to this act to be or remain on duty for a longer period than sixteen consecutive hours, and whenever any such employee of such common carrier shall have been continuously on duty for sixteen hours he shall be relieved and not required or permitted again to go on duty until he has had at least ten consecutive hours off duty; and no such employee who has been on duty sixteen hours in the aggregate in any twenty-four-hour period shall be required or permitted to continue or again go on duty without having had at least eight consecutive hours off duty. Provided, that no train despatcher who [handles] orders affecting train movements shall be required to remain on duty for a longer period than eight hours in any twenty-four-hour period, and that no employee who transmits, receives or delivers orders pertaining to or affecting train movements shall be required or permitted to be or remain on duty for a longer period than twelve hours in the aggregate in any twenty-four-hour period except in case of emergency, when the employees named in this proviso may be permitted to be and remain on duty for four additional hours in a twenty-four-hour period on not exceeding three consecutive days in any week.*

Sec. 3. That any such common carrier, or any officer or agent thereof, requiring or permitting any employee to go, be, or remain on duty in violation of the second section hereof, shall be liable to a penalty of not to exceed $500 for each and every violation, to be recovered in a suit or suits to be brought by the United States district attorney in the district court of the United States having jurisdiction in the locality where such violation shall have been committed; and it shall be the duty of such district attorney to bring such suits upon satisfactory information being lodged with him; but no such suit shall be brought after the expiration of one year from the date of such violation; and it shall also be the duty of the Interstate Commerce Commission to lodge with the proper district attorneys information of any such violations as may come to its knowledge. In all prosecutions under this act the common carrier shall be deemed to have had knowledge of all acts of all its officers or agents, provided that the provisions of this act shall not apply in any case of casualty or unavoidable accident or the act of God, nor where the delay was the result of a cause not known to the carrier or its officers or agent in charge of such employee at the time said employee left a terminal, and which could not have been foreseen.

*As we go to press we find that this paragraph is wrong. A nine-hour limit is put on all operators, including despatchers, in day and night offices, and a 13-hour limit in day offices.

Provided further, that the provisions of this act shall not apply to the crews of wrecking or relief trains.

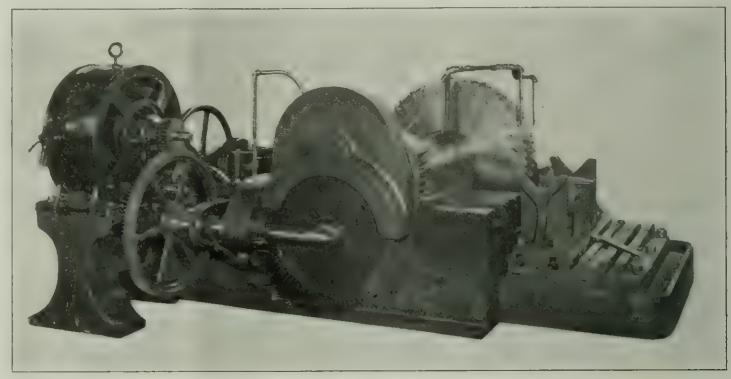
Sec. 4. It shall be the duty of the Interstate Commerce Commission to execute and enforce the provisions of this act, and all powers granted to the Interstate Commerce Commission are hereby extended to it in the execution of this act.

Sec. 5. That this act shall take effect and be in force one year after its passage (March 4, 1908).

Motor Driven Rotary Slotting Machine.

The accompanying illustration shows a double rotary slotting machine built for the Union Pacific by the High Duty Saw & Tool Co., Eddystone, Pa. The machine is to be used in slotting forged steel crank shafts, connecting rods and links. It can also be used as a general cut-off machine on axles and miscellaneous straight stock by the removal of one of the saw blades. Two "Tindel" high duty high-speed steel inserted teeth milling saws are operated by the machine. Each milling blade is 36 in. in diameter and has 60 inserted cutters of high-speed steel.

The machine is electrically driven by a 15-h.p. Westinghouse direct-current motor geared 2 to 1. The motor is attached directly to the driving shaft of the machine, through the gear and spur pinion shown. Power feeds ranging from ⅜ in. to 1⅛ in. per minute can be obtained with both saws feeding simultaneously. No worm gearing is used in the drive; all driving power is transmitted to the saw blade through straight and bevel gearing. The enormous friction of worm gearing under heavy feeds is thus eliminated, and the frequent renewals of costly worm wheels obviated. The housing of the machine is massive and the saddle carrying the arbor has a large surface bearing on the table. It is fitted to it with an underlock cast solid. All wear on the saddle or table is taken up with phosphor bronze tapered shoes. A removable table with screw adjustment for setting work to the line is also furnished. On it are mounted special "V" stands and rest blocks with clamps and bolts designed especially for setting and firmly holding crank shaft work while being slotted. These fixtures are removable so as to leave the table underneath clear for bulky work, or for mounting other special fixtures for holding a variety of work. A liberal reservoir for a supply of drilling or other compound and an automatic pump with flexible piping maintain a liberal stream for cooling and lubricating each milling blade while the machine is in operation. Troughs cast around the bed of the machine collect and return the lubricating fluid to the reservoir and pump. The machine has capacity to cut double slots spaced up to 10 in. wide and 11 in. deep. On steel up to .45 carbon the machine cuts slots of these dimensions in 15 minutes when driven with moderate power.



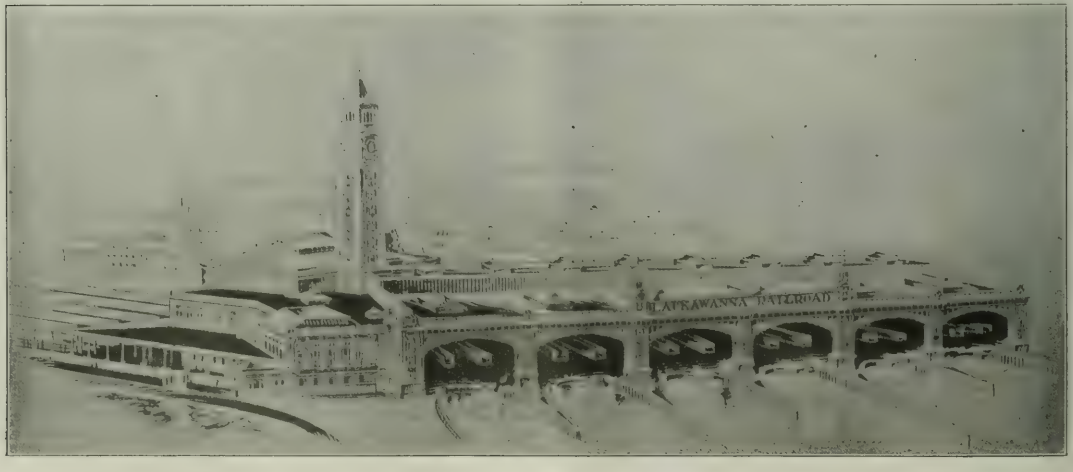
High Duty Slotting Machine.

New Hoboken Terminal of the Lackawanna.

The new ferry terminal and passenger station at Hoboken of the Delaware, Lackawanna & Western was opened to the public on February 25. It will be remembered that on the night of August 8, 1905, the Hoboken terminal and ferry houses of the road were burned to the ground. Before the last flame had flickered out plans were being drawn for a temporary terminal. In a few days the temporary arrangements were in place. The destruction of the old buildings, which were well insured, was not an unmixed misfortune to the road for a new terminal within two or three years was a necessity, and it was something of a problem to know how to dispose of the old buildings. The fire solved the problem.

The first concrete construction on the new terminal was begun on March 25, 1906. Except for three of the ferry slips, the whole passenger station was finished on February 3, 1907. It was built over traffic with 100,000 people and 3,600 teams daily using the temporary buildings. The buildings are built over the water on concrete and steel foundations which rest on piles. The terminal building is fireproof even to the racks and desks in the ticket office. The train shed, which was designed by Lincoln Bush, Chief Engineer of the road, is original and noteworthy. It is built of steel, concrete and glass. There is a smoke opening over each track. It was described in detail in the *Railroad Gazette* of September 1, 1905. The train shed covers 14 tracks and is 607 ft. long.

On the first floor of the building is the waiting room and its dependencies; also the ferry concourse. The waiting room, an interior view of which is shown, is 90 ft. x 100 ft. and 55 ft. high. It is finished in limestone and plaster with high windows on all sides and a leaded art glass ceiling light. At night this room will be lighted by 1,000 incandescent lights. In each corner hangs a bronze chandelier weighing a ton. There are also brackets of lights around the sides and canopies of lights over the seats. This room



New Hoboken Terminal of the Delaware, Lackawanna & Western.



Main Waiting Room; Lackawanna Terminal.



Restaurant; New Lackawanna Terminal at Hoboken.

and the baggage room are finished in Indiana limestone with copper work above. From the waiting room ornamental bronze stairways lead down to the ferry concourse. The decorations are in Louis XVI. style. Opening off from the waiting room are women's rooms, smoking rooms, information bureau, lunch room, telephone booths, baggage and express windows and news stand. On the second floor, which is reached by an easily inclined plane and by elevators, is the restaurant. A fully equipped emergency hospital, a barber shop and bath rooms and offices are also on this floor. The restaurant, a photograph of which is shown, is the most ornate room in the building. It is finished in old ivory with old gold hangings and French gilt fixtures. All the woodwork is mahogany. The seating capacity is over 250. The room overlooks the water, and an outdoor balcony, seating 45, will be used in summer.

The ferry approaches have been built with the special purpose in view of convenience. Three pairs of slips, each accommodating two large double-decked ferryboats, serving Twenty-third, Christopher and Barclay streets, New York, have been provided. To reach the ferryboat there is a concourse 70 ft. x 100 ft. with rows of coupled columns and heavy ornamental beams across the ceiling, to the upper deck. To reach the concourse passengers have the choice of three ways, an inclined plane, a stairway and elevators. The waiting rooms and ferry concourse have a joint capacity of 40,000 people.

The whole building is to be covered with copper. As shown by the architect's drawing, a tower 250 ft. high rises from the central facade. This tower contains a clock 12 ft. in diameter, the largest in New York harbor. At night the tower is illuminated from top to bottom with electric lights and the six ferry slips are spanned by arches supported by ornamental piers, all of which are outlined by electric lights. The terminal is to be heated and ventilated by the most modern appliances; in winter, warm fresh air will be forced into the various public rooms.

The street elevation of the ferry house will have, when finished, five bays surmounted by pedaments. Of the 8,000 incandescent lights used, 2,100 are used in five large electric signs, one of which has letters 9 ft. high.

There is an immigrant station with a ferry slip and building of its own, accommodating 800. It is built with the special purpose of having it kept in an absolutely sanitary condition. It has special car tracks and a special ferry boat.

Kenneth M. Murchison is the architect of the Lackawanna terminal.

Railroad Decisions in February.

The following decisions were handed down by Federal and Supreme courts in February:

Assumption of risk of injury by brakemen.—A brakeman injured by striking a switch target while on the ladder at the side of a car will not be denied a recovery for injuries, on the ground that they were caused by an assumed risk, where it appears that the switch target was placed dangerously near the track shortly before his injuries were received and he had no knowledge of this fact and had not been warned about it. Boston & Maine vs. Gokey, 149 Fed. Rep. 42.

Presumption of care by person killed at crossing.—The legal presumption that a traveler killed at a crossing exercised due care for his safety, which is based on the instinct of self-preservation, obtains only where there were no witnesses to the accident. It cannot be invoked where the surrounding facts and circumstances conclusively show that he did not exercise this care. Rich vs. Chicago, Milwaukee & St. Paul, 140 Fed. Rep. 79.

Duty of employees to observe defects in appliances.—A railroad employee, working constantly with an engine in railroad yards may not close his eyes to obvious and dangerous conditions or defects in the engine and then sue and recover for injuries caused by these defects. Williams vs. Choctaw, Oklahoma & Gulf, 149 Fed. Rep. 104.

Unblocked frogs.—A court cannot say that the failure to block frogs is actionable negligence where the evidence does not show a uniform custom of railroads in the state to block frogs and does show that the frogs on the railroad in question were not all blocked and there was a fair difference of opinion among practical railroad men as to whether blocking really made the frogs safer. Wabash vs. Kithcart, 149 Fed. Rep. 108.

Damage to property by operation of railroad.—In Nebraska a property owner may recover from a railroad for special injury to his property by the operation of a railroad in its vicinity which is in excess of that sustained by the public at large, although no part of such property is actually invaded or appropriated. The recovery will include damage to the property from noise, smoke, cinders and vibrations of the ground and obstructions which interfere with or impair the owners use of public highways in the vicinity. The measure of damages is the difference between the market value of the property before the construction and operation of the road and its market value afterward. Mason City & Fort Dodge vs. Wolf, 148 Fed. Rep. 961.

Employer's liability act.—The act of June 11, 1906, governing the liability of carriers to their employees is not strictly a regulation of interstate commerce, but imposes new rules of liability in the master and servant relation, which, if valid, are binding on all courts, state and Federal, but which have no such relation to interstate commerce as to bring them within the constitutional power of Congress to regulate such commerce. The act is so framed that its provisions are applicable alike to all commerce, including that between citizens of the same state, and cannot be confined to that which is subject to congressional control. Brooks vs Southern Pacific Co., 148 Fed. Rep. 986; Howard vs. Illinois Central, 148 Fed. Rep. 997.

Schedule of rates.—A shipper claiming an illegal exaction of freight charges in violation of the interstate commerce act must show either that there has been some unreasonable or excessive charge imposed or some unlawful discrimination practised against him by which he has been pecuniarily damaged. He cannot recover on a merely technical construction of the law, because in addition to the ordinary scheduled rate an extra charge forcing service, also shown by the schedules, but separately, has been collected from him, and it does not appear that the charge was unreasonable. Knudsen-Ferguson Fruit Co., vs. Michigan Central, 148 Fed. Rep. 968.

Expert witnesses.—A witness having practical railroad experience and familiar with overhead structures and buffers may testify whether a buffer at the end of a spur track was reasonably safe and proper one, and as to whether reasonable and proper care had been exercised in so building an overhead structure as to prevent the use of the hand-brake on a freight car until within 100 ft. of the end of the spur track. Gila Valley, Globe & Northern vs. Lyon, 27 Sup. Ct. Rep. 145.

Refusal to transport liquors.—An express company doing business as a common carrier must serve the public impartially. Judge Goff holds that under this rule an express company has no right to refuse to receive and carry packages of liquors from lawful dealers therein in one state, while it receives and carries the same in other states, nor to refuse to carry the same C. O. D. and to collect and return the purchase money from the consignee in accordance with the general custom of the business, where it follows such custom with respect to other commodities, nor can it require a consignee of such liquors before delivery to furnish a certificate or affidavit that he is a *bona fide* purchaser of the same for his own personal use or has a state license to sell liquors. Crescent Liquor Co. vs. Platt, 148 Fed. Rep. 894.

Rates in Mississippi.—The Federal Constitution presents no obstacle to establishment by the Mississippi Railroad Commission of a flat rate of 3½ cents a 100 lbs. on grain and grain products carried from Vicksburg to Meridian over the Alabama & Vicksburg, where that company, under the guise of a "rebilling rate," gives any Vicksburg merchant receiving a carload of grain or grain products over the Vicksburg, Shreveport & Pacific a rate of 3½ cents a 100 lbs. on any grain he may ship to Meridian. Alabama & Vicksburg vs. Railroad Commission, 27 Sup. Ct. Rep. 163.

Indictments under the Elkins Act.—An indictment for violation of the Elkins act for giving or receiving rebates need not allege that the carrier's published rate was a reasonable rate nor set out its tariff in full. It is sufficient if it avers that a certain named rate was in force between designated points as shown by the published tariffs. Under this act the consignee is liable to indictment no less than the consignor by receiving concessions from the published tariffs of an interstate carrier. United States vs. Standard Oil Co., 148 Fed. Rep. 719.

Foreign Railroad Notes.

On the railroad in German East Africa from Dar-es-Salam westward the track was laid for 70 miles from the coast Dec. 1.

The freight blockade in Hungary reached such proportions that the State Railroads gave notice that no freight would be received for shipment after Jan. 9 until previous accumulations should be cleared away, which would take "a few days."

The plans for the new great station in Leipsic covered nearly half a mile of the little river Parthe. To avoid building an archway of that length, it has been decided to move the river, which will reduce the length of the archway to about 1,050 ft.; but retaining walls for 2,800 ft. of the new channel must be built.

In Germany round-trip tickets, good for a return within 45 days, are issued at a large reduction in price. Children less than 10 years old pay half price. A case has come up in which a child made his outward journey when less than 10 years old, but reached his birthday before returning, though within the 45 days. The railroad refused to accept the return part of the ticket as fare; suit was brought, and the courts decided that the ticket was good for the return journey. As there will be no more round-trip tickets at reduced rates after April next the decision has little practical importance.

Handling Immigrant Traffic at the Port of New York.

The enormous flood of foreign immigration during the past decade has created the necessity for most complete and careful methods, not only that the country itself may get the best results from the new blood, but that the foreigners may not be subjected to the many abuses which formerly existed. In the correction of these evils the railroads of the country have had a large part. The opening of new territory through railroad expansion has encouraged the movement of immigration from the coast into the interior. The railroads have perfected a system whereby the immigrant may reach these sections with least possible delay, safeguarded from the depredations of those who would make him their prey. In cooperation with the Department of Commerce and Labor, which has charge of immigration, the railroads have created what might be termed an auxiliary government department into whose care the immigrant passes when his fitness for American residence has been certified to by government officials.



Main Building and Barges; Ellis Island.

As nearly 75 per cent. of the immigrants to the United States enter the port of New York—over 1,000,000 in 1906—whence they scatter to every part of the country, the chief office of the Immigrant Clearing House, as this railroad bureau is called, is at Ellis Island, the government headquarters for reception and examination of immigrants at New York. Auxiliary offices are located at the other ports of entry, but most of the business passes through the New York office. The entire immigrant traffic after being examined by the government authorities under supervision of Robert Watchorn, Immigrant Commissioner of the port of New York, is turned over by the government to the Immigrant Clearing House, which represents all of the initial lines, rail or water, moving traffic from New York. The ticketing and checking of baggage is attended to by this bureau, which not only looks out for the correct ticketing of the immigrants to destination—a difficult problem owing to the various nationalities represented, and their ignorance of conditions in this country—but divides the competitive traffic on an agreed basis between the different lines.

It is estimated that nearly 80 per cent. of the immigrants who land at the port of New York are destined for some point on the railroads of the United States and Canada, only 20 per cent. going to New York City and its suburbs for permanent residence. About 60 per cent. of the immigrants handled at Ellis Island are destined to some point west and south of New York City and about 20 per cent. to points east. Of the 60 per cent. going west, 35 per cent. go to the various commercial and agricultural centers east of Chicago and the Mississippi river; the rest, to the great wheat and corn growing states of the northwest and southwest and to the Pacific coast for employment in its vineyards.

Before formation of the Immigrant Clearing House the immigrant was the legitimate prey of agents of every line leading out of New York. Many of these agents were irresponsible, and the helpless foreigner, unable to speak English and unused to American methods, in consequence suffered not only actual money loss in being forced to pay higher fares than he should have done but loss in time through circuitous routing. In those days, Castle Garden, then the government headquarters, was a scene of Babel worse confounded. In the midst of the rushing, jostling horde of railroad agents and interpreters, the poor immigrant was like a rabbit harried by a pack of hungry hounds.

To-day all is changed. The immigrant, if he wishes, may arrange with the steamship agent in Europe for his whole trip to destination, including steamship and railroad accommodations. Transportation is furnished in the form of a prepaid order on the



Branch Post Office and Money Exchange; Immigrant Clearing House.

Immigrant Clearing House which is accepted at the New York office and exchanged for the proper railroad tickets, collections being made from the steamship agents through the regular channels. This greatly simplifies the ticketing of immigrants. Large numbers of immigrants, however, buy their railroad transportation after reaching New York. It is to this class of business that the new arrangement particularly appeals, and it was primarily for their protection that the bureau was established.

The progress step by step of an immigrant in entering the country is interesting to follow and shows how closely his interests are looked after, not only by the government, but by the officials of the steamship lines and railroads on which he travels. Having obtained the proper steamship transportation, he embarks for America. While on the ship he is under the care of the ship's officers. His interests are safeguarded from corrupt influences and his health looked out for. The immigrant remains subject to the ship's rules until he is delivered to the United States officials at the dock, although the government first observes him when the quarantine inspection is made. If he is found free from disease, the regular quarantine clearance certificate is given him before the ship lands.

At the dock the immigrant first comes under the care of the Immigrant Clearing House. He is met by a representative who, of necessity, is an expert linguist. Baggage is examined by the customs officers. If it is found free of dutiable articles it is taken in charge by the Clearing House people, who give the immigrant a check for its safe delivery at Ellis Island. If the baggage is held by the customs, it is also sent under a special form of check to Ellis Island, where there is a branch customs office. Here it is re-examined and the necessary charges adjusted. All baggage arranged for, the immigrant, with his thousands of fellow travelers, is transported by special barge or steamer under care of government officers to Ellis Island. His baggage is taken on the same boat to be delivered to the Clearing House baggage room at the island.

Handling of the immigrant traffic before it is turned over to the railroads is a most complicated problem, necessitating not only great care, but also all possible despatch owing to the very large numbers. Great improvements have been made from time to time in the government facilities at Ellis Island, especially during the term of the present Commissioner, who has been notably successful in relieving the hardships which must necessarily result from the immigrant's gross ignorance of American conditions.

At Ellis Island the immigrant is unloaded from the barges and passes into the main door of the large building shown in the photograph. To the immigrant this is the most important part of his progress into the new country. Entering the central door of this main building, he passes directly into the heart of the government's domain. Up a wide stairway he goes, the first sight meeting his view being a large American flag which hangs over the top of the stairs. Under it he meets an official who examines his quarantine certificate. If this is correct, he is passed along between two high walls of iron grating to the eastern end of the large registry room. At the further end he is turned to his right between two railings and faces in succession three doctors, each of whom examines for certain physical defects, which may be sufficient to bar him from entering the country. If any trace of disease is detected his coat is marked with certain cabalistic chalk marks and he is turned to an enclosure on the left for further examination. Special waiting rooms, divided by high iron railings and gratings, are provided for this purpose.

If, on the other hand, he passes the examination satisfactorily, he is passed along to another official, who directs his steps into one of 20 railed enclosures, each of which has bench room for 30 immigrants. These are called the free pens and are shown in one of the photographs. Here the immigrant waits his turn for examination by an inspector who sits at a high desk at the end of the pen. Questions about name, age, residence, destination, education and funds—this last to guard against accepting persons likely to become a public charge—are asked, and if the answers are satisfactory and agree with the information given in the steamship company's waybill, the immigrant, who is waybilled to this country like a piece of freight, passes the inspector holding in his hand his waybill, a card bearing a distinctive number and color.



The Final Government Inspection at Ellis Island.

At the west end of the registry room are four ways of exit, to which the colored cards are an index. One leads to detention rooms where are sent those who have not satisfactorily passed this last inspection. Here the immigrant's case receives the attention of another set of officials. On the floor above the registry room are dormitories, one for men and one for women and children, where these special cases are housed until they are attended to. In summer time the roof gardens on this floor are popular. Here families gather during the day; at night they are separated.

Another exit leads down a flight of stairs in the center of the building. To this are guided those who go to New York City. At the foot of the stairs is a waiting room to which friends and relatives come to welcome the new comer. From this point on he is free to take the ferryboat which runs hourly to New York.



The Ticket Counter of the Trunk Line Association at Ellis Island.

If the immigrant is destined to a point east of New York City, his card will bear the proper color and he will be guided to another flight of stairs to the right of the one leading to the New York ferry. Here he will be met by a representative of the New England lines, who will arrange for his railroad ticket and baggage, collecting the checks given by the Clearing House and arranging for the transfer of passenger and baggage to the stations of the New England lines in New York. The immigrants bound for nearby points in New York state and for New England points are carried by the government ferry to the Battery. Those for nearby points on the Hudson, Harlem and Putnam divisions of the New York Central, as well as the New England contingent which goes out mostly over the New York, New Haven & Hartford, also go to the Battery by ferry and from there under escort by subway, elevated or surface cars to the Grand Central Station.

The immigrant going to a point west, north or south of New York passes to the left of the New York exit. Down another flight of stairs he goes and into the room of the Immigrant Clearing House of the Trunk Line Association. This room looks like the ticket office of any large railroad company. Facing the immigrant as he enters is a long ticket counter with office rooms at each end. On his left is a branch post office, and the desks of the money exchange, which does a land-office business on a big day exchanging all kinds of foreign coin into American currency. The immigrant makes this exchange at better than market rates. A little further on are the quarters of the representative of the Western Passenger Association, which attends to all business



Immigrants Leaving Ellis Island for the Railroad Stations.

west of Chicago and St. Louis. On the right, stretching along the sides of the room, are the booking offices of the coastwise steamship companies, who handle immigrant business; the office of the Canadian Pacific and of the Western Union and Postal Telegraph Companies.

Representatives of the various transportation companies meet the immigrant as he enters the door of the main room. This is not to solicit business, but simply to see whither he is bound. If he has a prepaid steamship order for transportation, he is directed at once to the proper ticket window to obtain his tickets. If he is a cash customer, unless he has American money, he is directed to get his money changed.

The ticket office of the Trunk Line Association, as is shown in the illustration, is a long counter which stretches across one whole side of the room. Here ticket sellers of long experience in handling foreigners and able to understand almost any dialect or decipher almost any address, however illegible, sell him a through ticket at second-class rates to any point in the country, which he can buy with absolute assurance that no advantage is being taken of his ignorance and inexperience.

Having purchased his tickets, the steps of the immigrant are turned toward the general waiting room. At the exit door he is asked for the baggage checks which have been given him at the steamship dock. It has been found that in many cases the immigrant either lost or mislaid these small checks. A different system has recently been adopted. The checks are collected by an official of the Clearing House at the exit door, and the immigrant is given a receipt for them, bearing not only the numbers of the checks but the forms and numbers of his tickets. With this receipt he goes into the general baggage room of the Clearing House to which his baggage has been taken from the steamer. He identifies his baggage and if the check it bears corresponds to the check numbers on the memorandum he holds, the baggage is weighed. Each immigrant is allowed 150 pounds of baggage on a whole ticket and 75 pounds on a half ticket. If the gross weight of the baggage exceeds the limit of all the tickets he holds he pays the excess charges. He then receives a check for all his baggage through to destination, the baggage being placed in one corner of the room, in piles, according to the road over which it goes. At the scales a memorandum is taken of the kind of baggage, the number of pieces, the gross weight and the number and kind of tickets held. This information is included on the way-bill to the railroad over which the baggage goes, the immigrant receiving a regular duplicate check such as given to any passenger holding baggage. The baggage being checked through to destination, the immigrant is relieved of the necessity of attending to any transfers and is not subject to the many extortions which used to be the practice by irresponsible express companies and local agents.

The record of the railroad baggage department at Ellis Island is remarkable. Immigrants' baggage is the most miscellaneous imaginable. Crockery, furniture and pianos are not unusual impedimenta. Names and addresses are written in foreign languages, and often most illegibly, yet in 15 years only one piece of baggage has been lost during its handling at Ellis Island. The ticketing and baggage arrangements are all under the direction of T. J. Faulkner, agent of the Immigrant Clearing House.

The immigrant now passes to the waiting room at the eastern end of the building to wait for the barge which will take him up the river to his station. This room is divided by high wire screens into a number of sections, each for the immigrants destined to one station. Thus those for the Pennsylvania and Lehigh Valley go to one compartment; those for the Reading-Jersey Central and Baltimore & Ohio routes to another; for the West Shore and New York, Ontario & Western into another; for the Erie to another, and the Lackawanna passengers to another.

A restaurant keeper has a concession for lunch stands in this room, which are well patronized. There are on sale at a low price packages of food sufficient for a several days' trip, each with the price and description in several languages plainly marked on it. Here again the immigrant is protected from unscrupulous dealings. This is the only feature of the service at Ellis Island which is not directly under the control either of the Government or the railroads.

In all its features the handling of immigrants at Ellis Island is a remarkable example of fast and efficient work. On days of heavy arrivals over 5,000 immigrants have been examined by the government inspectors and handled by the Immigrant Clearing House.

Late in the afternoon the barges are loaded. The number used depends on the number of immigrants to be transported. If the number is large, a barge is loaded for each of the five stations; if small, only one is used. The boats are held until

the passengers and baggage have all been loaded before proceeding up the river.

Each railroad on the New Jersey side of the Hudson has a special waiting room or passenger station for immigrants. This is necessary, for all immigrants destined for points any great distance from New York are handled on special trains, usually in the evening. These waiting rooms are plain but comfortable. Refreshments may be obtained here of the attendants. In these waiting rooms, as well as at Ellis Island, the greatest care is used to keep the immigrants from outside interference. They are kept in the waiting rooms or the enclosures surrounding them until there are people enough for a whole train, and then carefully guarded to the trains. When the immigrant starts on his journey every safeguard is thrown around his person and belongings, and every precaution taken to insure his safe and prompt arrival. The special trains are run through to western destinations without change of cars, often as second sections of regular passenger trains. On these trains special care is taken by the crew to see that each person leaves the train at the station to which he is ticketed.

The immigrant travels in cars in which none but this class of business is allowed to travel, if he is going any distance. Not only the trunk lines, but western connections, adhere to this rule, thus maintaining an oversight without which these people would be easy prey for unprincipled sharpers. Immigrants have not intelligence enough to be treated like ordinary passengers, but while they may at times apparently be ordered about roughly —and this seems the only way to manage them—their welfare is looked out for from the beginning until the end of their trip. At least one of the roads sends out in charge of each immigrant train an interpreter, whose duty it is to look out for the immigrants while *en route*, thus insuring safety from interference and contributing in every way to the comfort of the immigrants.

Thus from the time the immigrant enters the port of New York until he reaches his final railroad destination he is not only watched over with great care and given favorable prices in purchase of his necessities, but is carefully protected from contact with unauthorized persons, so that even in cases where he is utterly ignorant and inexperienced and has a considerable sum of money in his possession, he can reach his destination safely.

The following table is of interest as showing the number of arrivals at New York last year and the tremendous growth of immigration during the last 10 years:

Total Immigration to the Port of New York.

	Cabin.	Steerage.	Total.
1897.....	90,932	192,004	282,936
1898.....	80,586	219,651	300,237
1899.....	107,415	303,762	411,177
1900.....	137,852	403,491	541,343
1901.....	128,143	438,868	567,011
1902.....	139,848	574,276	714,124
1903.....	161,438	643,358	804,796
1904.....	162,389	572,798	735,187
1905.....	184,932	776,330	961,262
1906.....	218,720	940,831	1,159,551

New York State Drawbridge Rules.

The New York State Board of Railroad Commissioners, adopting as its own the recommendations of J. D. Schultz, its inspector, concerning drawbridges, sends to the railroads of the state (those on which there are drawbridges) Mr. Schultz's report, and calls on them to advise if they will comply. The substance of the report follows.

There are in this state 41 openings in the main track roadway of steam railroads for passage of boats. At most of such openings there are swing bridges; a few are lift bridges, and there is one—in the Rutland Railroad, where the Addison branch crosses Lake Champlain—where a float draw is used. There are 10 openings on the Long Island; 16 on the New York Central & Hudson River; four on the Delaware & Hudson; three on the Delaware, Lackawanna & Western; two on the New York, New Haven & Hartford; two on the Staten Island Rapid Transit; one on the Rutland; one on the New York, Ontario & Western; one on the Buffalo Creek, and one on the Buffalo, Rochester & Pittsburg.

In making my regular inspection of railroads during the past summer I examined carefully 37 of those bridges, and have since receiving your instruction made thorough inspection of all.

The method of operating, protecting draw, connecting shore and bridge rails, etc., differs greatly on different roads, and in many instances on the same roads. I find none where the conditions, as operated, can be considered dangerous, and at only a few, where the protection is especially good, do the trains run at speed when crossing the draws; at all others the trains are required to come to a full stop before crossing or run with train under perfect control.

The method of securing the movable rails, that are necessarily unspiked for much of their length, at the ends of most drawbridges, the manner of signaling the approach to the draws, and the interlocking of the signals with the mechanism operating the draws can in nearly all cases be improved. I also consider that there should be derailing switches in all tracks approaching the draws, located a sufficient distance from the end of the bridge that a train derailed thereby would not be likely to run far enough, on the ties, to get into the draw opening; guide rails can be secured to the ties that will prevent a train so derailed getting away from the track.

I respectfully recommend the following method of securing movable rails on drawbridges and signaling and protecting operation of trains crossing them: The movable rails on ends of all drawbridges to extend 2 ft. or more beyond the end of the bridge, and together with the shore rails, to have a miter joint; rails cut at an angle of approximately 30 deg.; points to be trailing for double-track bridges and to be trailing for wheels approaching the draw on single-track bridges; the mitered rails to meet in a "trough" or channel not less than 3 ft. in length, that will insure the rails being held in correct alinement; the movable rails to be bolt locked in position and the bolt lock to be interlocked with the signals governing the approach to the draw; the movable rails to be not less than 17 ft. in length and for at least 12 ft. of their length on the bridge to rest when in place on plates that shall have an angle or raised plate on the outer side that will prevent the rails being moved outward. This plate may be in sections, with space of one tie distance between the sections. Those plates to be firmly secured to the bridge ties and the rails to be connected to each other by at least four tie-bars.

The draw must be protected by home and distant signals and also by derails, the derails to be located, wherever practicable, not less than 500 ft. from the end of the draw, the home signals about 50 ft. farther away, and the distant signals not less than 1,500 ft. beyond the home signals, and all interlocked with the mechanism of the draw in such manner that the first movement toward opening the draw sets the distant signal to the danger position next the home signal to the danger position, then opens the derail; then the bolt lock securing the movable rails may be withdrawn, the rails raised, draw unlocked, wedges withdrawn and draw opened. The locking to be in such manner that when the draw is again closed, the wedges inserted and draw locked, movable rails lowered to place and bolt locked down, then derails can be closed, home signal cleared and the distant signal cleared, and that the above described movements can only be done consecutively and in the order named. In cases where the draw lifts, the rails on the end of the bridge can be securely spiked to the ties and will raise and lower with the bridge, but the method of connecting them at the ends of the draw will be the same, as will be the method of operating the bridge bridge lock, rail lock, derails and signals.

If it is desired to use square end instead of mitered rails, with all the rest of the protection as above described, the only difference will be that the open joint will not ride quite so pleasantly, but will be practically as safe, and I see no serious objection to that form of joint being used. In some cases where the block signal system is in use and block towers are near the drawbridges, the draws are interlocked with the towers in such manner that the bridge tenders cannot make any movement towards opening the draws until unlocked by the signal tender. This is a good plan and should be followed wherever it can be done consistently.

New York State Block Signal Recommendations.

The New York State Board of Railroad Commissioners has issued to the steam railroads of the state the following circular:

We desire to call your attention to the necessity for the operation of trains on all steam roads under some form of block system that will prevent more than one train being in a block at the same time and that will serve to prevent the frequency of collisions. This can be done either by the manual controlled system, the automatic electrical block system or the telegraphic block system. If, owing to the volume of traffic, the telegraphic stations as they are now located are too far apart to properly handle the business by the telegraphic block system, intermediate blocks should be established. In the automatic electrical block system the blocks can be established of any desired length. The same is true of the manual controlled system.

The method now used on very many roads of spacing trains, or the permissive block system which allows more than one train in a block at a time, under cautionary orders, is not shown to be effective. A heavy train may make slow progress; a lighter one, even if held five or ten minutes at a telegraphic station, may overtake the leading train and collide with it. Also in the permissive block system a train enters the block and the men are too apt to consider that they are protected and do not flag promptly. Also another train entering the block under cautionary orders is too liable to assume that the first train must be out of the way by that time and does not proceed as cautiously as it should, and collisions result. We are aware that at terminal stations and large yards it will in some cases be necessary to permit more than one train at a time in such blocks; but those blocks should be made as short as they can consistently be made and the restrictions governing movements in them be made promptly and rigidly enforced.

We are of the opinion that permissive blocks should not be oper-

ated, and we recommend that all steam roads where the permissive block system is in operation install sufficient additional block signals at the earliest possible moment. You are requested to notify this board as to compliance with the recommendations.

William A. Garrett.

The new President of the Seaboard Air Line, William A. Garrett, has before him a problem which can, perhaps, be solved only by radical changes in operating and traffic department methods. It calls for just that genius for organization with which Mr. Garrett is credited. The Seaboard's earnings have not been up to the average of other southern roads with which it may fairly be compared; the increases in operating expenses seem greater than conditions justify, and even gross earnings have been falling off.

Mr. Garrett is a rigid disciplinarian. He brings out the best there is in his subordinates and directs their efforts along lines of maximum efficiency. He is quick to notice and encourage those who show initiative and do not hesitate to take responsibility. In the operation of passenger trains he insists on strict adherence to rules and, particularly, keeping to schedule time. The late train, he holds, always adds to the unavoidable risks of accident.



William A. Garrett.

Mr. Garrett is 45 years old. He began railroad work as a messenger boy in a ticket office of the Ohio & Mississippi, now part of the Baltimore & Ohio Southwestern. Then he worked his way up in different departments in the St. Louis Union Depot until he was made Assistant Superintendent. From 1893 to 1896 he was Superintendent of the Terminal Railroad Association of St. Louis and at the same time Terminal Superintendent of the Wabash; for the last two years of this period he was also Superintendent of the St. Louis Merchants' Bridge Terminal. He was then appointed Superintendent of the Western division of the Wabash, and after a year was transferred to the Middle division. In 1899 he went to the Philadelphia & Reading as Superintendent of the Philadelphia division, being made Superintendent of the New York division in 1900. While in this position he was continually out on the line in his observation locomotive, and during the year beginning in 1902, when he was General Superintendent, he almost lived in the car. His work on the Reading showed his ability as a reorganizer in straightening out and building up the operating department. In 1903 he went to the Queen & Crescent Route as General Manager of the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern, where he remained until, last November, he was elected First Vice-President of the Seaboard Air Line.

Some Railroad Problems.*

In the early days of railroads the chief problem was that of construction and equipment; later, when more railroads had been built than there was traffic to feed, there came the traffic problem, and all the abuses which followed in its train. These, in turn, led to the legislative problem accompanied by the Interstate Commerce Law of 1887, and through the nineties all sorts of problems—including bankruptcy for many. Now, within the past few years has come the great problem of enlargement—the construction period again, but in a different shape. Not experimental, for we had learned how to build and how to equip; not the building so much into new country, but to take care of the traffic which was overflowing our rails.

Events of the past year have proved the absolute necessity for almost all the large railroads in this country to enlarge their trackage, their terminals, and their equipment; and yet, here again, when in considering where to obtain the necessary funds for such purpose—which must, of course, come from the public—the railroad managers find themselves confronted with great difficulties. This, of course, is largely due to the tremendous demands for capital, in the development that is going on in all parts of the world, but it is increased, at the moment, by the natural timidity of capital to invest its funds in railroad securities, in view of the violent attacks that are being made against corporations through Congress and the state legislatures.

This brings us, then, to our greatest and most perplexing problem—that of how to restore a state of reciprocal understanding and fairness between the carriers and the public. Many railroad officials believe that so deep-seated is the apparent hostility of the people that the management of the railroads will be taken practically out of the hands of their owners, and that great disasters are to follow. I do not share this view, principally for the reason that whatever may have been the faults in the past, the methods and practices of railroad management are now based upon a decent regard for their public responsibilities. Sooner or later the people will recognize this—as I believe they are already beginning to do. But by no means can we minimize the actual situation of to-day. It is, indeed, a time of great anxiety to all those entrusted with railroad management, and who have the interests of their country at heart as well.

With the old rebates and secret discriminations things of the past, with all kinds of business in a most prosperous condition, we all know that within the past three years, suddenly, out of an almost cloudless sky, there has burst forth upon the railroads of this country a torrent of the most bitter and violent attacks—by political orators upon the stump; in magazines and newspapers; in Congress and state legislatures. It is fair to say, I think, that this onslaught had its origin in the agitation of 1904 for changes in the Interstate Commerce law. It was based upon a misunderstanding of existing railroad conditions and the position of the railroad in regard to the points at issue, which I shall presently explain.

Following the agitation surrounding the passage of the rate bill has come a swarm of bills in Congress and state legislatures, which, if they become laws, and are enforced, will prove disastrous to the railroads, and, equally so, to the public at large. The question is, What is to be done to prevent it? The old method of influence has been abandoned, and, I hope, forever. Has it left us unequipped to meet the issue? To answer this question let us get a perspective.

We must not imagine, to begin with, that we are entirely blameless. We are in some respects only realizing the wages of past sins. We have done many of "those things which we ought not to have done," and we have left undone many of "those things which we ought to have done." Most of the evils date back many years and many of them might have been prevented had the government done its duty and enforced the law. Yet even in most recent years we can find some mistakes with which to concern ourselves. It is not strange that many men who have suffered loss through delays in their traffic, or in their personal transportation, or who saw themselves deprived of profitable business because they could not secure cars, should have become exasperated and, not having time to properly analyze the difficulty, thought that the railroads were lacking in foresight and management.

But let us go back a few years. It is a great mistake to hold the railroads responsible for such practices as rebating in those days, when it would have been impossible to throw a stone in a commercial community without hitting somebody who was taking rebates and wanting more. Many men are to-day running for office on anti-railroad platforms who if you were to say "Rebates" would duck their heads very much as David Harum said his Newport friends would do if he called out "Low bridge!" That rebates

*From an address of Vice-President Thayer of the Pennsylvania before the Traffic Club of New York, Feb. 16.

were wrong nobody questions, but to pillory a man to-day for accepting rebates at that time is a farce.

Many persons believe that the so-called discriminations, resulting in the secret arrangements, were largely influenced by the desire upon the part of railroad officials to favor one man against another, but no thoughtful man who has at all studied the problem believes this. Rebates and other forms of discrimination—whatever may have been the result in specific instances—had their origin mainly in the competition between carriers for the traffic. Incidentally, in transacting railroad business through secret arrangements, as became the custom in that period, there were many cases of discrimination in favor of the strong and against the weak.

There was a strong feeling upon the part of many men, both in and out of railroad service, that the larger shipper, under the ordinary rules of business, was entitled to a lower rate, and they could not conceive the real principle which should govern the making of railroad rates—which, however, has come clearly to be realized since that time. The railroad systems, generally, were not more anxious to pay rebates than they were to pay higher prices for their supplies, and simply pursued the course of their competitors because, otherwise, they saw nothing but loss and probable bankruptcy staring them in the face. The railroads were forbidden by law to meet and make formal agreements for the maintenance of rates, and by another law were required to compete. We all thought that the old plan *was* competition.

Had the government, through its Interstate Commerce Commission, vigorously undertaken to enforce the law—passing if necessary, long before it did, the Elkins Act—I think we should have seen a correction of these abuses long before the reform came; but, as a matter of fact, neither the government authorities nor many of those managing the railroads had yet reached a clear conception of the significance of the abuses which existed and of the proper legal method of uprooting those evils.

Upon the resumption of business activity, in 1898 and 1899, and, later, following the passage of the Elkins Act, the opportunity was presented—and in general accepted by the railroads—to get away from the old methods. While since then there have been some cases of violation of the law, in the matter of secret arrangements, yet I think that, at least within the last four or five years, it is safe to say that they have been of small importance, and perhaps in many of the cases—while a technical violation of the law—were actually not discriminations. I say this advisedly, so far as the eastern situation is concerned, because I know that the Pennsylvania Railroad Company has not paid a rebate for years, and it is fair to believe that as that company held its traffic—in fact, largely increased it—without the necessity for such arrangements, its competitors must have to a large extent pursued the same policy.

But not alone in reference to freight rates was there more or less complicity in evil between the people and the railroads, but let me ask you to consider, for a moment, the question of free transportation, or passes—whether political or business. It is only within the last year or two that the public conscience has been awakened on this subject. It is true, the railroads have been abused for several years by those who did not enjoy such favors, but is the railroad more responsible for the conditions that existed than the government of the people, either in the National Congress or in the state legislatures, and how could it be expected that the legislators in one state could feel that they were doing very wrong in accepting passes, when the legislators of another state enjoyed them by law of the state? How could members of Congress be criticized for accepting such privileges, or the railroads for extending them, when the Presidents of the United States and members of their cabinets, and other important officers of the government, not only accepted them, but practically exacted them, and, further, expected that private cars and private trains should be furnished without charge. Upon one occasion within the past two years I called upon the Interstate Commerce Commission to ask its assistance in eliminating the pass abuse, and was very frankly told that it could make no move, nor take any interest in the subject, in view of the fact that important public officials, including Senators and the members of Congress, felt that it was not improper for them to accept them. Out of this situation grew a large part of the pass abuse, because, following the national government and the legislatures, the large men of business felt that they could properly accept similar privileges.

The danger does not lie in the provisions of the new national law. There is no substantial difference between its provisions and those of the old law, except in respect to the powers of the Commission. There was no necessity for the new law, so far as the prevention of the old abuse of secret rates and discrimination was concerned. The operation of this law does not involve any material change in traffic operations of the railroads; the only danger is as to how the Commission may exercise its power in influencing reductions in rates, but even in that respect the railroads have the right of appeal to the courts. It is from various other bills being presented in Congress in which the immediate danger lies, showing possible interference by the national government with the operation of railroads, with respect to the hours of labor of its employees, systems of signals, and other methods of operation, which should properly be left to the railroads themselves. This threatened interference of the federal government is having a powerful and dangerous influence upon the legislatures of the various states, who apparently are—in a slang term—"Seeing Congress and going them five or six better"—in the bills for reduction of state rates, both passenger and freight; for increase in taxation, and all sorts of measures which tend to reduce the earnings and increase the expenses, and hamper and delay the actual development necessary.

It was unfortunate that in the agitation and discussion following the President's recommendations, until the present law was finally adopted, there was a total misunderstanding upon the part of the public at large as to this attitude of the railroads. It was most unfortunate in that campaign that the principal point of contest upon the part of the railroads was lost sight of—and that is—the objection upon their part not to reasonable amendments to the law, and not—if the people wanted it—to some increase of power to the Commission, but to the attempt to make a commission of five or seven men—in many respects a political body—the final arbiters as to the rates and fares of the railroads.

Yet even with the new law on the statute books, our traffic problems are still with us. We are forbidden by law to make formal agreements as to rates, yet it is universally recognized that in order to secure an equitable adjustment of rates, it is absolutely necessary that the traffic managers of the railroads shall confer frequently. It is well known that such conferences are held and must be held to prevent discriminations, yet no definite agreements can be made.

The present law stipulates that there shall be no discrimination by railroads against persons or communities. Right here, however, the railroads are face to face with a problem all their own, which is a very serious one, and that is: How shall a particular railroad prevent discrimination against a community on its own line by some other railroad seeking to specially favor a community on its line? Is it not absolutely essential that there should be both an understanding and a virtual agreement on the part of the two railroads concerned for the purpose of protecting both communities?

Cases of dispute between railroads as to proper rate adjustments have, indeed, been referred to Interstate Commerce Commissioners as arbitrators and their findings have been observed. This shows how absolutely vital to all business is the necessity for that co-operation which can only be secured by agreement and conference between all interested parties. The President of the United States recognized the necessity for this fact in his last annual message and recommended that some legislation be passed which would permit agreements between railroads as to rates.

We are thus in the presence of this ridiculous situation; that on the one hand we are being threatened with prosecution by the government for violation of the Sherman Act in respect to methods which on the other hand the President of the United States and the Interstate Commerce Commissioners agree must be followed in order to properly discharge our responsibility to the public.

So much for the moment, for our national problem. As to state regulation: while not believing—now that we have a national law—that it is necessary or desirable for the public to establish state commissions and special railroad laws, at the same time, if the people desire such commissions, we have no right to look upon such a demand as "anarchistic," but we feel that the working of such commissions will be unsatisfactory to the business interests.

To avoid these dangers a regime of confidence and fairness on the part of the public toward the railroads must be restored, and to accomplish this we must place our case, as it were, before the legislators and the people and make clear our difficulties and the complications which beset us. Few, after all, understand the railroad problem, and we have not made it plain to the people, either because it was the fashion not to do so, or because we could not realize that things simple to us were not understood by the public. We must not stop at one statement, but discourse upon and elucidate every subject which the public misunderstands.

Let us be frank and take the public into our confidence as fully as is consistent with the proper conduct of our business. Let us approach the subject with the feeling that the railroads are not absolutely perfect, that we have to some extent brought this condition of affairs upon ourselves, and that we should govern ourselves in the future accordingly. Let us undertake to go frankly before the people and present the actual facts in connection with our affairs.

Let me illustrate: The Pennsylvania Legislature is in session. Numerous bills have been presented, of a most radical nature. It is our purpose to appear before every committee that will hear us, and tell our side of the story. I doubt very much if the average legislator—and certainly not the average citizen—understands whom he is injuring in unjust acts towards the railroads. Take our company, for example: It is not a small group of rich capitalists; it is not Mr. McCrea and myself and a few others; the Pennsylvania Railroad is owned by more than 40,000 people, 30 per cent. of whom live in Pennsylvania. Forty-seven per cent. of our shareholders are

women; and in many cases the dividend is their only source of income. Then there are thousands of bondholders; beyond them are nearly 100,000 employees in the state of Pennsylvania dependent upon the prosperity of the Pennsylvania Railroad for their livelihood.

Therefore, by the usual computation, it is safe to say that approximately half a million people—men, women and children—are actually dependent upon the welfare of this company in the state of Pennsylvania alone.

Upon the Pennsylvania Railroad's prosperity depends the prosperity of the other lines in its system, and including the employees of these lines there are 200,000 men, who, with their families, constitute an army of a million or more. Behind them, again, are the thousands of men, with their families, who produce the coal and other materials which the railroads use. Anything that cripples the railroads injures every one of these people.

When we make these and other facts plain, I cannot but feel that no injustice will be done. In the meantime, let us keep our minds well balanced, and not allow ourselves to believe that chaos is coming; let us meet the issue fairly and squarely and frankly While, therefore, necessary for the present, at least, to suspend many improvements, let us keep our courage, trusting to the ultimate good sense of the lawmakers and the people for that sympathy and support to which we feel that we are entitled.

Cars for the Electric Lines of the Erie.

One of the cars to be used by the Erie on the electrified section of the Rochester division from Rochester to Mt. Morris is shown in the accompanying illustration. Four cars of this type were built by the St. Louis Car Co., which also built one combination passenger



Electric Motor Car for the Electrified Line of the Erie Between Rochester and Mt. Morris.

and baggage car. They are 54 ft. long and seat 56 persons. The electrical equipment consists of four 100-h.p. Westinghouse a.c. motors, which will propel the cars at a maximum speed of between 45 and 50 miles an hour. In order to provide for trail car operation the cars are equipped with Westinghouse electro-pneumatic multiple unit control and air-brakes. They have M. C. B. passenger type couplers and buffers. A form of pantagraph trolley will be used.

Close of Congress.

The 59th Congress adjourned on Monday, March 4. The bill limiting hours of labor, amended so as to include despatchers and telegraph operators, was passed by a vote which was substantially unanimous. It will be found in this issue. The reporters say that members of Congress received in one day thousands of telegrams from telegraph operators asking that the bill be passed.

The bill giving the Government additional rights of appeal in criminal prosecutions was passed last week.

In the "sundry civil" appropriation bill as passed there is a clause appropriating $50,000 "to enable the Interstate Commerce Commission to investigate in regard to the use and necessity for block signal systems and appliances for the automatic control of railway trains, including experimental tests, at the discretion of the Commission, of such of said signal systems and appliances only, as may be furnished in connection with such investigation free of cost to the Government, in accordance with the provisions of the joint resolution approved June 30, 1906." The resolution of June 30 is that under which the Commission made the investigation reported in the *Railroad Gazette* last week. The present appropriation was asked for with special reference to the question of testing automatic stops.

Passenger Rate Regulation and the Canadian Parliament.

BY S. J. McLEAN.

The current agitation in the United States in favor of statutory reduction of passenger rates has to some extent found its counterpart in Canada. While there has for some time been sporadic interest in the establishing of a two cent maximum passenger rate, it is only within the last four years that the question has been actively discussed in the Canadian Parliament. The revision of rates in Manitoba, consequent upon the agreement of that province with the Canadian Northern, has led to complaints in the adjoining Province of Saskatchewan that the passenger rates are too high. Recently the matter has been discussed in Parliament in connection with the railroad from Regina to Prince Albert, which was acquired recently by the Canadian Northern.

So far as there is more general discussion of the advisability of direct legislative regulation of passenger rates it is attributable to the persistent advocacy of one man, Mr. W. F. Maclean, who represents one of the Ontario constituencies in the Dominion Parliament. While his campaign, in which he has been materially aided by the newspaper which he conducts, has been energetic, it at the same time shows lack of adequate attention to some of the important matters involved. The latter fact is illustrated in the proposition he made in Parliament at the end of 1906 to permit ticket scalping. He claimed that a railroad ticket should be like a bank note and readily transferable from hand to hand. That it ought to be good at any time and be able to be used by anybody in addition to the original purchaser. In proposing this legislation the mover stated that in the United States no such general restrictive regulation on this subject could be found as existed in Canada. This statement, however, neglected the admitted evils of the situation in the United States. The anti-scalping legislation of Canada was passed in 1882. The main object of the legislation was to prevent frauds on unsuspecting travelers. While the frauds connected with scalping had not gone to the length they have since gone in the United States, they were none the less sufficiently prominent to demand legislative regulation. The legislation existing in Canada so safeguards the situation that excursion rates may be made without the rigid restrictions which the existence of scalping necessitates in the United States. Under an arrangement in force since the beginning of the present year the holder of an unused ticket may present it at the ticket office where it was sold and receive a refund at once. If a ticket has been partially used, then the unused portion will be promptly redeemed on its transmission to the general office through any ticket agent of the railroad. All claims for refunds must be made in 30 days from the date of issue of the ticket. The law provides that when such a refund is made there is to be repaid the cost of the ticket, less the ordinary and regular fare for the distance for which the ticket has been used. Suppose a round trip ticket has been obtained for $18, where the single fare is $10. Then if the ticket is used only one way there would be a refund of $8, and the traveler would have his one-way trip at the same rate as a person buying a one-way ticket. If there is an

excursion rate of $8, for the same round-trip journey, then the traveler who has used the ticket for a one-way trip only would not receive any refund on the unused portion, since he has already received a one-way trip for less than the regular one-trip fare. The existing regulations have worked well. There have been few attempted violations of the regulations; and these have been summarily punished. It cannot be said that any real grievance exists.

The movement for the reduction of the statutory maximum from 3 cents, which is the maximum in the older settled sections, to 2 cents has obtained prominence in connection with the chartering of the Grand Trunk Pacific. The original charter of the Grand Trunk, passed in 1852, contained a provision for third class cars at a rate of 1 penny per mile. Some such cars were operated as late as 1857; since that date there have not been any in operation. In 1860 a Toronto lawyer applied, to make a test case, for a third class ticket for a passenger. He was unable to obtain it, and the legal representative of the railroad stated that the third class cars were simply like cattle cars. The Attorney-General, when applied to to take action in the matter, refused on the ground that the alleged grievance was of minor importance. In the discussion in Parliament, in connection with the granting of the Grand Trunk Pacific charter in 1903, it was urged that there should be a statutory 2 cent rate; and attention was attracted to the apparent disregard by the Grand Trunk of the provision in its charter. In October, 1906, another test case was instituted against the Grand Trunk to compel the sale of a third class ticket at a 2 cent rate. In the proceedings before the police magistrate in Toronto it was found, in December, 1906, that such a rate was provided for in the charter; and that, in not granting this accommodation at a 2 cent rate, the railroad was in technical violation of its charter. The matter will probably go to the higher courts.

So far as the original provision of the charter is concerned there can be no real dispute as to the fact. There has, however, been no real grievance. The public has acquiesced in the condition. The provision of the statute resembles various statutes on the British statute book which though unrepealed have come to an end by non-use. The situation in Canada is complicated by the passage of the Railway Commission legislation which placed both passenger and freight rates under the jurisdiction of the commission. To clear up the situation the Grand Trunk has applied to Parliament for legislation to rescind the section of its charter providing for third class accommodation at a 2 cent rate.

On February 25, 1907, Mr. Maclean's bill providing for a general maximum 2 cent rate was given the six months hoist, the bill being thereby killed. The mover of the measure claimed that such legislation had been successful in the United States. He argued that the question involved a matter of general policy on which a general rule should be laid down by Parliament. The government was opposed to this position. The Minister of Railways, Mr. Emmerson, stated that the complaint that there had been passenger discriminations must be settled not on the basis of general accusation but of adequate statistics. It would at the same time be unwise to impose a uniform rate regardless of difference in local traffic conditions. The Prime Minister, Sir Wilfrid Laurier, in upholding the same contention, said that while a 2 cent rate could be justified in Michigan by density of population identical conditions did not exist in Canada.

The general question of passenger rate revision has been referred to the Railway Commission for such action as it deems expedient, it being understood that there will be an adequate preliminary investigation. There was some suggestion that the commission be asked to take immediate action. The chairman of the commission urged, however, that such a recommendation be not made. In favor of delay he urged the congestion of business before the commission. The duties of the commission have indeed been subject to continuous expansion. It is now apparent that to cope with its increased responsibilities there should be increase of staff and rearrangement of personnel. To its original extensive jurisdiction over railroad matters there have been added supervision of express and telephone charges; and it is suggested that Pullman charges should be included in the expanding list. Like the English commission, the Canadian body is gradually becoming a general industrial court. It is apparent that an administrative body, such as the commission, is better fitted to deal with rate questions than a cumbrous body such as Parliament, which cannot adequately deal with matters requiring the consideration of complicated detail; and which at the same time, like any legislative body, is liable to be stampeded. It must at the same time be recognized that a considerable part of the increase in the commission's jurisdiction is attributable to the ease of referring troublesome questions to a standing organization.

In any attempt to deal with passenger rates in Canada there must be considered the conditions of the localities affected. In the early days of the St. Lawrence & Atlantic Railroad, now part of the Grand Trunk system, it was on one occasion calmly announced that the road would be closed for three weeks to permit the locomotives to be put in shape for the summer traffic. Such conditions have long since passed away. During the winter season in Canada passenger traffic is light while expenses are heavy. In February, 1905, it cost the Grand Trunk $1.25 to earn $1 from its passenger trains; while in February, 1906, when the climatic conditions were much more favorable, the figures were $1.04 for every $1 earned. In the winter of 1903-4 it cost the Grand Trunk $379,000 to remove snow on its Canadian lines, while at the same time there was a falling off in traffic. Of this expense a proportion was legitimately chargeable against passenger business. The snow blockades during the present winter in the Canadian Northwest, while unusual for that section, have entailed great expense and loss on the Canadian Pacific and the Great Northern. Other costs have also been increasing. During 1905 the Canadian Pacific and the Grand Trunk paid $1,050,000 in duty on coal imported from the United States. This is an item of cost to which the American railroads in the 2 cent belt are not subjected. The increasing burden of taxation on railroads, especially in Ontario, must be recognized; and this aside from any question whether the roads have made an adequate contribution to provincial revenues in the past.

In such a question the comparative density of traffic and population is a very important factor. In 1905 the Massachusetts lines earned from passenger traffic $7,357 per mile of track, while the average in Canada was one-fifth of this. In the same year the New York, New Haven & Hartford Railroad operated on the average 7,481 passenger-train miles per mile of single track against 1,341 on the Canadian lines. At the same time the former earned $1.59 per passenger-train mile, or 40 cents more per passenger-train mile than the Canadian lines. Massachusetts carries 25,037 passengers per mile of track against 1,231 on the Canadian lines. Ontario, the most densely settled section of Canada, has an average population of 10 persons per square mile of area, while Massachusetts has 350. From the standpoint of density of population it should be noted that the states of Pennsylvania, New York and Massachusetts, in which 2 cent rates are to be found, have a population of 16.3 millions, while Canada's total population is not more than one-third of this. The following table presents some data in a comparative form:

	Ohio.	Michigan.	Canada.
Population to square mile of area	102	43	1.4
Passenger train miles per mile of road	3,043	1,633	1,340
Earnings of passenger trains.*	$3,071	$1,724	$1,666
Government pay for mail service:			
Per train mile	10c.	9.2c.	(a) 6c.
Per mile of road	$547	$156	(a) $112 (b) $70

(a) Grand Trunk in Canada; (b) Canadian Pacific in Canada.
*From passengers, mails and express, per mile of road.

The average rate on the Canadian railroads is well within the normal 3 cent maximum. For the year ending June 30, 1906, the average passenger rate on the Canadian Pacific was 1.8 cents. On Canadian roads generally, only about one-fifth of the passengers travel on one-way tickets; the remainder of the travel makes up more than 17 classes of passengers who buy tickets at reduced rates, e.g., return tickets, commercial travelers, excursion tickets, convention rates, etc. The average rate on the Canadian Pacific has been reduced from 2.45 cents in 1885 to 1.80 cents in 1906, or a reduction of 26.5 per cent. in 11 years.

Arguments from the rate arrangements existing in densely settled sections of the United States are not pertinent to the conditions existing in Canada. It is apparent that an indiscriminating application of a 2 cent maximum would, by neglecting local differences, in many cases entail losses on the Canadian railroads. The problem of passenger rates can no more be settled in Canada than in other countries by inflexible rules. At the same time if real grievances appear, the existing regulative machinery is amply adequate to deal with them.

Foreign Railroad Notes.

In spite of the inability of the Italian State Railroads to carry the traffic offered, their gross earnings were 7 per cent. more in the last half of 1906 than in the corresponding half of 1905. In no country in the world, doubtless, have the railroads failed so much in doing their work as in Italy during this period; and in every important country of Continental Europe they have been inadequate to the traffic offered, mainly because the traffic increased beyond all expectations.

To fill a vacancy in the presidency of the Krugsberg directory of the Prussian State Railroad the appointment is announced of an official whose career has been in mechanical engineering, and it is remarked that this is the first instance of the promotion to that position of an official in that branch of the service. By far the larger number of the presidencies are (or were till very recently) occupied by men who had a juristic training, though they entered the railroad administrative service young. But the technical officers seem to find more favor now than formerly. At the same time with the appointment of this mechanical engineer, that of a civil engineer to another presidency was announced.

GENERAL NEWS SECTION

NOTES.

The West Jersey & Seashore has taken off a number of trains between Camden and Atlantic City, both steam and electric, and has laid off 50 trainmen.

The State Railroad Commission of South Dakota has issued an order to the railroads of the state to reduce rates on the first, second, third and fourth classes of freight 10 per cent., beginning March 15.

The Governor of Nebraska has allowed the 2-cent fare bill to become a law without his signature. He declares that the legislature must take the responsibility. The Burlington road has announced that it will not contest this law in the courts.

In the legislature of Arkansas a bill has been introduced to punish, as a misdemeanor, the offering, demanding or accepting of any valuable consideration for furnishing or setting freight cars. The bill is designed to stop the bribing of yard foremen and conductors.

A man in Texas swindled the Gulf, Colorado & Santa Fe Railway out of $75,000 by getting a bill of lading for cotton without delivering the goods, and the Grand Jury of Bell County has refused to indict him because the people of the county are so largely "agin' the railroads."

The Baltimore & Ohio announces an increase of five cents a ton, beginning May 1, on bituminous coal bound for eastern tidewater points, except points in New England. It is expected that the other roads carrying soft coal to the Atlantic seaboard will make the same advance.

The Monongahela River Consolidated Coal and Coke Company, of Pittsburg, on February 25 took contracts aggregating 1,000,000 tons. The largest was with the Southern Pacific, which will take 250,000 tons at its wharves at New Orleans.

The bill proposed by Governor Hughes to reorganize the New York State Railroad Commission and to consolidate the railroad and the gas commissions, was introduced in the legislature on Wednesday. It embraces an elaborate railroad law, modeled somewhat after the Interstate Commerce law, and fills 128 printed pages.

In the year 1906 the Pennsylvania Railroad paid pensions to retired employees amounting to $467,614, and the company has appropriated for pensions hereafter $600,000 a year, which is twice the sum allotted when the pensions were begun in 1900. There are now 1,940 men on the pension rolls of the company. Two hundred have died within the past year. Since 1900 the pension department has distributed about $2,500,000, and the number of men retired up to the present time is 3,031.

At Broad Street Station, Philadelphia, the Pennsylvania is now using four baggage trucks which are fitted with electric motors. The trucks are described as looking like the common four-wheel hand truck. The man in charge grasps the tongue, and appears at first glance as if he were drawing it; but he is only steering. He controls the power by a button in the handle of the tongue. At Jersey City there is an electric truck which is as large as a two-horse wagon. On this the attendant rides.

According to a press despatch from Toledo the Canton and Massilon bridge companies have been fined $1,500 each in the Allen County Court for conspiracy in restraint of trade. The fines were assessed under a compromise agreement between the companies and the prosecutor. The officers of these companies had been indicted as individuals, and these indictments will not be prosecuted. Eight other bridge companies are said to have been indicted in the same way as those named, and it appears that they are in a similar situation. These eight are Huston & Cleveland, Owego-Oregonia, Bellefontaine, West Virginia, Mt. Vernon, Champion Bridge, the West Virginia Bridge & Iron and Brackett Bridge & Iron, Cincinnati, now in the bankruptcy court.

The Interstate Commerce Commission in an opinion by Commissioner Prouty has announced its decision in the case of The Cattle Raisers' Association of Texas against the Galveston, Harrisburg & San Antonio, and others, in favor of the complainant. On complaint of failure by defendants to establish a through route and joint rate on beef cattle from points on the International & Great Northern to New Orleans, it appeared that a former through rate of 45 cents per 100 lbs., except from Laredo, from which it was 47 cents, was discontinued by defendants other than the International & Great Northern on October 14, 1906, because of dissatisfaction with the rate divisions; that there is no other practicable route to New Orleans, and that much inconvenience and loss have resulted to shippers from discontinuance of the route. The Commission rules that the public interest requires establishment and maintenance of the through route and joint through rates, and that the route and former joint rates should be established. No opinion upon the reasonableness of such rates is expressed, and this decision is without prejudice to determination of the question of reasonableness which may be involved in another proceeding now pending.

The Supreme Court of Indiana has decided that the employers' liability act of that state is unconstitutional as applied to all corporations except railroads, and has reversed the case of The Bedford Quarries versus Bough. The ground for regarding the act as unconstitutional with regard to private corporations is that it discriminates as between employers (between corporations and natural persons) engaged in the same business. With regard to railroads the act is upheld because of the peculiar character of their business, and the extraordinary dangers incident to railroading, and because the law makes it practically impossible for an individual to operate a railroad by reason of lacking the powers of eminent domain and other privileges conferred on railroad companies.

The Right Kind of Conciliation.

Comptroller A. H. Plant, of the Southern Railway Company, announces one of the most sensible improvements in railroad management that has come to our notice for many days—the appointment of traveling freight claim agents who are to actually come in contact with the claimants. Mr. Plant says:

The duty of the Traveling Freight Claim Agents will be to travel continuously in the respective territories assigned to them, visiting at each station not only the local agent, but the company's patrons with the following objects in view:

(1) To secure the prompt handling and settlement of all fair and honest loss, damage and overcharge freight claims against the company.

(2) To give assurance of this to the patrons of the company by prompt, courteous and efficient attention to their rights.

(3) To prevent accumulations of freight claims and over and refused freights at stations and to reconcile as far and as promptly as possible all over freights with shortages.

(4) To educate local agents to the highest degree of efficiency in treating with patrons in respect to their transactions with them both in respect to the handling of freights at their stations and the prompt payment or declination of freight claims.

Plain Talk from G. L. Peck.

Recent wrecks on Indiana railroads have been under investigation by the State Railroad Commission, and at a private session of the commission General Manager G. L. Peck of the Pennsylvania Lines West made the following statement:

In railroading, the greatest safeguard is in careful administration all the way from the top down, rather than in particular rules or legislation. The price of safety on a railroad is eternal vigilance, and that is what you must depend upon in the final analysis. No matter how many laws you make, unless we have efficient officers, efficient men and efficient organization, which it would be very difficult to prescribe by law, we are going to continue to have accidents.

If I could be furnished with all the money that I want to put the railroads in my charge in the safest possible condition I feel that I could make them very much safer than they are to-day. But there is a limit as to what I can do under existing conditions.

I would like at once to install the most approved forms of signals on the main lines where the passenger traffic is the heaviest. But if I should attempt to do that this year I would not have any money for interest. If I should attempt to borrow the money to do this most important duty to the public and our patrons my executive officers would say to me that their credit had already been extended to such an extent in their endeavor to meet the various demands of the public, the shippers, the traveling public, the stockholders and the employees that they did not feel that they could go further. That is the exact situation to-day on the road I represent.

Supposing that I had the money, I would have the block system everywhere; I would build, in addition, a great many miles of double track, so that where the traffic was the heaviest I would avoid such accidents as that at Woodville. The first duty of the railroads, the first duty of the legislature, the first duty of the people, is to see that their railroads are safely operated. But what causes me grave alarm is the fact, taking my own particular case and desiring as I do to meet the situation, that I am unable to do it because of the fact that we cannot borrow money for the im-

provement or raise the rates to furnish the revenue for expenditure in that field.

Now, as to new criminal laws punishing railroad men for wrecks: I should not fear so much if the commission had the power when a wreck occurred on my railroad to call me here and punish me. But I would fear a law providing that if a wreck happened I should go to jail. There is this distinction: You would be given some latitude to investigate all the facts and would not be bound down to inflexible statutes.

I should not like to be understood as advocating a law of this kind, for the reason that I should fear that it might not always be possible to place the responsibility exactly where it belongs. It is difficult for railroad officials to do it. I think you ought to punish employees for violating the rules, but in the case of an officer it would be very difficult to put your hand on the right one, and in many instances it would be very hard even for a court, unless it were a court composed of railroad officials and employees, to make an equitable decision as to whether the man was guilty or not.

Now as to the age and working hours of employees. I was a telegraph operator when I was 16 and a train despatcher when I was 18, and I feel that I was a better train despatcher when I was 18 than when I was 28. I was, as a matter of fact, a better one. I didn't have the timidity that I got with the increase of responsibility. Generally, except at very busy places, telegraphers work twelve hours. To a hod carrier that sounds very long. It wouldn't have sounded long to me. I used to work eighteen hours as a train despatcher, but I didn't have the benefit of modern ideas on these matters. I would not say that I approve of long hours, but it is not always easy to arrange for short hours. The men know that.

If you should attempt to put the whole business on eight hours a day you would stop all the railroads. You couldn't get operators enough to do the work. It is just so with trainmen; you could not run your trains on eight hours; you could not handle the business and you could not get the men.

It ought to be possible for any operator to keep awake. I have done it myself for fifteen years, day and night. In my case I would go home, eat breakfast, lie down until lunch, and then go to the ball game when I ought to have been in bed. That is the trouble in many of these cases of going to sleep. It isn't because the man hasn't the opportunity to go to sleep; it is because he has not availed himself of it. Legislation cannot prevent that.—*Indianapolis Star.*

The "Railroad Club."

A number of prominent railroad and financial men of New York City are forming a social club, under this name, and it is said that they have engaged the two top floors of the Cortlandt street building, which is being put up at Cortlandt and Church streets by the Hudson & Manhattan Railroad—the Cortlandt street tunnel. The building will not be finished for a year or more. Among the men named as charter members are Cornelius Vanderbilt, Howard Gould, H. H. Vreeland, E. P. Bryan, W. H. Marshall, Ralph Peters, F. D. Underwood and others of equal prominence.

Technical Publicity Association.

The Technical Publicity Association held its "Railroad Night" at the rooms of the Aldine Association, New York City, on February 28. G. M. Basford, Assistant to the President of the American Locomotive Company, read a paper on "The Progress in Transportation." The following companies were represented by members at the dinner: A. Allan & Son, the T. R. Almond Manufacturing Co., the American Locomotive Co., the American Wood Working Machinery Co., the A. S. Cameron Steam Pump Works, the Crocker-Wheeler Co., the General Electric Co., Hammacher, Schlemmer & Co., the Ingersoll-Rand Co., the H. W. Johns-Manville Co., the Lidgerwood Manufacturing Co., the New York Edison Co., the New York Telephone Co., the Niles-Bement-Pond Co., the Sprague Electric Co., and the Yale & Towne Manufacturing Co.

The Congo Railroad.

The Congo Railroad earned net about 18 per cent. on its capital stock in its fiscal year ending with June last. Nearly 90 per cent. of its earnings were from freight, and the working expenses were but 28 per cent. of the gross earnings. It must be remembered that its comparatively short railroad is the sole outlet for some thousands of miles of navigable rivers.

New Chinese Railroad Opened.

The Chaochowfu & Swatow, which is the first railroad in China built with Chinese capital, was recently opened for traffic. It runs from Swatow, a treaty port in the province of Kwangtung at the mouth of the Han river, north 30 miles up the river to Chaochowfu. The grades are low and the curves few. Japanese hardwood sawed ties and American rails, angle bars and spikes were used. The road has three 54-ton American-built locomotives, 22 passenger coaches and some small freight cars. The first-class coaches are corridor cars, seating 50 passengers, and were built in Japan. A standard train is made up of 14 coaches and a guards' van, the latter and the locomotive being fitted with brakes. The one-way first class fare is 67 cents gold, and second class 27 cents. The distance of 30 miles is covered in about 1½ hours. The enginemen, conductors and the train despatcher are Japanese; the train auditors and all other employees are Chinese. Train orders are given by telephone.—*Consular Report.*

Speed Limits on New York Central.

The New York Central has issued an order that hereafter trains within the electric zone must not be run over 45 miles an hour on straight track, and not over 35 miles an hour on curves.

London & North-Western.

Gross earnings of the London & North-Western for the year ended December 31, 1906, were $72,581,521 (£1 = $4.85); operating expenses, including taxes, were $46,661,821, leaving net earnings of $25,919,700. Other income amounted to $2,161,965, and the net income was $21,465,819, of which $21,199,287 was paid in dividends, leaving a surplus for the year of $266,532, of which $145,500 was deducted and credited to the general reserve account. The surplus in 1905 was $455,289, so that the surplus on hand December 31, 1906, was $576,321. There were 85,990,919 passengers carried during 1906, and the passenger train mileage was 29,296,499; there were 51,582,307 tons of freight carried, and the freight train mileage was 19,195,784.

Prussian Hours of Labor.

The Prussian regulations prescribe that a railroad man may not be employed in night service more than seven nights successively. It being questioned whether seven was not too great a number, inquiries were made of all the separate managements, whose medical advisers were generally of the opinion that frequent changes from day to night service are bad, as it takes some time for the system to adjust itself to new habits. The action taken is to require an interval of 30 to 36 hours between a week of day and a week of night service, this, when possible, to be between Saturday and Monday.

For the Comfort of Trainmen.

Rest and bunk houses on the Pennsylvania Railroad east of Pittsburg now number about fifty. Beds, lockers, baths, reading rooms and games are the usual equipment of these terminal and freight yard resting points, but some of them have mechanical and air-brake equipment for instruction of the men. Following are notes concerning some of these houses:

The Filbert street rest house in Philadelphia is the largest. It has eighty beds, 1,000 lockers, baths, and a library of 1,200 volumes; the reading room is used daily by more than 1,000 men. The building and its furnishings cost $38,655 and the monthly cost of maintenance is $750. In Philadelphia there are also buildings at West Philadelphia, at Round House No. 2 at Forty-sixth street; at Greenwich and at Gray's Ferry.

On the New York division there are at Jersey City, Harsimus Cove, Greenville Yards, Waldo avenue, Meadows, Coalport, Trenton, West Morrisville and Chestnut Hill. At Jersey City there are five separate rooms with accommodations for 58 men, tub and shower baths, electric fans, steam heat, hot and cold water.

On the P., B. & W. there are houses at Lamokin, Thurlow, Wilmington, Newark Center, Perryville, Bayview and Cox. At Washington there are seven bunk rooms and shelters, some of them having reading rooms. Other rest rooms are at Delmar (reading room), Harrington, Oxford, Lewes, Franklin City, Centreville, Wawa, West Chester, Oxford and Perryville.

On the Philadelphia and Erie and the Northern Central there are ten houses. At Kane, Pa., the rest house was recently destroyed by fire. To take its place there is now under construction a two-story building, with reading, smoking, locker and toilet rooms on the first floor, and four bedrooms, baths and toilets on the second floor. The contract price of the building is $6,539, and the estimated cost of maintenance $44 per month, exclusive of lighting. Other houses or rooms are located at Renovo, Calvert Station, Cockeyville, Harrisburg, Columbia, Marysville and at Canandaigua and Williamsport on the Elmira and Canandaigua Division.

At Buffalo the trainmen share with men of other roads the conveniences of the Y. M. C. A. At East Aurora, Olean and Emporia on this division trainmen use rented furnished rooms in houses near the station. Also at Corry, Brockton and Oil City. The bunk houses of the Rochester Branch are located at Rochester and Nunda. Sleeping rooms are provided on the Alleghany Division at Oil City, Phillipston, Braeburn, and, on the Low Grade Branch at Driftwood. Other houses are at Pottsville, Phoenixville, Paoli, Harrisburg, Enola, Altoona, East Altoona and Hollidaysburg.

The mechanical instruction room at East Altoona contains air-brakes, injectors, etc. The monthly cost of maintenance is $150.

Besides the Twenty-eighth street Y. M. C. A. and the passenger trainmen's barracks in Pittsburg, the trainmen of the Pittsburg Division use rooms at Pitcairn, Youngwood and Conemaugh.

A Public Technical School at Altoona.

The industrial department of the Altoona High School has received as a gift from the Pennsylvania railroad an elaborate equipment that places it in this respect on a par with the foremost technical schools in the United States. There is to be a four-year course and the railroad expects to secure from the school candidates for its shops who will enter them on a footing between that of the regular and the special apprentices. The city of Altoona secures a splendidly equipped industrial school and the total investment in the new high school will be $350,000.

A. E. Karlson is director of the Department of Industrial Arts. The four-year programme is similar to that in other schools of the kind.

The equipment includes 25 utility adjustable drawing tables, 36 x 48, five combination 37 x 50 drawing tables, electric blue printing machine, 20 single benches 5 ft. by 24 in., fitted with standard tail vises and cabinet makers' vises, one wood trimmer, three mitre machines, twelve sets and many special carving tools, a 24-in. surface planer, Universal saw bench, scroll saw, hand planer and joiner, 18-in. swing, 10-ft. pattern makers' lathe and star brazing lamp and forge. Eighteen 12-in. swing speed lathes to turn 24 in. between centers; eight double benches with special vises, wood trimmer with all attachments, motor-driven grindstones; a 32 x 36 in. natural draft brass furnace; a patent core oven and complete equipment for both bench and floor moulding. In the forge shop: 24 down-draft forges, a power hammer and completely equipped anvils and benches. In the machine shop: Head engine lathe, 16 in. by 8-ft. bed; two 6-ft. lathes, an engine lathe, a speed lathe, universal milling machine, spur-geared planer, crank shaper and upright drill press, wet tool grinder, benches with special ironworkers' vises and a complete outfit of tools. The shops have been laid out by Pennsylvania engineers in conjunction with Director Karlson. There is no belting or shafting in any of the shops. In most cases the motors are directly connected or are built as a part of the machine; there are in all thirty-nine motors, ranging from ¾ to 15 horsepower.

Bonus for Railroad Extensions in Denmark.

The Danish Minister of Transportation has laid before Parliament a plan for a considerable extension of the railroad system of the country, coupled with a financial plan which the railroads in this country must mourn not to have had applied to them. The real estate affected by the proposed railroads is to be appraised, and if it is increased in value more than 10 per cent. by the railroads a part of this increase is to go toward paying for their cost. Apply that to Kansas City, Omaha, Chicago, Indianapolis, etc. A moderate proportion of increase in value would have paid for the railroads twice over, to say nothing of the farm lands.

Manufacturing and Business.

The National Foundry Co., Erie, Pa., made the first "heat" last week at its new open-hearth steel casting plant.

Stanley Woodworth has been appointed Chicago representative of the Northwestern Malleable Iron Co., Milwaukee, Wis., with office at 701 Fisher Building.

D. E. Baxter & Company, railroad contractors, New York, have ordered from S. L. Benz, Pittsburg, Pa., 26,500 standard cross ties for the Harrisburg & Ohio River, for immediate delivery at Galatia, Ill.

George Moses has resigned from the mechanical department of the Southern Railway to become traveling representative in the east and south for James B. Sipe & Co., Allegheny, Pa., makers of Japan oil.

A. C. Dallach, Assistant to the Passenger Traffic Manager of the Chicago, Burlington & Quincy, has been appointed Assistant to the Vice-President of the American Colortype Company, Chicago, effective April 1.

F. T. Bentley has been appointed Western Traffic Manager of the Universal Portland Cement Co., with office in The Rookery, Chicago. L. C. Bihler has been appointed Eastern Traffic Manager, with office in the Carnegie Building, Pittsburg.

The Rail Joint Company of Canada, Limited, has taken over the patents and business of the Continuous Rail Joint Company of Canada, Limited, and has begun the manufacture of their products in Canada. The general offices are at 216 Board of Trade Building, Montreal, Canada.

Iron and Steel.

The Hudson Companies has given to the American Bridge Company an order for 2,400 tons of structural steel for the Church street terminal station, New York.

During the last week of February, and including the first two days of March, the orders booked by the fabricating shops showed a considerable increase over the previous three weeks, making the total orders for February between 90,000 and 100,000 tons. Of this amount the American Bridge Company has orders for 50,000 tons. The February orders include 8,300 tons for the east approach to the Blackwell's Island bridge, New York; 2,300 tons of fabricated steel for bridges for the St. Louis & San Francisco; 600 tons for the Baltimore & Ohio; various orders aggregating 4,000 tons for the New York, New Haven & Hartford, divided between the Pennsylvania Steel Company and Ridder & Conley, of Pittsburg. The New Haven is in the market for between 600 and 700 tons additional. The St. Louis & San Francisco and the Baltimore & Ohio orders were given to the American Bridge Company. A total of about 100,000 tons of structural and fabricated steel is pending which will probably be let during March. The Great Northern is negotiating for 6,000 tons of steel for bridges.

OBITUARY NOTICES.

Frank Van Dusen, Chief Assistant General Passenger Agent of the Pennsylvania Lines West of Pittsburg and Erie, died on March 4 at Pittsburg of pneumonia; his wife died two hours later from the same disease. Mr. Van Dusen was born in Cincinnati in 1845, and came to Pittsburg in 1880 as Assistant to E. A. Ford, then General Passenger Agent of the Pennsylvania Company.

Major William L. Smith, General Agent of the Illinois Central at Memphis, Tenn., who was drowned on February 22 in Menesha Lake, Ark., with his son, was 45 years old. He was born in Virginia, and began railroad work in 1883 as a freight clerk on the Memphis & Charleston, now part of the Southern Railway. The next year he was made chief clerk to the General Superintendent of that road, and in 1888 was appointed Secretary to the Vice-President and General Manager of the Louisville, New Orleans & Texas, which is now a part of the Yazoo & Mississippi Valley. In 1890 he was made traveling freight agent of the same road, and the next year contracting freight agent at Memphis. Two years later he was made commercial agent of the Illinois Central and the Yazoo & Mississippi Valley at Memphis, and in 1896 was promoted to be Assistant General Freight Agent of both roads. He was made Assistant to the Second Vice-President in 1903, and in November, 1906, was made General Agent at Memphis, reporting directly to the President, and acting as his representative in southern territory.



W. L. Smith.

TRADE CATALOGUES.

Flue Gas Analysis.—J. A. Caldwell, 45 Broadway, New York, United States agent for Sanders, Rehders & Co., London, sends a pamphlet describing the Sarco Automatic CO_2 Recorder, which is made by the English company. This machine makes a continuous analysis of flue gases and records on a chart the varying percentage of carbon dioxide; as this percentage depends on the amount of air admitted to the firebox, the record shows at once whether the proper amount of air is being admitted for getting the most nearly complete combustion.

Rock Drills.—Catalogue No. 46 of Ingersoll-Rand Co., New York, fully describes the rock drills made by the company. It gives sizes, capacities and prices, and is well illustrated with half-tones of machines and parts, and line drawings showing the construction. Full lists of all repair parts are included.

The Los Angeles Limited.—This unusually attractive pamphlet is being distributed by the passenger department of the Chicago & North-Western. It is 6 x 8½ in., artistically illustrated with full-page and half-page colored half-tone and uncolored corner engrav-

ings. The letter press is in three colors. The binding is unique and bears embossed colored designs. The train described runs over the Chicago & North-Western, the Union Pacific and the San Pedro, Los Angeles & Salt Lake.

Asphalt and Rubber Products.—The Standard Asphalt & Rubber Co., Chicago, has a new catalogue concerning its products, which include paving asphalt, asphalt filler, mastic matrix, asphalt roofing, mineral rubber water-proofing, pipe dips and coatings, insulation and mineral rubber. The composition and qualities of the asphalt are explained, and the other products are covered in detail. The pamphlet is arranged for insertion of future leaflets on this company's products.

Saws.—The Champion Saw Co., Pittsburg, Pa., sends a catchy little folder entitled "The Champion and the Mexican." It calls attention to the analogy between the use of old-fashioned saws by conservative manufacturers and the Mexicans' use of wooden plows.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Meeting of the Franklin Institute.

At the meeting held on March 7 a paper on "The Modern Locomotive," by Paul T. Warner, was presented.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Gulf & Interstate.—E. M. Barnes, Treasurer, has been appointed Auditor, succeeding George W. Barnes, resigned. W. C. Brothers has been appointed Treasurer, succeeding E. M. Barnes.

Illinois, Iowa & Minnesota.—F. M. Clark has been elected Secretary, with office at Chicago, Ill., succeeding as Secretary, J. C. Duffin, General Superintendent.

Illinois Valley Belt.—A. E. George has been elected Secretary and Treasurer, succeeding J. P. Griffin.

Natural Bridge Railway.—The officers of this company are as follows: President, J. L. Phillips; Vice-Presidents, J. S. Gordon and Charles Phillips, all of Thomasville, Ga.

Pittsburg & Lake Erie.—See Pittsburg, Chartiers & Youghiogheny.

Pittsburg, Chartiers & Youghiogheny.—J. M. Schoonmaker, Vice-President of the Pittsburg & Lake Erie, has been elected also President of the Pittsburg, Chartiers & Youghiogheny, succeeding Joseph Wood, resigned. J. G. Robinson, Secretary and Treasurer of the Pittsburg & Lake Erie, and Treasurer of the P. C. & Y., has been elected also Vice-President of the P. C. & Y. T. H. D. McKnight, Treasurer of the Pennsylvania Lines West, has been elected also Secretary and Treasurer of the P. C. & Y., succeeding, as Treasurer, Mr. Robinson.

Western Pacific.—The following new members of the Board of Directors have been elected: F. W. M. Cutcheon, General Counsel of the company, and L. H. Calef, Secretary and Treasurer of the Missouri Pacific. They succeed W. W. Miller and Warren Olney, Jr.

Operating Officers.

Boston & Albany.—W. J. Fripp, Superintendent of the River division of the New York Central & Hudson River, has been appointed General Superintendent of the Boston & Albany, succeeding J. B. Stewart. See New York Central & Hudson River.

El Paso & Southwestern.—See Sonora Railway.

Kentwood & Eastern.—J. Shull has been appointed to the new office of Superintendent, with headquarters at Kentwood, La.

New York Central & Hudson River.—Miles Bronson, Superintendent of the Harlem division, has been appointed Superintendent of the River division at Weehawken, N. J., succeeding W. J. Fripp, appointed General Superintendent of the Boston & Albany. G. F. Van Tassel, Trainmaster of the Harlem division, succeeds Mr. Bronson as Superintendent, with headquarters at White Plains, N. Y.

New York, New Haven & Hartford.—A. W. Honywill, chief clerk to the General Superintendent, has been appointed Superintendent of the Hartford division, succeeding W. L. Derr, resigned.

Norfolk & Western.—B. W. Browning, Assistant Trainmaster of the Norfolk division, has been appointed Trainmaster in charge of terminals at Norfolk.

Oregon Short Line.—S. E. Canady has been appointed Trainmaster of the Utah division, with jurisdiction over the First and Sixth districts, the Cache Valley and Malad Valley branches and the Salt Lake joint yard, with headquarters at Salt Lake City, Utah, succeeding E. N. Botsford, now Acting Assistant Superintendent.

Seaboard Air Line.—T. F. Whittelsey, heretofore Second Vice-President and General Manager of the Mobile, Jackson & Kansas City, has been appointed General Manager of the Seaboard Air Line, with office at Norfolk, Va., succeeding, as General Manager, W. A. Garrett, recently elected President. Mr. Whittelsey was born in 1856 in Kentucky, and began railroad work in 1876 as a freight clerk on the Lake Shore & Michigan Southern at West Detroit, Mich. Two years later he went to the engineering department of that road as a clerk at La Porte, Ind. In 1881 he was made assistant track master at Toledo, Ohio, and the next year was made track master at Englewood, Ill. He was appointed Superintendent at Kalamazoo, Mich., in 1887, and the next year was transferred to Hillsdale, Mich. He was transferred to Toledo, Ohio, in 1890, as Superintendent of the Michigan division, and in 1893 left the company to become General Superintendent of the Toledo & Ohio Central and the Kanawha & Michigan. In 1901 he was made General Manager in charge of construction and operation of the Toledo Railway & Terminal Company, and in the spring of 1905 was appointed General Manager of the Mobile, Jackson & Kansas City. He was later elected also Second Vice-President, which position he left on March 1 to go to the Seaboard Air Line.



T. F. Whittelsey.

J. M. Shea, Superintendent at Birmingham, Ala., has been appointed Superintendent of the Second division, with office at Raleigh, N. C.

Sonora Railway.—A. R. Oster, Superintendent of the Eastern division of the El Paso & Southwestern, has been appointed Assistant General Manager of the Sonora Railway, succeeding J. A. Naugle, resigned.

Southern.—W. J. Bell, Superintendent of the Columbus division, has been appointed Superintendent of the Macon division, with headquarters at Macon, Ga., succeeding Frank J. Egan, resigned. J. L. McClendon, Trainmaster at Macon, Ga., succeeds Mr. Bell, with headquarters at Williamson, Ga. J. C. Ellis has been appointed Trainmaster, with headquarters at Macon, Ga., succeeding Mr. McClendon.

Traffic Officers.

Delaware & Hudson.—William J. Mullin, who was recently appointed General Traffic Manager of this company, was born in Pennsylvania in 1863. He was educated at Whitehall, N. Y., and the Milton, Pa., Academy, and began railroad work in 1881 as a telegraph operator on the Pennsylvania. He was made agent at Selinsgrove Junction, Pa., in 1883. After being transferred several times, he went to the Delaware & Hudson in 1903 as southern and western freight agent at Philadelphia. A few months later he was appointed Industrial Agent of the company, and in 1905 was appointed Assistant to the Second Vice-President in charge of traffic, where he remained until his recent promotion.

Great Northern.—S. G. Yerkes, Assistant General Passenger Agent, has resigned to go into other business.

Illinois, Iowa & Minnesota.—Jonas Waffle has been appointed Assistant General Freight and Passenger Agent, with office at Chicago.

Lake Shore & Michigan Southern.—F. L. Talkert has been appointed General Eastern Freight Agent at Buffalo, N. Y. R. C. Kennedy has been appointed General Agent of the passenger department at Dallas, Tex.

Mexican Railway.—R. M. Mondragon, freight and passenger agent at Mexico City, has been appointed General Agent of the traffic department at Mexico City, succeeding H. A. Tolle, resigned to go to the Tehuantepec National.

Mobile & Ohio.—J. L. Moulton has been appointed General Agent at Mobile, Ala.

Tonopah & Tidewater.—H. E. Needham, General Agent at Ludlow, Cal., has been transferred to Los Angeles. C. J. Ennis succeeds Mr. Needham.

Engineering and Rolling Stock Officers.

Canadian Pacific.—J. C. Sullivan has been appointed Manager of Construction of Eastern lines, with office at Toronto. Division Engineers of Construction will report to him.

Erie.—E. A. Williams, General Mechanical Superintendent, has resigned, and the office has been abolished.

Louisville & Nashville.—J. J. Flynn, general foreman at Mobile, Ala., has been appointed Master Mechanic at Nashville, Tenn.

Nevada Railroad.—H. H. Hale, formerly Assistant Master Mechanic of the Pere Marquette at Grand Rapids, Mich., has been appointed Superintendent of Motive Power and Consulting Engineer of the Nevada Railroad and of the Nevada Consolidated Mining & Milling Company, with office at 11 Front street, San Francisco, Cal.

New York Central & Hudson River.—S. P. Hull has been appointed Engineer of Signals outside the electric division, with office at New York. J. J. Cozzens has been appointed Assistant Engineer of Signals, with office at Syracuse, in charge of installation and maintenance of signals on the Western district.

Purchasing Agents.

Georgia Railroad.—J. A. Best has been appointed Purchasing Agent, with office at Augusta, Ga.

Southern.—A. Gordon Jones has been appointed Purchasing Agent, with office at Washington, D. C., succeeding Joseph P. Minetree, deceased.

LOCOMOTIVE BUILDING.

The Virginia & Truckee has ordered one passenger locomotive from the Hicks Locomotive & Car Works.

The Wisconsin & Northern, now under construction, will shortly ask bids on 15 or 20 freight locomotives.

The Phosphate Mining Co., New York City, has ordered one locomotive from the Hicks Locomotive & Car Works.

The Hecla & Torch Lake is now being made standard gage and when the work is completed will buy some locomotives.

The South Manchuria Railway, which is being built by the Japanese Government, will, it is said, order locomotives in the United States.

The Terminal Railroad Association of St. Louis, as reported in the *Railroad Gazette* of February 22, has ordered 10 switching locomotives from the Baldwin Locomotive Works.

The St. Louis & San Francisco, as reported in the *Railroad Gazette* of March 1, has ordered 25 consolidation (2-8-0), 10 ten-wheel passenger (4-6-0), and 10 six-wheel switching (0-6-0) locomotives from the Baldwin Locomotive Works. The specifications are as follows:

General Dimensions.

Types of locomotives	Consolidation	Ten-wheel.
Weight, total	207,000 lbs.	182,000 lbs.
Weight on drivers	182,000 lbs.	134,500 lbs.
Cylinders	22 in. x 30 in.	21 in. x 26 in.
Type of locomotive	Switching	
Weight, total	120,500 lbs	
Cylinders	19 in. x 26 in.	

The Seaboard Air Line, as reported in the *Railroad Gazette* of February 22, has ordered from the Baldwin Locomotive Works five simple ten-wheel passenger locomotives, 10 simple ten-wheel freight locomotives and 10 simple six-wheel switching locomotives, and from the American Locomotive Company 20 simple ten-wheel freight locomotives and five simple consolidation locomotives. The specifications are as follows:

General Dimensions

Type	Switching
Weight on drivers	135,000 lbs
Total weight	135,000 lbs
Diameter of cylinders	19 in.
Stroke of pistons	28 "
Diameter of drivers	51 "
Type of boiler	Extended wagon top
Working steam pressure	200 lbs
Heating surface, total	2,198 sq. ft.
Tubes, number	274
" material	Charcoal iron
" outside diameter	2 in.
" length	15 ft. 1 "
Firebox, length	66 "
" width	66 "
Grate area	30.25 sq. ft.
Tank capacity	4,000 gals.
Coal capacity	7 tons

Type	10-wheel passenger (Baldwin)
Weight on drivers	132,500 lbs
Total weight	165,000 lbs
Diameter of cylinders	20 in.
Stroke of pistons	28 "
Diameter of drivers	67 "
Type of boiler	Extended wagon top
Working steam pressure	200 lbs
Heating surface, total	2,584 sq. ft.
Tubes, number	328
" material	Charcoal iron
" outside diameter	2 in.
" length	14 ft. 1 5/8 in.
Firebox, length	108 "
" width	41 1/4 "
Grate area	31.09 sq. ft.
Tank capacity	5,000 gals.
Coal capacity	9 tons

Type	10-wheel freight (Am. Loco. Co.)
Weight on drivers	130,000 lbs.
Total weight	168,000 lbs
Diameter of cylinders	19 in.
Stroke of pistons	28 "
Diameter of drivers	60 "
Type of boiler	Extended wagon top
Working steam pressure	200 lbs
Heating surface, total	2,602 sq. ft.
Tubes, number	328
" material	Charcoal iron
" outside diameter	2 in
" length	14 ft. 2 "
Firebox, length	108 "
" width	41 1/4 "
Grate area	31.09 sq. ft.
Tank capacity	5,000 gals.
Coal capacity	9 tons

Type	10-wheel freight (Baldwin)
Weight on drivers	125,300 lbs. (approximated)
Total weight	161,050 lbs. (approximated)
Diameter of cylinders	19 in.
Stroke of pistons	28 "
Diameter of drivers	60 "
Type of boiler	Extended wagon top
Working steam pressure	200 lbs.
Heating surface, total	2,584 sq. ft.
Tubes, number	328
" material	Charcoal iron
" outside diameter	2 in.
" length	14 ft. 1 5/8 "
Firebox, length	108 "
" width	41 1/4 "
Grate area	31.09 sq. ft.
Tank capacity	5,000 gals.
Coal capacity	9 tons

Type	Consolidation
Weight on drivers	179,000 lbs.
Total weight	202,000 lbs.
Diameter of cylinders	22 in.
Stroke of pistons	30 "
Diameter of drivers	57 "
Type of boiler	Straight top
Working steam pressure	200 lbs.
Heating surface, total	3,195 sq. ft.
Tubes, number	403
" material	Detroit seamless drawn steel
" outside diameter	2 in.
" length	14 ft. 6 1/2 "
Firebox, length	102 "
" width	73 3/4 "
Grate area	53 sq. ft.
Tank capacity	6,000 gals.
Coal capacity	10 tons

Special Equipment.

Air brakes	Westinghouse
Bell ringer (for switching)	Gollmar
Boiler lagging	Magnesia
Brake beams (all except consolidation)	Monarch
Brake-shoes (switching)	Perfecto or Herron
" (Am. Loco., 10-whl. drivers)	Perfecto or Herron
" (Am. Loco., 10-whl. tender)	Condon
" (Baldwin, 10-whl., freight)	S. A. L. standard
Couplers (all except consolidation)	Power
Headlights (switching and 10-whl. freight)	Standard
" (10-whl. passenger)	Pyle National
" (consolidation)	S. A. L. standard
Injector (all except consolidation)	Monitor
Injector (consolidation)	Sellers
Journal bearings (all except consolidation)	Ajax
Journal bearings (consolidation)	Am. Loco. standard
Piston rod packing	U. S. Metallic
Valve rod packing (switching and Baldwin 10-whl.)	Garlock
" " (consolidation)	U. S. Metallic
" " (Am. Loco. 10-whl.)	Soapstone
Safety valve	Coale muffled and consolidated
Sanding devices	Leach
Sight-feed lubricators	Nathan
Springs (all except consolidation)	Ry. Steel-Spring Co.
Steam gages	Ashcroft or Star
Tires, driving wheel (except consolidation and Am. Loco. 10-wheel)	Midvale
Draft gear	Farlow
Staybolts (except consolidation and Am. Loco. 10-wheel)	U. S. or Ulster special
Grease lubricator	Elrin
Journal boxes (all except consolidation)	Symington
Valve gear (all except switching)	Walschaert
Fire-door opener (Bald. 10-whl.)	Brewer
Relief valve (Baldwin 10-wheel freight)	Star
Side bearings (Bald., 10-wheel freight)	Norwood
Steam heat equipment (10-wheel passenger)	Safety

CAR BUILDING.

The Colorado Midland is about to receive bids on 100 box cars.

The Kenosha Electric, Kenosha, Wis., will order six city single truck cars.

The Colorado & Southern is in the market for 100 additional ballast cars.

The Ft. Worth & Denver City has ordered two baggage cars from the Pullman Co.

The Guanica Central has ordered two Hart convertible cars from the Rodger Ballast Car Company.

The Dallas (Tex.) Street Railway has ordered 19 double-deck cars through Stone & Webster, of Boston.

The Cumberland & Pennsylvania, C. W. Watson, President, has ordered a private car from the Pullman Co.

The Norfolk & Western, it is understood, has ordered 1,000 steel coal cars from the Pressed Steel Car Company.

The Assumption Coal & Mining Co. has ordered 10 gondola cars of 80,000 lbs. capacity from the American Car & Equipment Co.

The Atlantic Coast Line denies that it is in the market for 2,000 additional cars, as reported in the *Railroad Gazette* of February 22.

The Bolivia Railway has ordered, through W. R. Grace & Co., New York, 50 Hart convertible cars from the Rodger Ballast Car Co.

The Intercolonial of Canada has ordered an 80-120 h.p. Ganz self-propelled motor car from the Railway Auto Car Company, New York.

The Lamar Lumber Co., Hattiesburg, Miss., has ordered ten 41-ft. flat cars of 60,000 lbs. capacity from the Hicks Locomotive & Car Works.

The Missouri Southern has ordered 10 flat cars from the Ryan Car Co., and is having one combination coach and one passenger coach remodeled.

The J. D. McArthur Co., Winnipeg, Man., has ordered 100 36-ft. flat cars of 60,000 lbs. capacity from the Hicks Locomotive & Car Works for May delivery.

Swift & Co., Chicago, have ordered 100 steel tank car underframes of 60,000 lbs. capacity from the Bettendorf Axle Co., for April to July delivery. These cars will be 31 ft. long and 9 ft. wide, over all. The special equipment is as follows: Bolsters, Bettendorf; brake-beams, Damascus; dust guards, Harrison; trucks, Bettendorf.

The American Milling Co. has ordered 25 steel tank car underframes of 80,000 lbs. capacity from the Bettendorf Axle Co., for June delivery. These cars will be 31 ft. long and 9 ft. wide, over all. The special equipment is as follows: Bolsters, Bettendorf; brake-beams, Damascus; draft rigging, Cardwell; dust guards, Harrison; trucks, Bettendorf.

The Long-Bell Lumber Co., Kansas City, Mo., has ordered for the Longville Long Leaf Lumber Co. 120 logging cars of 60,000 lbs. capacity, and three tank cars of 6,700 gal. capacity from the Beaumont Iron Works, instead of 175 logging cars and six tank cars, as reported in the *Railroad Gazette* of February 22. The logging cars will measure 40 ft. long and 9 ft. 8 in. wide over all.

The Des Moines, Iowa Falls & Northern has ordered 50 gondola cars, 25 box cars and 10 standard stock cars, all of 80,000 lbs. capacity, from the American Car & Foundry Co. The gondola cars will be 36 ft. long, 8 ft. 6 in. wide and 3 ft. 9 in. high, inside measurements. The box cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The special equipment for all includes Chicago couplers.

The Temiskaming & Northern Ontario, as reported in the *Railroad Gazette* of February 22, has ordered 100 steel underframe flat cars of 100,000 lbs. capacity from the Dominion Steel Car Co., Montreal, Que., and 100 wooden flat cars of 60,000 lbs. capacity from the Rathbun Co., Deseronto, Ont. The steel underframe cars will measure 36 ft. 10 in. long, over all, and 9 ft. 4 in. wide, over side sills. The wooden cars will measure 36 ft. 9¾ in. long over end sills and 9 ft. ¾ in. wide over side sills. The special equipment for both includes:

Bolsters	Simplex
Brake-beams	Simplex (inside hung)
Brakes	Westinghouse
Brasses	Canadian Bronze Co.
Couplers	Tower
Draft rigging	Miner tandem
Journal boxes	McCord
Trucks	Arch bar

The Detroit, Toledo & Ironton has ordered for the Ann Arbor two first class coaches and two combination cafe coaches from the Pullman Company for June delivery. The first class coaches will measure 70 ft. long, and the combination cafe coaches will measure 72 ft. long; both the first class and the cafe coaches will measure 9 ft. 8 in. wide and 6 ft. 10 in. high, inside measurements. The special equipment for both includes:

Bolsters	Commonwealth
Brake-beams	Diamond special
Brake-shoes	Lappin
Brakes	Westinghouse
Curtain fixtures	Forsyth
Curtain material	Pantasote
Draft rigging	Miner
Heating system	Consolidated
Journal boxes	Symington
Light	Pintsch
Paint	Pullman
Platforms	Standard Coupler Co.
Roofs	Pullman
Trucks	Pullman
Vestibules	Pullman
Wheels	Paige

RAILROAD STRUCTURES.

Albon, Minn.—Plans are being made by the Duluth, Missabe & Northern for a new passenger station.

Chambersburg, Pa.—The Chambersburg & Gettysburg Electric Railway Company, it is said, will put up a large bridge over Conococheague creek; also one over the Western Maryland tracks.

Denison, Tex.—The Missouri, Kansas & Texas has appropriated $145,000 for a new passenger station, and $40,000 for a new freight house.

Exeter, N. H.—The car barns of the Exeter, Hampton & Amesbury Street Railway Company were recently damaged by fire; loss $50,000.

Hamlin, Tex.—An agreement, it is said, has been made by the Kansas City, Mexico & Orient with the city officials to make this place its division terminal. The company proposes to put up a roundhouse and repair shops.

Kankakee, Ill.—The Chicago, Indiana & Southern, it is reported, has plans ready for building additions to shops here.

Macon, Ga.—Arrangements are reported made by the Central of Georgia to put up new shops here.

Mt. Carbon, Pa.—Additions to the Pennsylvania roundhouse, it is said, will be made at a cost of $48,000.

Norfolk, Va.—The Tidewater has given a dredging contract for work near its proposed new steel pier at Sewall's Point, Va., which is to be 60 ft. wide, 65 ft. high and 1,000 ft. long, to the P. Sanford-Ross Company, Inc., of Jersey City, N. J., and a contract for the superstructure of the pier to the McLean Contracting Company, of Baltimore. The value of the contracts is about $2,000,000.

Roanoke, Va.—The Roanoke Railway & Electric Company, it is said, has secured land as a site for a new power station to cost $250,000.

Santa Barbara, Cal.—The Southern Pacific, it is said, will put up a new roundhouse at a cost of $100,000, and new machine shops.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Arkansas, Oklahoma & Western.—Work is said to be under way on this proposed line from Eureka Springs, Ind. T., north to Pryorcreek, 40 miles. The company has a capital of $3,000,000. A. L. Williams, of Fayetteville, Ark., is Vice-President. It is said that the company will absorb the Rogers Southwestern.

Atchison, Topeka & Santa Fe.—The Denver, Enid & Gulf has opened an extension from Medicine Lodge, Kan., to Lake City, 14 miles.

Atlantic, Northern & Southern.—This company is said to have raised funds to build its road, and preliminary surveys are to be started at once. J. H. Simmons, President; E. Marquis, Treasurer, Atlantic, Iowa. (Feb. 15, p. 226.)

Au Sable & North-Western.—A new branch, called the Curran branch, has been opened for business from Crooked Lake Junction, Mich., to Curran, six miles.

Boston & Albany.—See New York Central & Hudson River.

Brandon & Laurel.—Incorporated in Mississippi by residents of Brandon. The company is making preliminary surveys for a line from Brandon, Miss., southeast to Laurel, 65 miles.

Canyon City & Royal Gorge.—Incorporated, with a capital of $1,250,000, to carry out the work of the Canyon City, Florence & Royal Gorge Interurban, which was projected to build an electric line from Canyon City, Colo., through Royal Gorge, about 11 miles, and which went into the hands of a receiver. The directors of the new company are F. D. Heath, D. E. Gibson, James H. Peabody, W. H. Peabody and E. M. Smith, of Canyon City; W. W. Umberhauer and T. J. Budd, of Philadelphia; W. Wood and W. Hutty, of Kansas City.

Chesterfield & Lancaster.—This road has been opened from Ruby, S. C., to Guess, eight miles.

Chicago & North-Western.—On the Manitowoc, Green Bay & Northwestern, a new section from Eland Junction, Wis., east to Pulaski, 53 miles, has been opened for business.

Chicago, Burlington & Quincy.—Surveys, it is said, are being made by this company for an extension of the Sargent branch from Sargent, Neb., west to Anselmo, 30 miles.

Cincinnati, Toledo & Detroit Short Line.—This company has bought from the People's Rapid Transit Company its right of way for a proposed line from Toledo to Cincinnati. President Morgan, of the C., T. & P., is reported as saying that contracts for building the line have been let.

Denver, Enid & Gulf.—See Atchison, Topeka & Santa Fe.

Little Kanawha.—This company now operates its road from Parkersburg, W. Va., to Owensport, 31 miles, and has steamer connections to Creston.

Louisiana Railway & Navigation.—Part of the New Orleans division of this road, from Edenboro, La., southeast to New Orleans, 59 miles, has been opened for both passenger and freight business.

Mexican International.—This company has opened for business a new branch from Sabinas, Mex., to Rosita, 10 miles.

Mississippi Roads.—Application has been made at Jackson, Miss., to incorporate a company to build a line from Gulfport, Miss., north to West Point, 220 miles. This is thought to be a project of the St. Louis & San Francisco.

New York Central & Hudson River.—About $1,500,000 is to be spent for betterments on the Boston & Albany. The plans call for 14½ miles of third track between Pittsfield, Mass., and Albany, N. Y., and additional track at Charlton, Mass., also an extension of the third and fourth tracks from Lake Crossing, Mass., west to South Framingham, about five miles.

Niagara Peninsula.—An application will be made to the Ontario Legislature for incorporation of a company under this name to build a line from Port Colborne, Ont., west to Welland. The application is made by Rowell, Reid, Wilkie, Wood and Gibson, of Toronto, solicitors.

Northern of Maine.—Application has been made in Maine by a company under this name with a capital of $500,000 for a charter to build from a point near the terminus of the Bangor & Aroostook near Fort Kent southwest to the St. Johns and the St. Francis river, 25 miles; also from near Kent east to Frenchville, Madawaske and Grant Isle, thence southeast to Van Buren, 35 miles. Arthur H. Lewis, of Chicago; V. N. Therriault, of Fort Kent; E. E. Goodrich, of Waterville, and E. R. Michand, of Frenchville, are interested.

Ocean Shore & Eastern.—See Ocean Shore.

Ocean Shore (Electric).—This company, it is said, has incorporated the San Jaoquin Valley Western to build an extension of its road from Santa Cruz, Cal., east via Holester towards Fresno, 40 miles.

The Ocean Shore & Eastern has been incorporated with a capital of $3,000,000 to build from Santa Cruz, Cal., southeast to Watsonville, 20 miles.

Oregon & Washington.—See Oregon Railroad & Navigation Company.

Oregon Railroad & Navigation Company.—For the Oregon & Washington, to run from Portland, Ore., north to Puget Sound, land for terminals has been secured in Seattle by purchase from the Great Northern.

Pennsylvania.—The report of this company for the year ending December 31 last, shows that the four-track system was completed on the Middle division between Granville and Mayes, and that work is being pushed in changing the alinement between Vandyke and Port Royal; also between Ryde and a point west of Mount Union. The latter section involves heavy cutting and the building of two new stone arch bridges over the Juniata river.

On the Pittsburg division four-tracking work is in progress between Sang Hollow and Bolivar. This includes a change of line and two stone arch bridges over the Conemaugh river; also considerable work between Beatty and Southwest Junction.

On the West Pennsylvania division, the line between Blairsville and Tunnelton and the Sang Hollow extension are being revised and double tracked. A number of other important changes are being made at various points on this division.

The company has completed a large amount of yard extension work at various terminal points.

At Greenville, N. J., the work of dredging the channel and filling in the yard has been continued, and additional storage provided for freight, particularly structural steel.

At West Morrisville, Pa., the western terminus of the proposed new freight line from that place to Newark, N. J., the yard is being improved to permit prompt handling of traffic passing over the Trenton cut-off, as well as over the new line from Morrisville to Newark.

On the Monongahela division an extension is being built south 4½ miles to a connection with the Pennsylvania, Monongahela & Southern, which is being built up the valley of the Monongahela river to Rice's Landing, 7½ miles, to develop the coal and other traffic of that section.

Work on the New York tunnel extension is being continued. The tunnels under the East river are about one-quarter finished. The tunnels under the Hudson river have advanced so that laying one of the tubes from Manhattan to Weehawken, N. J., was completed on September 12, and the second tube October 9. The work of lining these tubes with concrete is now under way. On the section between Harrison, near Newark, where the tunnel line leaves the present main line, and the Hudson river, most of the bridges have been built, and the one over the Hackensack river is nearing completion. Excavation work has satisfactorily advanced at the Bergen Hill tunnel approach, and considerable progress has been made on the tunnel. The excavation for the great passenger station in New York City, between Seventh and Eighth avenues, is about finished, and foundation work is now in progress. Work under the streets in the Borough of Manhattan, New York, and in Long Island City is about two-thirds finished.

The Cherry Tree & Dixonville branch has been extended from Clymer, Pa., four miles to Dixonville.

Philadelphia, Norristown & Northern.—Incorporated in Pennsylvania to build a line from Villanova, Pa., north to Norristown, five miles. Morris Bernheimer, Philadelphia, is President.

Pontiac Central.—The Quebec Legislature has been asked to incorporate this company to build a line from Bryson, Que., along the valley of the Coulonge River to a point on James Bay; also to build branches. Ryan & Bickerdike, Montreal, are solicitors.

Portland & Rumford Falls.—Application has been made to the Maine Legislature to incorporate a company to extend this road from Rumford Junction, Me., south to Portland, 30 miles.

Raymondville & Waddington.—Incorporated in New York with $150,000 capital to build from Raymondville, Lawrence County, N. Y., to Waddington, 15 miles. When completed the line is to form an extension of the Norwood & St. Lawrence.

St. Louis, Hillsboro & Southern (Electric).—This company has voted to issue bonds to secure funds to build an electric line from St. Louis, Mo., to Hillsboro, 40 miles, with a number of branches. Land has been bought for terminals and freight yards in southern St. Louis. H. M. Bower is General Manager.

St. Louis Southwestern Railway of Texas.—The Lufkin division of this road has been extended from Monterey, Tex., to Warsaw, four miles.

St. Louis, Springfield & Oklahoma Western.—Incorporated in Oklahoma with $3,750,000 and offices at Lawton, Okla., and Sulphur, Ind. T. The company proposes to build from Lawton, Okla., east to Sulphur, Ind. T., thence northeast through McAlester and Stigler to Sallisaw, 225 miles. The incorporators include: G. S. Stocker, of Sallisaw; W. T. Douglas, R. Downing and A. D. Goodnough, of Sulphur; J. D. Jennings and J. J. Beall, of Oklahoma City.

San Jaoquin Valley Western.—See Ocean Shore.

South Texas Gulf.—Incorporated in Texas with $40,000 capital to build from Artesia, Tex., on the International & Great Northern, northwest to Carrizo Springs, 40 miles. The incorporators include: W. H. Myers and A. W. Raht, of Henrietta; C. M. Wright, R. H. Westlake, A. M. McElenee and M. Schott, of Fort Worth, and J. C. Davis, of Temple.

Spokane & Inland.—This company has extended its road from Waverly, Wash., south 12 miles to Rosalia.

Taylor, Brenham & Houston.—Under this name, a company is being organized in Texas to build a line from Taylor, Tex., southeast to Brenham through the counties of Williamson, Milam, Lee

and Washington, 71 miles. The headquarters of the company are at Brenham. Rights of way for the entire line reported secured.

Tennessee Coalfields & South Atlantic Transcontinental.—There is a bill before the legislature of North Carolina to incorporate a company under the above name to build from Knoxville, Tenn., to Waynesville, N. C., and thence to Greenville, S. C.; also to build a branch from Waynesville to Asheville, N. C., and one to Rutherfordton, N. C., at which place connection can be made with the Seaboard Air Line, a total length of about 250 miles. The project is being backed by Asheville men.

Tennessee Roads.—Plans are being made by O. G. Wales, of Chicago, to build a line from Florence, Ala., north via Waynesboro and Linden, Tenn., to Waverly, Tenn., 90 miles.

Virginia-Carolina.—This company has opened for business a new branch from West Damascus, Va., to Taylor's Valley, seven miles.

Wabee & Wawasee.—Incorporation will be asked for by a company under this name to build a line from Syracuse, Ind., west to Wabee lake in Kosciusko County, and thence to Milford; also to build from Syracuse to Lingle lake, 12 miles. A. St. J. Newberry, W. D. Frazer, C. I. Reilly and J. P. Nolan are interested.

Winnipeg & Northwestern.—Application will be made by A. S. Drummond, of Winnipeg, Man., to the Parliament at Ottawa for a charter to build a line from Winnipeg, north by way of Lake Manitoba and thence west via Fort La Corne and the north side of Saskatchewan River to Lopstick River, and to build branches to Battleford, Lac la Bieche, Edmonton and Athabasca Landing.

Wisconsin Valley (Electric).—Incorporated in Wisconsin, with a capital of $25,000, to build an electric line from Grand Rapids, Wis., northeast to Stevens Point, 15 miles, and eventually via Wausau to Merrill, 60 miles. The incorporators include George A. Whiting, of Neenah; H. F. Whitcomb and George Lines, of Milwaukee.

RAILROAD CORPORATION NEWS.

Atlantic Coast Line.—This company has sold to J. P. Morgan & Co. $5,000,000 5 per cent. three-year notes. It is not stated exactly what use will be made of the proceeds.

This company has made an equipment mortgage to the Safe Deposit & Trust Company, of Baltimore, securing an issue of $4,500,000 4 per cent. equipment trust serial notes. The mortgage covers 3,280 freight cars and 100 locomotives.

Brooklyn Heights Railroad.—See Brooklyn Rapid Transit.

Brooklyn Rapid Transit.—The Transit Development Company, which already owns some of the principal power houses used by the Brooklyn Rapid Transit, is hereafter to furnish power and take charge of the maintenance and repair of the railroad and its equipment. The entire capital stock of the subsidiary company is owned by the Brooklyn Rapid Transit. Hereafter all the elevated lines are to be operated by the Brooklyn Union Elevated, while the surface roads will operate only surface lines. To this end, the leases of the Brooklyn Union Elevated, of the Sea Beach Railway and of the South Brooklyn Railway to the Brooklyn Heights Railroad have been terminated, while the lease of the Prospect Park & Coney Island has been assigned to the South Brooklyn Railway. These changes are in accordance with an opinion to the effect that elevated railroad corporations and surface railroad corporations are governed by different provisions of the law. The arrangement will not interfere with the through operation of trains.

Brooklyn Union Elevated.—See Brooklyn Rapid Transit.

Buffalo & Lake Erie Traction.—This company has asked permission to increase its capital stock from $6,750,000 to $7,500,000 in order to acquire the $600,000 stock of the Jamestown, Chautauqua & Lake Erie, which is a steam road running from Jamestown, N. Y., to Chautauqua, 31 miles.

Canadian Northern.—The Dominion Securities Corporation, Toronto and Montreal, is offering for sale $600,000 4½ per cent. gold bonds, series L, of the Imperial Rolling Stock Company, a subsidiary of the Canadian Northern. The issue of which this amount is a part is limited to $2,200,000. The bonds are secured on 46 locomotives, 51 passenger cars and 1,383 freight cars, costing $2,941,443. Principal and interest is guaranteed by the Canadian Northern.

Chicago & Milwaukee Electric.—The Western Trust & Savings Bank, Chicago, is offering at 99 and interest the unsold part of an issue of $2,000,000, two-year 6 per cent. collateral and convertible gold notes secured on $2,500,000 Chicago & Milwaukee Electric, Wisconsin division, first mortgage guaranteed 5 per cent. bonds of 1925, the notes being convertible into these bonds.

The Chicago & Milwaukee Electric owns 140 miles of double-track road on a private right of way from Racine, Wis., south to Evanston, Ill., where it connects with the Chicago, Milwaukee & St. Paul and the Chicago Street Railway system. The proceeds of the notes are to pay for the completion of the road north to Milwaukee.

Colorado Southern, New Orleans & Pacific.—Rudolf Kleybolte & Co. recently offered for sale $1,600,000 equipment trust 5 per cent. notes of this company, guaranteed principal and interest by the St. Louis & San Francisco. The notes are secured on 38 locomotives and 1,045 freight cars costing $1,895,136, of which the railroad company paid $295,136 cash.

Corvallis & Eastern.—Control of this line has passed to Harriman interests, and it is said that the road will probably be turned over to either the Southern Pacific or Oregon Short Line. The road runs from Idanha, Ore., to Yaquina, 142 miles, and has outstanding $1,410,000 capital stock and $2,145,000 bonds. It crosses the Southern Pacific at Albany, Ore.

Henderson City Railway.—The property of this company has been bought for $80,000 under foreclosure by Charles A. Hincne, President of the Fifth National Bank of Cincinnati, representing the bondholders. The Henderson Traction Company has been organized as a successor.

Henderson Traction.—See Henderson City Railway.

Hocking Valley.—The time for deposit of the stock of this company and the Kanawha & Michigan under the plan for the merger has been extended from March 1 to June 1, by which date it is expected the suit brought to prevent the consolidation will have been settled. (March 1, p. 290.)

Jamestown, Chautauqua & Lake Erie.—See Buffalo & Lake Erie Traction.

Kanawha & Michigan.—See Hocking Valley.

Louisville & Nashville.—This company has sold $6,500,000 5 per cent. three-year notes. Of this amount it is understood that $1,500,000 was sold privately and the remainder to J. P. Morgan & Co. The specific purpose for which the proceeds are to be used was not stated.

Milwaukee Electric Railway & Light Company.—N. W. Harris & Co., and Spencer Trask & Co., of New York, are offering jointly $1,000,000 refunding and extension mortgage 4½ per cent. bonds at 95¾ and interest, being part of an authorized issue of $20,000,000, of which $4,000,000 is now outstanding, and the remainder, $8,000,000, is reserved to retire underlying liens, and is not to be issued until after January 1, 1908, and then only at the rate of not more than $1,000,000 a year, the proceeds to be used for extensions, improvements and acquisitions. The company owns 103 miles of road, and controls all the gas and electric lighting companies of Milwaukee.

Natural Bridge Railway.—The property of this company has been bought by J. L. Phillips & Co., Thomasville, Ga. The road runs from Vereen, Fla., to Delph, 17 miles, and is being extended northerly 15 miles to a connection with the Seaboard Air Line at Chaires. Surveys have been finished for a further extension from Chaires to Thomasville, 30 miles.

New York, New Haven & Hartford.—The legislative committee on railroads reported in the House on Tuesday against the petition of this company that the company, to enlarge its terminal facilities in Boston, may take property on the South Bay, which lies near the present terminal station. But the committee did report a bill to permit the company to take land for the enlargement of its terminal facilities on the South Bay, naming the property of the Roxbury Wharf Company and of the South Bay Wharf & Terminal Company. The latter plan is of smaller scope than the former. But the company is to get enlarged facilities just the same.

Pennsylvania.—The $60,000,000 three-year 5 per cent. notes recently sold to Kuhn, Loeb & Co. are secured by $45,000,000 Pennsylvania 4 per cent. equipment trust certificates, $10,000,000 Pennsylvania 4 per cent. water bonds, and $8,800,000 Pennsylvania Company stock.

Pennsylvania Company.—See Pennsylvania.

Prospect Park & Coney Island.—See Brooklyn Rapid Transit.

Sea Beach Railway.—See Brooklyn Rapid Transit.

South Brooklyn Railway.—See Brooklyn Rapid Transit.

Southern Pacific.—See Corvallis & Eastern.

Syracuse & South Bay (Electric).—The property of this company has been sold under foreclosure to Clifford B. Beebe for $251,000. The road runs from Syracuse, N. Y., to Oneida Lake, 15 miles.

Transit Development Company.—See Brooklyn Rapid Transit.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, except IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Reducing Train Resistance by Compensation 323
- Extensive Use of Track Circuits on the New York Central 323
- New Railroad Building 324
- Developing an Impact Formula by Experiment 324
- Modern Methods of Railroad Building 325
- Railroad Track Superstructure 326
- Stresses in Track on Curves 327

ILLUSTRATED:
- Bay Shore and Dumbarton Cut-offs of the Southern Pacific 328
- The Indianapolis Southern Railroad 332
- A Longitudinal Steel Sleeper System for Railroad Track 336
- A Level of the Time of Louis XIV 337
- Method of Placing Heavy Double Track Through Plate-Girders on Union Pacific 338
- Reinforced Concrete Floors for Through Truss Spans 339
- The Tidewater and Deepwater Railways. 340
- Norfolk & Western Improvements 351
- South Boston Coaling Station of the N.Y., N. H. & H. 362
- Track Deformations and their Prevention 363
- Upward Inclination Three-Position Signals on the P., B. & W. 368
- Some New Scherzer Bascule Bridges 372
- The Abbott Rail Joint Plate 373
- Strauss Trunnion Bascule Bridge on the New Jersey Short Line 374

MISCELLANEOUS:
- A New Locomotive for the Northern Railway of France 328
- The Schlemmer Case 331
- The Wide Awake Station Agent 361
- Economy in Track Work 366
- Preparation for Electrification of the New York Central Terminal 366
- Railroad Liability for Damage by Fire .. 367
- Proposed Kansas City Union Station 367
- Annual Construction Record 379

GENERAL NEWS SECTION:
- Notes 371
- Obituary 376
- Meetings and Announcements 376
- Elections and Appointments 376
- Locomotive Building 377
- Car Building 377
- Railroad Corporation News 378

VOL. XLII., No. 11. FRIDAY, MARCH 15, 1907.

In building the Indianapolis Southern Railroad, which is described on another page of this issue, an interesting feature was the effort of the engineers to provide a grade condition that would offer no train resistance at any point in excess of what would be encountered by a train on the maximum grade on a tangent. To do this, all curves were compensated at the rate of .04 per cent. per degree of curvature when the length of the curve was equivalent to the full length of a maximum train, and at .03 per cent. where the curve was one-half the maximum train length, or less. At all stations, passing tracks, water or coaling stations, railroad crossings, or other points where it was contemplated that trains carrying full tonnage would have to make stops, a reduction of one-tenth of 1 per cent. in gradient was made; that is, one-half of 1 per cent. grades were reduced to four-tenths, for example. Also an effort was made to obviate the cumulative adverse effects of any excessively long maximum grades. It is generally known, of course, that where an opposing maximum grade is unusually long—several miles, say—even though it be properly compensated for curvature the tonnage rating of locomotives must be reduced below that which they are quite able to take up a maximum grade of ordinary length. The approaches to Bloomington plateau on the Indianapolis Southern required long stretches of maximum grade. As stated in the article, the heaviest tonnage is toward Indianapolis on account of the coal traffic. As originally located, the westerly approach to the plateau mentioned was a continuous ascent of the maximum northbound grade—one-half of 1 per cent. To avoid this, a new location was made at considerable expense to enable the introduction of two relief grades, the presence of which is to afford opportunity to engines in continuous motion to recover their normal steam pressure, and also to lighten the grades for trains pulling into and out of passing tracks at these points. The reduction of one-tenth of 1 per cent. in gradient at stations, passing tracks, etc., was not arrived at by theoretical determinations of what was required; but having recognized the advisability of providing help at such points, the amount of same was based on what was assumed from experience would probably be correct, influenced by the extra cost of including it in the work; for in many cases a greater reduction than the above, even though it might have been desirable, would have added excessively to the cost. The features mentioned which have been embodied in the construction of this line to equalize its adverse characteristics, so to speak, and thereby reduce the maximum train resistance to an equivalent of that offered by the maximum tangent gradient, make it unique in this respect, and the operating results will be watched with interest.

The New York Central has decided to make the block signals on its passenger tracks "semi-automatic" throughout the whole of the main line from Albany to Buffalo, 300 miles; and also throughout the Hudson division (Albany southward to the Electric division). Here there are no separate main tracks for freight trains.* Each block section will have a track circuit (or successive circuits) the whole of its length, so that collisions due to the parting of trains will be guarded against, and permissive blocking will be as safe as under automatic signals. The improvement will make the New York Central main line passenger tracks the most thoroughly signaled railroad in the world, for no such combination of operator-control and track-circuit control has been installed anywhere else, except for very short distances. The block sections on the New York Central are two and three miles long, so that, with the track circuits made 3,500 ft., there will have to be three or four or more circuits in each block in most cases. Outlying switches, where not interlocked, will have the protection of switch indicators, as is common in simple automatic signaling. At present such switches are controlled from the towers, but by the use of time-releases, where necessary, there would seem to be no reason why the indicators alone should not afford all reasonable protection. This use, on a busy railroad, of track circuits which from the engineman's standpoint are two or three miles long, will give new force to the question whether a track-controlled signal remaining in the stop position should be understood as limiting the speed of trains to a rate low enough to avoid danger from a possible broken rail. We notice that Mr. W. H. Elliott, in a paper read this week before the New England Railroad Club, takes the stand that the speed should be thus limited. On straight lines this must impose some

*On the freight tracks between Albany and Buffalo automatic signals have been installed at a number of places intermediate between the manual signals. This course has been found necessary because of the large number of freight trains run and the necessity of giving permissive signals unless the block sections are shortened. It is probable that this improvement will be continued on the freight tracks until they are equipped with track circuits throughout; and when that has been accomplished it is quite likely that the manual signaling on these tracks will be abolished, or, at any rate, that the control apparatus will be taken out.

unnecessary delays, unless failures of batteries, wires, etc., are made exceedingly rare. How strictly is this broken-rail speed enforced in actual practice? Some testimony on this point would be of decided interest, especially from enginemen who run fast trains at night on lines run by automatic signals. That the double control—man-control and machine-control—now to be used on the New York Central would definitely increase the safety of trains on many lines (we cannot apply this to the New York Central specifically for we do not know but its discipline may be far above the average) is strikingly indicated by a list of collisions on block signaled lines in the United States which is contained in the report recently made by Messrs. Adams and Anthony to the Interstate Commerce Commission. In this list all of the important collisions occurring in two years under the telegraph block system (13) were due to errors of signalmen, while all occurring under automatic block signals (7) were due to errors of enginemen.

NEW RAILROAD BUILDING.

The thirteenth regular Construction Record of the *Railroad Gazette* is published in this issue. This comprehensive list of railroad construction work projected, authorized or under way was compiled semi-annually from the spring of 1898 until March, 1902, when it was made an annual report. It is a record of railroad companies incorporated and railroads projected or building in the United States, Canada and Mexico, largely compiled from our regular construction columns and brought up to date wherever possible by later official reports.

Considering the United States as a whole, no new construction has within the past year been undertaken of anything like so great importance as the St. Paul's Pacific extension, the Western Pacific and the Denver, North-Western & Pacific, begun during the preceding two or three years. Since last year the route of the St. Paul's extension has been announced, which shows that it will be a sharp competitor of the Hill roads, particularly the Northern Pacific, along the Yellowstone river and in the Butte territory, which lends strength to the belief that the Harriman influence in the road is far stronger than disclosed in the Union Pacific's small investment in St. Paul stock. Work has been actively under way on the Western Pacific, which has over 100 miles of track laid, mostly on the eastern end. As on all other roads under construction during the year, progress has been greatly hampered by scarcity of labor, but there are now some 5,000 men at work on the line. Perhaps the most important other new line is the Portland & Seattle which before the end of the year will give the two Hill roads a splendid low grade line to the Harriman stronghold—Portland. Successful development of mining in Nevada accounts for the large amount of new construction in that state. The incentive for building may be judged from the record of the Tonopah & Goldfield, which, in its first year of operation, paid 17 per cent. on each class of stock and has begun payments at the rate of 20 per cent. for its second year.

Canada is particularly active in new railroad building. The lines of advance by the three dominating systems are in each case in similar directions: a through line from coast to coast as a backbone with branches connecting it with the principal traffic producing regions north or south. Actual construction work has been begun on the eastern section of the Grand Trunk Pacific, which the government is to build through rugged country at high cost. In Mexico the principal work under way is on the Southern Pacific's 775-mile extension south and east from the southern terminus of the Sonora Railway, of which 100 miles is now in operation and 300 miles more nearly finished.

The present prospect is that in the United States at least a much smaller proportion than usual of the new enterprises will be carried out this year. The following expressions of opinion, the first from the Chicago, Milwaukee & St. Paul in regard to the building of a proposed branch; the second from the recently issued annual report of the Pennsylvania Railroad summarize the situation.

"With the persistency with which state and national legislation is being sought for the purpose of decreasing earnings and increasing expenses of operation, there is not the slightest incentive for railroad companies to engage in any new enterprises, and much, if not all, the construction work now in progress would not have been under way if present conditions could have been foreseen. . . . No such line will be be built this year, nor will the construction of this or any other new line be undertaken until there is a cessation of that hostile sentiment which seems determined to reduce to a minimum the value of present railroad securities and annihilate all demands for new ones."

"The prompt recognition of the growing needs of the country for improved railroad facilities has resulted in most of the necessary additions and improvements to your road having been made on most favorable terms. But the demands for increased capital from other railroads influenced by the same reasons, and substantially from all branches of industry, have made the present rates for money exceptionally high. This, together with the increased cost of labor and material, the legislation, both state and municipal, to increase taxes, reduce rates and fares and force upon the railroads large expenditures that yield no direct return, would seem to make it a wise policy on the part of your company to reduce its capital expenditures to a minimum, avoid new undertakings and restrict its expenditure for the present to such work as is now under way and must be completed."

With strong companies like the St. Paul and Pennsylvania face to face with such discouraging conditions, it is obvious that weaker companies are even less likely to be able to carry out new construction work. While the difficulty of obtaining money for new work will affect the undertakings of existing systems and of the larger new projects, it is not likely to prevent the construction of some of the smaller local roads in the West, Southwest and South, where, as a result of the continued prosperity of recent years, local interests have money ready at hand for investment. The serious aspect of the money stringency which the larger railroads have to face is, of course, the fact that greatly needed improvements to existing lines will have to be indefinitely postponed. Mr. Harriman has recently pointed out that the improvements and extensions which should normally have been each year were omitted during the six or eight years of the receivership and reorganization period following 1893. Then suddenly the country emerged from the years of depression into the greatest prosperity ever known and the railroads were obliged to crowd into the past few years all the work of providing new facilities which should have been done in the years preceding as well as that which normally belonged to those years. They have by no means yet caught up with the demands. Therefore, it will be a great hardship, both to the railroads and, in the end, to the country at large, to have these improvements postponed.

DEVELOPING AN IMPACT FORMULA BY EXPERIMENT

At the 1906 convention of the American Railway Engineering and Maintenance of Way Association, in discussing the report of the Committee on Iron and Steel Structures, considerable attention was devoted to the formula for impact given in the report, which was declared to be unsatisfactory. The desirability of developing a satisfactory formula by a series of experiments caused the adoption of a motion that the committee be authorized to make the necessary experiments, the board of directors of the association being requested to provide the necessary funds in such manner as it deemed advisable. President Kelley, of the association, in a recent letter to members, suggests that the railroad companies contribute the money for these experiments.

This project is one that ought to be encouraged not only by all of the members of the association, but by the railroads as a whole. When the state of knowledge of bridge design is considered, the general haziness of treatment of this particular, and most important, feature is surprising. It is not because of any lack of appreciation of its importance on the part of engineers, however, for a great deal has been written on the subject and a good many experiments made. But the difficulties in the way of determining the effect of impact are manifold. Attempts at such determination have already been made with various instruments, some of them measurably successful, most of them failures, all containing some defect fatal to complete success and the solution of the problem. The cost of special trains, of adequate arrangements, and of the numerous assistants necessary, is great, and this no doubt has been the chief deterring factor with individual engineers or railroad companies in undertaking tests in a way which might be expected to yield correct results. Such tests as have been recorded show some surprising results; in the last analysis, however, little that is final or convincing can be deduced from them.

While the question is a mooted one among engineers, the difficulties in the way of its solution are, of course, most apparent to those who have made attempts to solve it. It is evident to all who have given any attention to the subject that the effect of impact may easily amount to quite as much as the static effect of the weight of the rolling loads on track, while on the other hand it may be considerably less. The fact that the effect of so considerable a proportion of the load should be, at this late date, so purely a matter of guess work, of empiricism, is amazing.

The value to all the railroads of the country of experiments which can be depended upon and from which can be deduced an impact formula or factor reasonably near the actual, will be enormous. Instead of an allowance by designers sufficient to cover the

unknown quantity, which allowance must of necessity be well on the safe side, a much more exact determination of stresses can be made. With so much of uncertainty out of the way, there is no doubt that economy will result; for providing for forces of unknown amount is not only difficult, but is apt to be wasteful. There is reason to believe that, as commonly designed, there may be a disproportion among members of a bridge. If some members are strong enough, others may be too heavy, or vice versa. Likewise, the effect of impact on track is apparent, but means of calculation are lacking. There is no doubt that track, as now made, is overloaded. How much, is a question which can only be answered by the aid of such tests as are proposed.

Not alone in designing new structures will the correct determination of an impact allowance be of value. Every railroad bridge engineer well knows the perplexing quality of the problem of determining just how far to go in allowing existing structures to carry loads in excess of those for which they were designed. Every operating officer will appreciate the expense which would be saved his company if the engineer could permit the heaviest power to run over all his track structures. It is evident, then, that if the engineer can eliminate this one, and in the majority of cases the greatest, element of uncertainty, he will be enabled to decide this question with much more assurance. The very fact that failures from overloading of bridges have been almost unheard of is evidence that provision for the unknown forces hitherto has been ample; and it is fair to conclude that a less provision might be made in many cases, with resultant economy.

When asked to appropriate funds for a purpose of this sort, railroad managers are apt to require some assurance that the work will be well done, and when done will be of value. The carrying on of a series of experiments of this sort is best done by a committee of an association such as the one proposing it. Composed mainly of engineers whose whole practice is in railroad problems, who are familiar with the conditions of railroad operation and are representative of all sections, any work of this character which they do is bound to be valuable. The committee to which it is proposed to entrust these experiments is by no means of one mind on the question of impact. This in itself is strongly indicative of the lack of precise knowledge of the subject and will, moreover, insure that any work done and any values deduced will not be laid before the association and the profession until they have been pretty thoroughly scrutinized. The presence on the committee of Professor Turneaure, of the University of Wisconsin, who has done more of this sort of work than any one else in the country, will go far to insure that thoroughly scientific methods will be employed.

It is stated by Mr. Kelley that during the past year a new recording extensometer has been devised which is free from many of the defects of earlier instruments. Those who have worked on the problem will appreciate the extent of the progress achieved by the construction of this apparatus when it is understood that it is practically free from instrumental vibration, and that deformation curves obtained from locomotives at high speeds are almost as smooth as those taken at lower speeds.

Knowing the things outlined above, the railroads of this country should feel that they can well afford to supply the funds to make these experiments, especially since, in comparison with the scientific importance of the subject and the economic results it is expected to yield, the cost will be extremely small.

MODERN METHODS OF RAILROAD BUILDING.

During the present generation, the methods of railroad location have undergone a complete change. This has been caused not so much by the increase of skill on the part of the engineer as by the improvements that have been made in the methods of construction and the realization on the part of promoters and builders of the intimate connection existing between the cost of that construction and the cost of operation. Early railroad location followed the lines of least constructional resistance, and apparently but little thought was paid to the extra cost of operation involved by heavy grades and sharp curves. Or, if these things were considered, an easy location was necessitated by the limited resources available for moving material. When the hand shovel and the cart were all that could be obtained, a deep cut, a high fill or a long overhaul were more serious objections to a low-grade line than they are in these days of the steam shovel and locomotive haulage. So location has progressed with the facilities available for construction, and work is undertaken to-day with a certainty of obtaining satisfactory returns that would have been out of the question a generation ago.

It is due to this progress that much of the relocation and straightening of old lines have been undertaken. Roads that were built in the days when every shovelful of earth to be moved had to be carefully considered, and upon which an enormous traffic has subsequently been developed, have found themselves hampered in operation by curves and grades which these new conditions required should be removed. On the other hand, new roads have been projected and built on a location and through a country that would have offered insuperable difficulties under the old regime.

Examples of these two conditions are becoming more and more frequent in this country, but perhaps there are none more pronounced than the two that are set forth in this issue. Starting in the low ground of eastern Virginia, the Norfolk & Western has wormed its way across the country to the mountains, and by climbing their summit and following the flow of the streams has reached the Ohio. Much of the work in the early days was tentative, with nothing in sight ahead but the local traffic of the towns it touched, so that no long extensions were made until the railroad was well into West Virginia and a western outlet became desirable. But the purity of the coal found in the region which it tapped doubled and trebled its traffic by leaps and bounds with the result that it was hampered and clogged by its own prosperity. The result of this has been the inauguration of a series of improvements extending over a number of years in which many miles of line have been rebuilt, and in which a great deal of curvature has been eliminated, accompanied, in some cases, by a notable reduction of grade. In this there has not been so great a reduction of distance as might have been expected from the amount of track that has been built, so that the remuneration for the investment will have to be found solely in the added speed of trains and the general lessening of the obstacles to transportation by which the capacity of the road can be increased. The increased traffic calls also for increased terminal facilities at division points where extensive yards are being built that involve the removal of large quantities of material on account of the natural topography of the ground where they are located. Hills have been leveled and valleys filled to such an extent that it is impossible to judge from the final appearance the amount of work that has been done. This is the example of the betterment of a road, otherwise in prime physical condition, that was built under the old regime but which demanded that these changes should be made so as to bring it up to modern standards and requirements.

In contrast with this condition and yet paralleling it in the results, we have the building of the Tidewater-Deepwater, which is a notable example of the modern spirit of location, that sets a grade and a rate of curvature in the quiet of the office; that makes a careful study of the country's topography before a party is put into the field; that works over the feasibility of the line in seclusion, and determines where it is worth while to make surveys; and, then, having settled these points, investigates and maps the country with a completeness that gives such a broad and comprehensive view of the situation that there is no gainsaying the contention that the best location the country affords has been secured. It is short, direct, and within the arbitrary limits of grade and curvature that have been set, and is a marked illustration of the value of extensive topographical work, so strongly urged by a book reviewed not long since. Such work costs more to prepare, and it is apt to cost more to execute than that where a single preliminary is run which is afterwards adopted for location. This is not a case of pig-headed persistence in a course that has been adopted simply because it has been adopted, but a cold-blooded calculation that the expenditure of so many dollars and cents will pay a certain definite interest on the investment. Where such work as this is done, the relation existing between the cost of building and the cost of operation is never lost sight of, and where a decrease of the one is possible, there is no hesitation about increasing the other.

Aside from the engineering features, the building of this new low-grade line from the West Virginia mountains to the sea offers a notable example of advanced railroad practice in that the line is built from a coal territory where few mines have been opened, with an absolute disregard of all local traffic, and with the courage of the conviction that when the facilities are offered the mines will be operated and the product offered for movement in quantities sufficient to warrant the outlay in the preparation.

In such work as that exemplified by the two roads under consideration we have, side by side, the spirit of the new railroad construction and that which has been born of the requirements of great traffic on a road built by a past generation. Of course such

work of improvement, and such construction would hardly be warranted where light trains and few of them were to be run. This will hold for many roads in remote communities where nothing but a light local traffic can ever be expected, but, as roads develop some such betterment as is outlined may be expected to come in for the old roads, while, for the new, the idea of coupling the estimates of future possibilities with present first cost and making the second dependent upon the first has become a well established economic principle.

RAILROAD TRACK SUPERSTRUCTURE.

In 1894 some experiments were conducted on railroad track, under the direction of the commanding officer of the Watertown Arsenal, to determine the actual stresses in rails under service conditions, and the results were contained in the annual report of the Chief of Ordnance for 1895. Dr. P. H. Dudley, connected with the New York Central Lines, has also made tests with an instrument called the "stremmatograph," which he devised, to show the depression of the track below the trackman's surface, and the stresses in the rails, and some of his results were presented to the International Railway Congress at Washington in 1905. But railroad literature dealing with the stresses in cross ties is scant. Mr. S. Whinery has made certain calculations, given in the November 4, 1904, issue of the *Railroad Gazette*, but it has remained for Mr. G. Cuënot, Chief Engineer Ponts et Chaussées, Service Ordinaire et Hydraulique du Département des Deux-Sèvres, and connected with the Board of Control of the Paris, Lyon & Méditerranée Railway to present the results of actual tests made to determine the strength of different kinds of cross ties, and at the same time deduce from them the proper length, in his opinion, to be given to cross ties, and the extent of the tamped bed under them to produce the best track.

The American Railway Engineering & Maintenance of Way Association has been considering, by committee, this very problem for the past two years, without very satisfactory results. The different opinions are usually based on the practice under which the individuals expressing them have grown up. Those who have been familiar with the use of 8½-ft. ties are opposed to diminishing the length, while on the contrary, those who have been using 8-ft. ties consider it unnecessary to make any change, and it is usually found that just as heavy equipment, and just as large axle loads are run over the one as the other. Therefore, when we saw Mr. Cuënot's book on the subject, it seemed to us that it had been published just at the right time. It matters not whether we agree with his views; there is, nevertheless, a lesson to be learned by the railroad engineers of the United States, in the manner of attacking a problem of this kind. All real knowledge comes from trained observation and experiment. Our railroad engineers have been usually too busy in the past to give the required attention to experimental work, but we think we notice a gradual progression in that line. The severe conditions of modern traffic require a very intelligent consideration of the foundations for supporting it, and some engineers have begun advocating an entirely new track substructure. Owing to the prevalent use of concrete, some of them propose that material, but it is a fact, up to the present time, that concrete has not proved to be a very suitable material for a cross tie.

Mr. O. E. Selby, Engineer of Bridges and Structures of the Cleveland, Cincinnati, Chicago & St. Louis, has made a beginning in the right direction in his "Study of the Stresses Existing in Track Superstructure and Rational Design Based Thereon," published in Bulletin No. 80 of the American Railway Engineering and Maintenance of Way Association, but so far it is theoretical only; it has not been backed up by a "figure or a number," determined by experiment, to quote Mr. Cuënot's own words. To illustrate: Mr. Selby has calculated the maximum fiber stress in rails for the usual span of ties. In the Ordnance Department report above referred to, Mr. Howard calculated the equivalent free span corresponding to the observed fiber stresses, and found "that the equivalent span has a value much lower than the distance from center to center of ties in some cases and a much greater value in others. The cases in which the equivalent span is greater than the distance from center to center of ties are the ones generally caused by the outside wheels of the locomotives, or wheels next a wide unloaded space on the rail," that is, the first pair of wheels of the pilot truck and the rear wheels of the tender. Taking a particular case, at 100-lb. rail, where the measured distance from center to center of ties was 26 in., the equivalent span for the first pilot wheel was 37.7 in., for the drivers 26.8 and 26.6 in., respectively; for the first three wheels of the tender each 19.0 in., and for the rear wheels 38.0 in.

Mr. Howard therefore concludes: "So different are the computed spans based on the measured strains from the spacing of the ties that it would evidently be impracticable to compute the fiber stresses in the rail from the data furnished by the dimensions of the rail, the spacing of the ties, and the load on the wheels, at least taking rails as they exist in ordinary track."

On account, therefore, of Mr. Cuënot's researches into the problem of the right length to be given to cross ties, and the proper extent of the tamped bed, together with the description of his apparatus for making the tests, we have arranged with him for the rights to introduce his book in English to our English speaking readers, and the entire work will appear in the columns of the *Railroad Gazette*.

Our readers will find the author's deductions on the proper length to be given to a cross tie rather hard to accept, as his views are so much at variance with accepted American practice, but it is hoped that the subject will be taken up experimentally by our American engineers in order to obtain data under the conditions existing in this country. American railroads have locomotives with axle loads of 61,600 lbs. against 40,000 lbs. in French practice.

Apart from the length of it, there seems to us to be considerable merit in the design of Mr. Michel's composite cross tie, which is described in this book, and it is commended to the serious attention of American railroad engineers for experimental purposes. Of course it is now rather expensive as compared with our wood cross ties, but it is not to be forgotten that their price is annually creeping upward. The question of the cross tie of the future is a very grave one for the railroads to solve, and, as a sign of its near approach, we find new designs and materials for ties being constantly introduced for experimental purposes. Mr. Cuënot, in his book, condemns the steel tie of inverted trough pattern, and experience with them in this country, both on the Pennsylvania and the New York Central, lead to the same conclusion. Not long ago a short trial of the trough pattern turned rightside up like a basin on the Pennsylvania Lines West led to its rejection, so that there does not seem to be any future at all for the trough pattern, unless indeed it is made much heavier than now, in which event it will be very costly.

The apparatus used by Mr. Cuënot for making his tests is quite simple, which ought to be an inducement to others to make similar studies. One of the novelties in connection with his work is the use of the camera to record the track depressions during the passage of a freight train. The results are illustrated in one of the plates. Besides his studies on the proper length to be given to cross ties, as outlined above, Mr. Cuënot has furnished other interesting and valuable information. His information with reference to the amount of creosoting to be given to different species of woods is valuable to our engineers on account of their increased attention to the subject during the last few years. Practical experience gained by others is always valuable, and saves us to a certain extent from going over explored ground, which has been found valueless.

In connection with this topic, his information on the seasoning of timber is of interest and value. The use of treenails in connection with wood cross ties, to repair holes which have become worn by the action of the fastenings, has been somewhat advocated in this country, on account of their considerable use in France, and it is therefore profitable to learn intimately about their use, instead of having a vague idea. Mr. Cuënot tells us of some points in connection with their employment, especially in the case of the wooden ones of the Collet system, which the railroad men might otherwise have been a long time in finding out from their own experience, for, unfortunately, it takes a long time to carry on an experiment in almost everything connected with railroad work.

There is one practice which seems, from Mr. Cuënot's work, to be common in France, which will hardly be accepted by American engineers, viz., that of placing hoop iron shims between the splice bars and the rails to bring them to a more even bearing. It is not clear to us how they can be made to stay in place, so as to be effective. It is possible he only used these in his experimental work, but his language leads us to infer that it is common practice. There is hardly any doubt that the use of screw spikes in this country is going to grow, probably in the near future. There is demand for a better track superstructure, and one that is more stable in its position on the roadbed, so as to reduce the maintenance cost. Those roads especially which are making extensive use of preserved woods for cross ties will find it absolutely neces-

sary to use screw fastenings, or else they will not reap the full benefit from the preservative treatment. They will lose money on the investment, for the ties will be spike killed before they are decayed.

The same is true in the case of long lived untreated woods, softer than white oak, like cedar and catalpa. Only screw fastenings should be used in them, in order to reap the full benefit of their durability. Mr. Cuënot's book, however, teaches us that we must not expect a perfect fastening even in the case of the screw spike. It is acted upon by adverse forces, especially when the ties are not properly tamped up to their work, and is subjected to being torn out, and to gradually working loose. These evils have to be fought against in their case, as in the case of common spikes, but not to the same extent. Mr. Cuënot presents some data with reference to the force required to pull them out of different species of woods, and also the force of loosening. We have recently had data similar to the first published in this country, both by the United States Government and by the Engineering Experiment Station of the University of Illinois.

Mr. Cuënot recognizes that the joint is the weakest place in the track, and he deduces from his experiments that the proper way to strengthen it is to place a tie directly under the center of the joint, and bring the adjacent ties on each side as close to it as is consistent with good tamping. He will find many in this country to agree with him, and many who will not, as some railroads have adopted the supported joint as standard, while others have adhered to the suspended joint. It is true that equally as good track has been maintained with the one as with the other, but can any one say which company does it with the least expense? Does it cost more to maintain first class track with the suspended than with the supported joint, all other conditions being the same? That is at present a question impossible to answer. To arrive at an approximately correct reply would require just such careful and painstaking experimental work as Mr. Cuënot has given us an example of in his new book, which is the subject of these remarks.

This study has been presented to the French Academy of Sciences.

STRESSES IN TRACKS ON CURVES.

It is believed that we shall soon be able to present observed facts obtained by accurate measurements of the radial stresses produced in curved track by cars and locomotives of different weights and wheel bases moving at different speeds. This has never before been obtained. But it also seems to be true that these stresses have not been, until now, theoretically calculated, and, therefore, the following study is made, subject to all the modifications due to the disturbing forces which occur in practice.

Track on tangents is normally subjected to vertical stresses

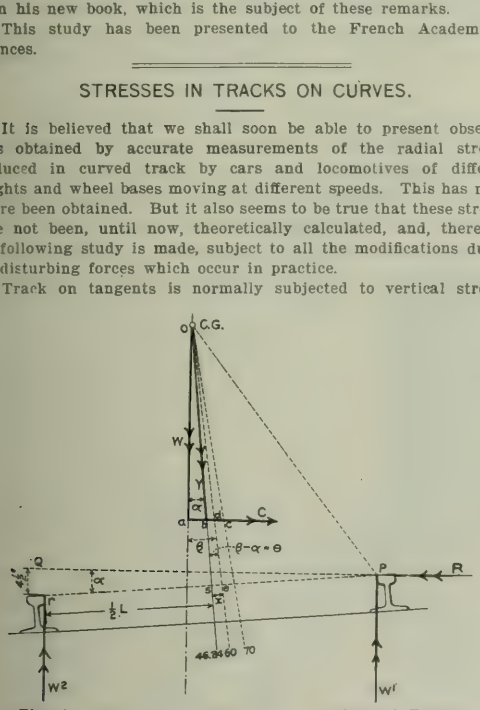


Fig. 1—Diagram of Vertical and Horizontal Forces.

only. On curves it is subjected to the same vertical loads, and in addition to horizontal thrusts arising from two causes, centrifugal force and the forces arising from the tendency of the truck to continue in a straight line. This thrust is resisted by the friction of the base of the rail on the ties or tie plate and by the shearing strength of the spikes. The magnitude of the forces acting and the resistance offered to displacement of the outer rail are both capable of mathematical demonstration. Having all the necessary data at hand in the case of the recent New York Central derailment, the following discussion will be based on the conditions obtaining there.

On the evening of February 16, 1907, an electric express train was derailed near Williamsbridge. The train consisted of two of the new electric locomotives and five cars. The front pony truck and the four pairs of driving wheels of the leading locomotive remained on the rails when the train came to a stop, but its rear pony truck was derailed. All the evidence seems to point to the conclusion that the direct cause of the derailment was some failure of the track due to obstruction or weakness occurring immediately after the first locomotive passed.

The curve at this point is 3 deg. 5 min. and had a superelevation of 4½ in. with a gage of 4 ft. 8¾ in. The rails were the Dudley section, 100 lbs. to the yard and 6 in. high, laid on tie plates on oak and pine ties spaced 21½ in. apart center to center and bedded in stone ballast. Each tie plate was secured with two spikes ⅝ in. x 7/16 in. x 5¾ in.

The electric locomotives at the head of the train weigh 189,000 lbs., of which 137,000 lbs. is on four pairs of drivers. The two-wheel radial pony trucks have spring centering devices and carry

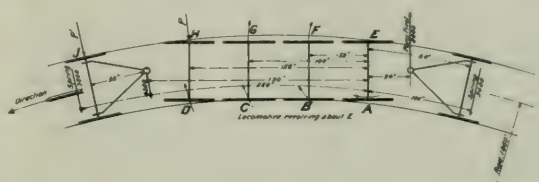


Fig. 2—Diagram of Track Stresses Under Electric Locomotive.

26,000 lbs. each. The rigid driving wheel base is 13 ft. and the total wheel base 27 ft. The height of the center of gravity of the locomotives is 44 in. above the top of the rails.

Referring to the diagram, Figure 1, which is laid out to suit the conditions above outlined. The angle q p r = a is the angle of superelevation measured from center to center of rail heads. The criterion that the effect of the superelevation shall exactly balance the centrifugal force is met when the resultant Y of the centrifugal force C and the weight W intersects the plane of the top of rails at the center s. The balanced speed can be found by the formula $\tan a = \frac{V^2}{gZ}$ in which V is the velocity in ft. per sec., g is the force of gravity = 32.166 and Z is the radius of the curve in feet. At any higher speed there is an excess of centrifugal force which resolves itself into a horizontal thrust R against the outer rail. From the formula $C = \frac{WV^2}{gZ}$ we can obtain the centrifugal force at the balanced speed, and for any higher speed the thrust R is the difference between the centrifugal force at that speed and the centrifugal force at the balanced speed.

Laying out to any convenient scale, the values of C and the weight W, the triangles of forces oab, oad, etc., are formed. The resultant force Y = o b, o d, etc., intersects the plane of the rails at s and e, etc. The value of the side thrust R is represented graphically to scale by a d — a b. From similar trianges the angle r p q or the angle of superelevation a = angle a o b. Therefore $\tan a = \frac{a\,b}{a\,o}$. The tangent of angle a o d or $\beta = \frac{a\,d}{a\,o}$ and the tangent of $\beta - a$ or $\theta = \frac{s\,e}{s\,o}$. Let s e = x. The distance s o is the height of the center of gravity above the rails or h. Solving for x we have x = h tan θ. The numerical value of $Y = \sqrt{W^2 + C^2}$. Taking now the summation of moments about the inner rail at the point r we have $\Sigma M = Y(\frac{1}{2}L + x) - W_1 L - R \times$ (superelevation E) which for equilibrium = O. Solving for $W_1 = \frac{Y(\frac{1}{2}L + x) - RE}{L}$. Similarly W_2, the reaction on the inner rail can be found by summation of moments about p, from which $W_2 = \frac{Y(\frac{1}{2}L - x)}{L}$.

Wellington in discussing the mechanics of curve resistance* points out that when a four-wheel truck moves around a curve the front outer wheel only presses against the rail and that the other wheels exert no outward lateral pressure on the rails due to change of direction alone. We have here to deal with a more complicated

*Economics of Railway Location, p. 282.

vehicle having radial front and rear pony trucks with spring centering devices and a rigid eight-wheel truck formed by the drivers. In rounding a curve the wheels would probably assume the positions shown on the diagram, Fig. 2. They are guided by the flange pressure P^1 on the outer wheel of the front pony truck and by the pressure P on the front outer driver. The locomotive as a whole would pivot about either E or F, and it can be shown by the theory of least work that it would pivot about E in the case under consideration. Driving wheels A, B, C and D would slip laterally inward and longitudinally backward due to the smaller radius. Wheels H, G and F would slip laterally but the slip would be self-contained at H and would not produce pressure on the rail. The front pony truck is pivoted to the main frame 50 in. back of the axle and the centering spring is attached 16 in. in front of the axle. The amount of the deflection can readily be calculated and the corresponding pressure on the centering spring and the resulting pressure on the pivot can be found. For the case under consideration the values are as shown on the diagram. The pressures exerted by the rear pony truck can also be found in a similar manner.

The force necessary to produce slipping of the wheels on the rails is the product of the coefficient of friction between wheel and rail and the actual wheel loads at any given speed already determined. The usual coefficient of friction of 0.25 is perhaps high since the surfaces are moving over each other at high speeds, but it should be used to give the maximum forces. If now we take the summation of moments about E of all the forces acting, including the spring and pivot pressures of the front and rear pony trucks and place it equal to zero we have an equation which can be solved for P, the pressure against the rail at H. This equation would be of the form

$$P = \frac{52\,F + 104\,G + 60\,A + K^1\,B + K^2\,C + K^3\,D + 100\,(3{,}400) - 34\,(3000) - 190\,(4{,}200) - 256\,(3{,}800)}{156.}$$

K^1, K^2 and K^3 are the diagonal distances of the different wheel contacts from E.

From the position assumed by the driving wheels it will be seen that the flanges of the front and rear outer drivers only press outward against the rail. The unbalanced centrifugal force R already found is resisted by the pressure on these two driving wheels since the truck wheels are held against the rails only by spring pressure. The total thrust at H therefore is P + ½ R. To allow for impact the amount of the thrust due to centrifugal force ½ R should be increased by one-half so that the total thrust would be P + ¾ R.

The resistance to this outward thrust is that offered by the friction between the rail and the tie plates and the shearing strength of the spikes. The friction is the wheel load at any speed multiplied by the coefficient of friction 0.25. The shear on the spikes is evidently = P + ¾ R — Friction. This shear is divided between at least two spikes so that the shear in any one spike is

$$\frac{P + \frac{3}{4}\,R - F.}{2}$$

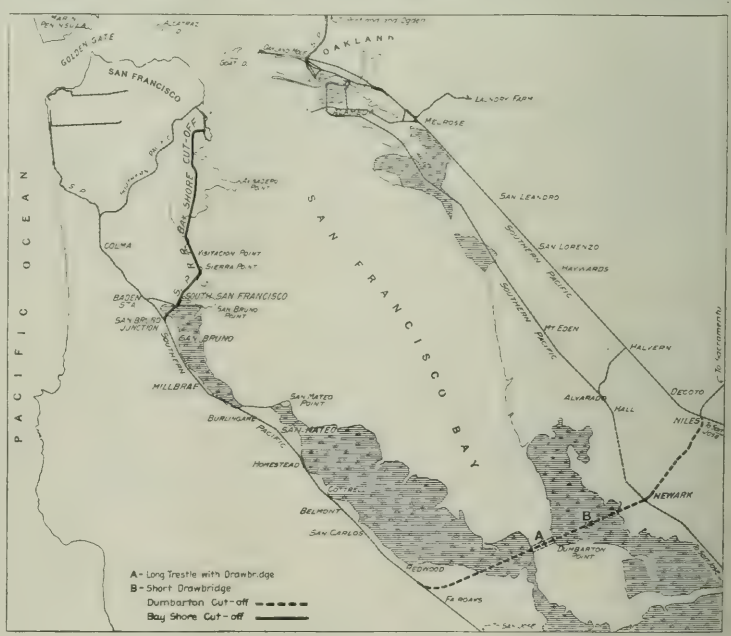
The engineers of the New York Central have made calculations of the stresses developed in the track by electric locomotives and by Atlantic (4-4-2) type steam locomotives which will be printed next week. While the above analysis was made independently and without knowledge of the methods employed by them, it is found that the results are very close together, and that with the exception of some slight changes in the form of the equations due to refinements not here considered, the theoretical assumptions must have been identical; but they made no allowance for impact. The complete outline of the calculations is given here because it is believed it is the first attempt to solve the problem of track stresses in curves with mathematical exactness. Wellington discusses the theory of the mechanics of curve resistance fully in the "Economic Theory of Railway Location," but without applying his conclusions to the solution of any problem of this kind.

A New Locomotive for the Northern Railway of France.

The Northern Railway has recently built an exceptionally heavy locomotive for freight service, intended especially for coal trains. It is of a new type and is probably the heaviest in use in Continental Europe. It is a compound machine with an articulated frame, and really consists of two engines connected by a bogie. The cylinders of the two engines take steam from one boiler that is fitted with a firebox of unique design. In other words, the machine has a single evaporating apparatus and a double mechanism. It has a length of more than 52 ft., and its weight in working order rises to what, in France, is considered the "enormous" figure of 231,950 lbs. Each set of engines at the front and rear drives three pair of coupled wheels; while, at the center, the carrying or bogie truck has four wheels, making 16 in all, that are beneath the engine. The tanks and bunkers that are set alongside the boiler will carry 11,000 lbs. of coal and 3,400 gals. of water. It will have a tractive power capable of hauling a train weighing 1,800 metric tons, of which 1,000 tons will be lading. Up to the present time, the heaviest trains that have been hauled do not weigh more than 600 metric tons.—*Le Journal des Transports.*

The Bay Shore and Dumbarton Cut-Offs of the Southern Pacific.

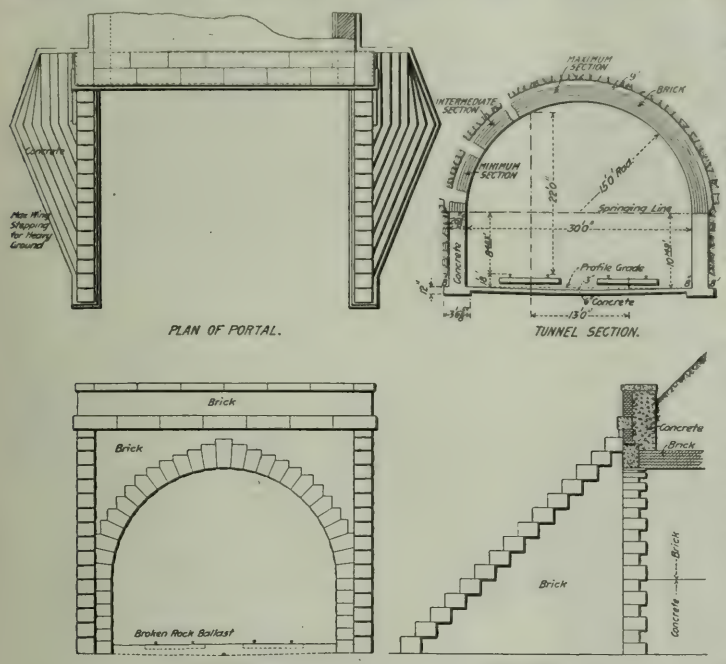
The Bay Shore cut-off of the Southern Pacific, south of San Francisco, begun in 1904, is nearing completion. As stated in a preliminary account of the work in the *Railroad Gazette*, Nov. 18, 1904, the line was built to secure a more direct and easier entrance into San Francisco for the trains of the Coast division. The present line from San Bruno into the city has heavy grades and curves along a narrow right-of-way, and for a considerable part of the distance is through a thickly populated section of San Francisco, the track being laid across blocks and through streets with heavy traffic. The need of conforming to the street grades necessitated the heavy grades and sharp curvature referred to, and helping engines have to be used over parts of the line for both passenger and freight trains. Southbound the maximum grade out of San Francisco through Mission hills to the summit at Ocean View, about five miles, is 158 ft. per mile. Northbound through these hills it is considerably less, 68 ft. per mile. Heavy grades are encountered also in the San Bruno mountains and helper service



Map of Bay Shore and Dumbarton Cut-Offs of the Southern Pacific.

required. Furthermore, the line makes a wide detour to the west, adding about four miles to the air line distance. As the accompanying map shows, the new cut-off is as nearly a direct line between San Bruno and the San Francisco terminus as it was practicable to make it. The actual length of new construction from existing tracks of the Southern Pacific in Seventh street, San Francisco, to junction with the original line at San Bruno, is 9.84 miles. The maximum gradient is three-tenths of 1 per cent., compensated

for curvature, and there are 10 curves, most of which are light. The junction curve at San Bruno is 4 deg. and there is one 2 deg. 54 min. and one 2 deg. curve, the rest being 1 deg. or under. The right-of-way and general design of this railroad are for a four-track line, but it is being built with two main line tracks at present, the remaining two tracks to be added when the volume of traffic warrants it.



Detail of Tunnels and Portals, Southern Pacific Bay Shore Cut-Off.

The bay shore is quite rugged, and to avoid the heavy curvature following the shore line five tunnels, aggregating nearly two miles of double-track bore—about 20 per cent. of the total length of the line—were built. Beginning at the northernmost tunnel, No. 1 is 1,817.3 ft. long through massive serpentine with clay seams. No. 2 is through similar material and 1,086.4 ft. long. No. 3, 2,364 ft. long, is partly through wet sand with seams of clay, and partly through very hard silicated formation. No. 4 is 3,547 ft. long and is mostly through very wet ground with quicksand and clay layers, with part through medium shale. The last, No. 5, 1,133.8 ft. long, is through hard sandstone. Next to the tunnel work the heaviest earthwork was at Visitacion point, where a cut 95 ft. deep, requiring the removal of some 750,000 yds. of material, was made. The excavated material was used in filling the cove north of the cut, known as Visitacion bay, where a large freight terminal will be built, the plans for which were described in the *Railroad Gazette* of January 4, 1907. It will contain complete facilities for receiving, despatching, classification and storage purposes, with division repair shops and a 40-stall roundhouse. It will be the first hump yard to be built in the vicinity of San Francisco, and the second on the Pacific coast, the first being the Southern Pacific yard at Roseville, Cal., built last year.

All of the tunnels were built for double-track. However, No. 2 has had the portal completed for four tracks, as the presence of a city street close to the side reserved for the third and fourth tracks required the construction of a high concrete retaining wall as part of the present work, and the portal for the second bore was therefore built at the same time. With the exception of No. 5, at Sierra point, which was built by cut and cover, the tunnels were taken out around a center core left to support the false timbering, this core being about 18 ft. high and 13 ft. wide. The false timbering was necessary to resist the rock pressure, which in some places was extremely heavy. The timbering was supported from the core by diagonal and vertical posts. In making the excavation, two bottom drifts about 8 ft. by 7 ft. were first driven on each side of the center core, followed by two drifts immediately over the first two and of about the same dimensions. These were followed by a heading drift between top of core and crown of excavation, the intermediate material between the upper side drifts and this heading drift being taken out last of all. All of the excavated material was removed through the bottom drifts, to which it was delivered from above by suitable chutes. The average progress in each end of each tunnel was a little over 4 ft. a day, or approximately 8 ft. a day total progress. The tunnel excavation of maximum section, including an assumption of 6 in. all around the masonry, was approximately 32.2 cu. yds. per lineal foot. No power drills were used except in the extra hard rock in tunnel No. 3.

The tunnel side walls and invert are of concrete, and the arch of brick. The latter has three different thicknesses of section according to the material passed through, as shown by the accompanying drawings of tunnel details. The packing between tunnel lining and natural material is in some cases broken rock and in some cases concrete, likewise depending on the nature of this material and the consequent overhead pressure. The centering for the brick arch was formed of steeel I-beams, 10 in. deep, joined at the crown. The portals are made of common hard-burned red brick, with buff sandstone trimmings. The portals are not adjusted to the present surface of the ground, but to the surface as it will be when the city streets and included property are graded to official city grades.

The series of photographic views shown illustrate the methods of tunnel construction and the appearance of the portals. One shows the five drifts already referred to, the top heading having just been begun. This is the north end of tunnel No. 3 and is an example of the application of the process to very bad ground. Another shows a view of the timbering for this same tunnel and the steel I-beam centers for the brick arch, taken two months after the preceding view. A detail view of the interior timbering from the springing line up and of the I-beam centers is also shown,



Completed Arch, I-Beam Centers and Top of Center Core.

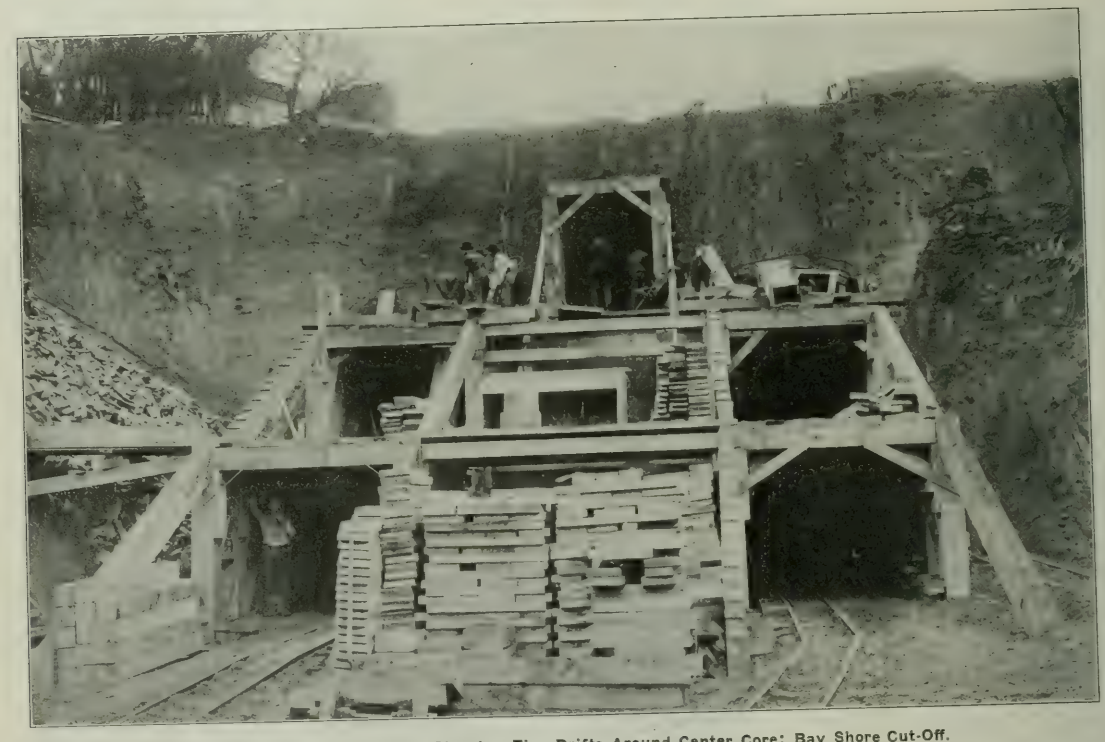
the centers being footed on sand boxes just above the springing line. One of the views shows the center core and completed brick arch, and further along the lagging and I-beam centers. There is a view of the traveler used for hoisting brick and mortar, concrete material and other material, by electric hoist, to run out on the

track on top of the center core and the tracks to the several drifts. The south end of tunnel No. 4 is shown with contact between masonry portal and earth excavation made by hand-laid dry rubble. The north end of tunnel No. 2, with double portal, is shown in another photograph, the concrete retaining wall referred to being on the right. The other side has an ordinary wing. There is also a view of another special portal—the north end of tunnel No. 1—which has on one side a concrete retaining wall 55 ft. high. The bridge in the foreground carries Mariposa street over the new tracks, and just beyond the bridge is seen a girder crossing for a steam road.

The Bay Shore cut-off is to be ready for service in the fall, and part of the freight terminal by the end of the year. The entire work, which was planned under the supervision of William Hood, Chief Engineer of the Southern Pacific, is being carried out under the immediate direction of W. E. Marsh, Assistant Engineer. Most of the grading and tunnels Nos. 2 and 4, were done by contract. The remaining tunnels, and all other work, were done by company forces under Mr. Marsh.

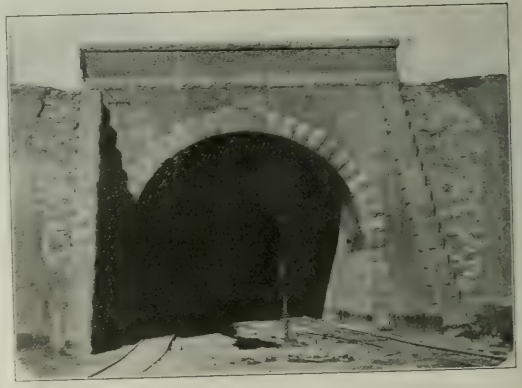


North End of Tunnel No. 2; Bay Shore Cut-Off.



North End of Tunnel No. 3, Showing Five Drifts Around Center Core; Bay Shore Cut-Off.

The Dumbarton cut-off, also shown on the map, is to bring the lines on the Oakland side of the bay into close communication with the San Francisco terminals. Work on this is just being begun. The line from Portland, Ore., and the line from Ogden, Utah, as well as a number of local lines now run to Oakland, whence freight must be transferred by car ferries to San Francisco or sent south around San Francisco bay by a "wish-bone" route via San Jose nearly 100 miles long. The Dumbarton cut-off is to run from Niles, which is about 25 miles southwest of Oakland on the easternmost of two parallel Southern Pacific lines running south to San Jose, via Newark on the western of these two lines, to Redwood City on the direct San Francisco line of the Southern Pacific. From Niles to Newark is five miles and from Newark to Redwood City 11 miles, making the total length of the new cut-off 16 miles. As will be observed by the map, the southern end of San Francisco bay is lined with tidal flats. The cut-off strikes these marshes almost immediately after leaving Newark. Over them on both sides of the bay a great deal of filling will have to be done. On the



South End of Tunnel No. 4.

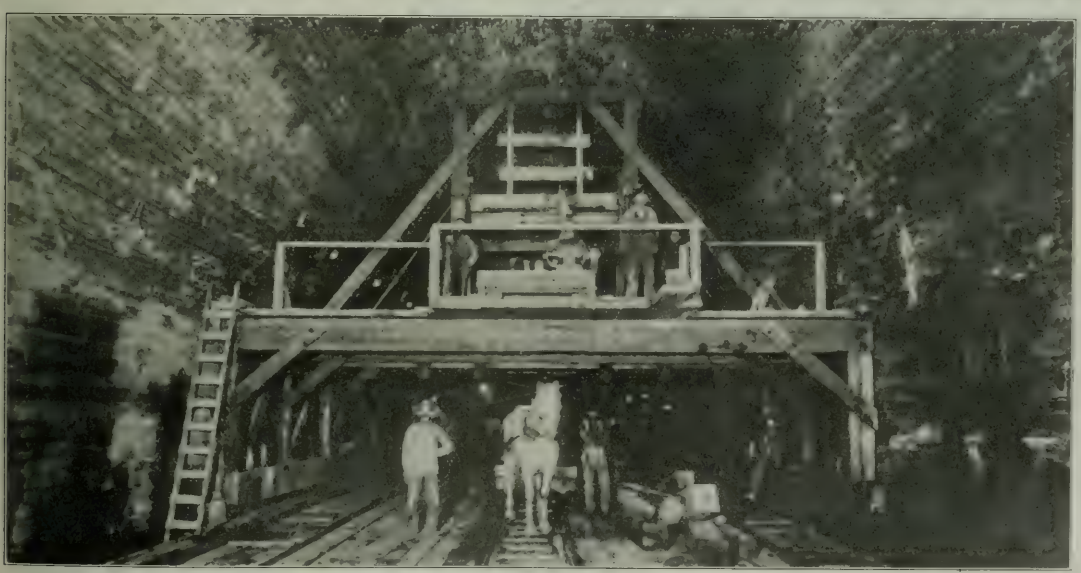
eastern side of the bay over Newark slough there will be a double-track steel drawbridge 182 ft. over all, supported on a central pivot pier with a short trestle approach at each end. Two miles west of this bridge will be a great double-track steel drawbridge from Potrero or Dumbarton point across the deep water of the bay to the western shore near Ravenswood point. The eastern approach is to be 1,145 ft. of ballast deck trestle work. The drawbridge will be 130 ft. over all with 155 ft. radius. It is to give a clear space of 125 ft. on each side of the central column support. The center



Mariposa Street Bridge; Bay Shore Cut-Off.

pier will be a circular iron, 40-ft. caisson filled with concrete. The depth of water is about 70 ft. at the draw. The trestle approach on the west side of the drawbridge is to be 5,500 ft. long, making the total length of the bridge, including the draw span, 6,955 ft. The trestle will be of heavy construction with six-pile bents, 15 ft. between centers. The bents will be surmounted by heavy caps and stringers. Rock and gravel filling will be used for most of the trestle.

With completion of these two cut-offs and the proposed Bay Shore yards, the Southern Pacific's terminal facilities on San Francisco bay will be greatly unified and improved. It will be possible to run freight cars from any one of the through lines from the south, east or north directly into the city of San Francisco. On through freight from Ogden for instance, which constitutes a most important part of the through traffic to San Francisco, there will be a saving by the new cut-off of nearly 50 miles and two car ferry transfers, one across the straits of Carquinez, the other across San Francisco bay.



Electric Hoist Traveler; Bay Shore Cut-Off.

The Schlemmer Case.

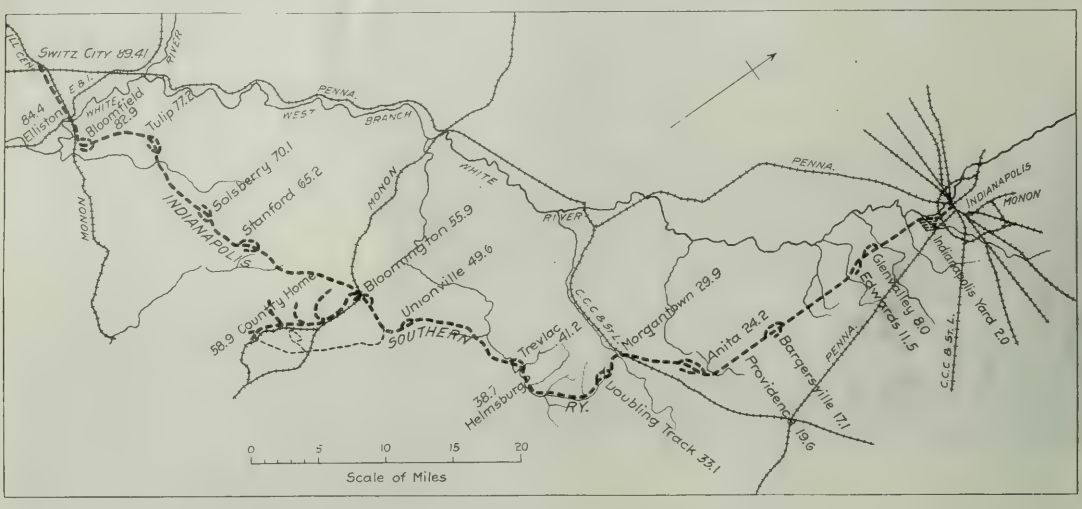
The Supreme Court of the United States has handed down a decision sustaining that clause of the Safety Appliance Law (Sec. 8), under which an employee injured in coupling cars not equipped according to law is not to be deemed to have assumed the risk of working with the deficient or defective equipment even if he continues at work after he knows of the defect or deficiency. The case was that of Catherine Schlemmer against the Buffalo, Rochester & Pittsburg Railway. The plaintiff, Catherine Schlemmer, sued in the State courts of Pennsylvania to recover damages for the killing of her husband, a brakeman, killed while endeavoring to couple together two cars which had not been equipped with automatic couplings. He had to go between the ends of the cars and crouch down below the level of the platform of the rear car, which was being propelled slowly along the tracks by the engine. Through no fault of his own he failed to make the desired coupling, and the cars came together, crushing Schlemmer's head between them.

The trial judge directed the jury to return a verdict for the railroad on the ground that the Safety Appliance Laws in question had no application to the case, and that if they did Schlemmer had been guilty of contributory negligence, which would bar him from making a recovery, because while making the coupling he had raised his head too high, though warned by the yard conductor, who was superintending the making up of the train, to keep it down. This ruling on appeal was affirmed by the Supreme Court of Pennsylvania, although it was urged in that court, as it had been in the trial court, that the injury which Schlemmer suffered was a risk incident to the coupling of cars not fitted with automatic couplings, and that the Federal Safety Appliance Laws expressly declared that a railroad employee who was injured by any such car when used in interstate commerce should not be deemed to have assumed such risks.

The Supreme Court of the United States, by a vote of five to four, has now reversed the judgment of the Supreme Court of Pennsylvania and remanded the case for a new trial, holding that under the circumstances disclosed by the evidence the Safety Appliance Laws in question should have been given effect by leaving the question of the alleged contributory negligence of the deceased to the determination of the jury. The Brotherhood of Railroad Trainmen furnished the funds for printing the record and briefs, and Secretary Moseley, of the Interstate Commerce Commission, aided by F. D. McKenney and L. M. Walter presented the case before the Supreme Court.

The Indianapolis Southern Railroad.

The Indianapolis Southern Railroad is a consolidation of the Indianapolis Southern Railway, recently built between Indianapolis and Switz City, Ind., and the Effingham district of the Illinois Central Railroad, extending from Switz City, Ind., to Effingham, Ill.

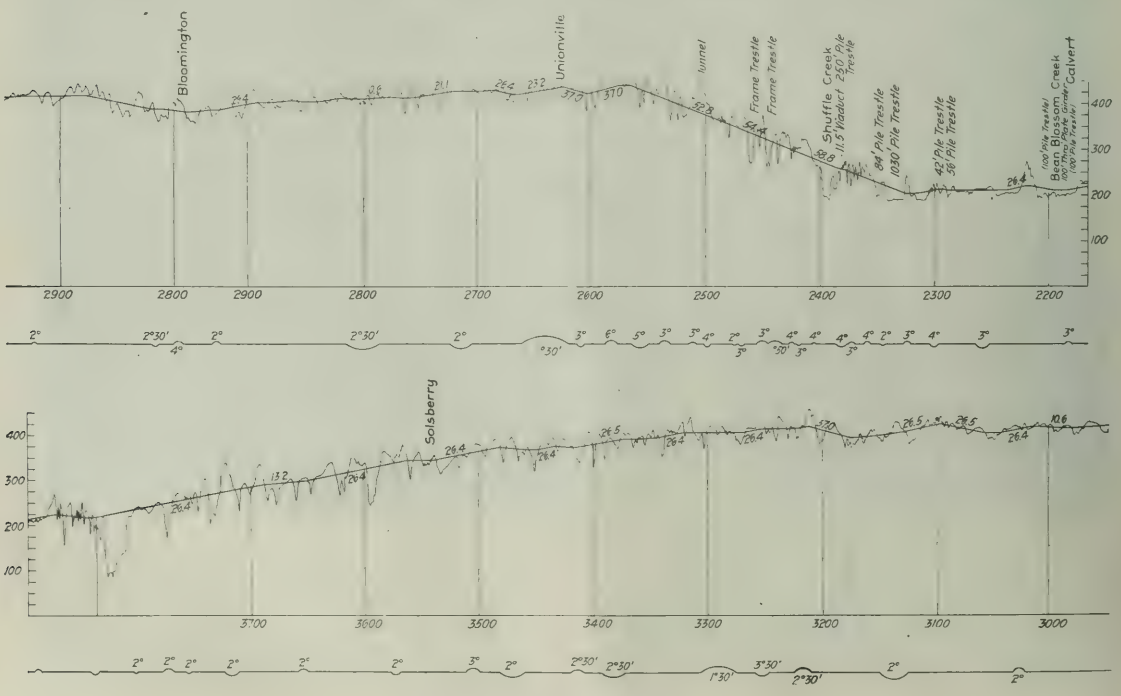


Sketch Map of the Northern Part of the Indianapolis Southern.

For convenience of description, that portion of the consolidated line formerly a part of the Illinois Central will be designated as the Effingham district, and the Indianapolis Southern Railway as the Indianapolis district.

The line between Switz City and Effingham has been in operation for some time. It is 88.51 miles long and as originally built was of the cheapest construction, alinement and grade both being sacrificed to secure a line of railroad capable of operation for light traffic at a minimum construction cost. Under the consolidation it is proposed to place this district on such a physical basis as to secure a minimum cost of operation and maintenance. The grades between Switz City and Palestine are now being reduced to a maximum of one-half of 1 per cent., compensated .04 per cent. per degree of curvature, with an additional compensation of one-tenth of 1 per cent. for a distance of one-half mile each way from passing-siding stations. The maximum curve will be 4 deg. and all curves of 2 deg. or more are to hape spiral approaches. The bridges will be built to carry Cooper's E-50 loading. The track will be laid with 75-lb. rail with 12 in. of ballast, and additional passing sidings will be built to provide facilities for handling a large increase in business, this constituting the heaviest part of the reconstruction. This work is expected to be completed and ready for operation June 1, 1907, and it is hoped to have the remainder of the district in first class condition before the close of the present year.

The Indianapolis Southern Railway—the Indianapolis district—extending from Indianapolis to Switz City, a distance of 89.23 miles,



Profile of the Indianapolis Southern.



Passenger Station at Bloomington; Indianapolis Southern.

was organized and financed at the outset by local capitalists and manufacturers of Indianapolis. The promoters of the enterprise felt the need primarily of placing the capital city of Indiana on a direct line of transportation to the shale and clay deposits of Brown, Monroe and Greene counties, the unexcelled oolitic stone formation in Monroe and Lawrence counties, and the immensely valuable coal fields in Greene and Sullivan counties; and, secondarily, to provide additional facilities for the movement of manufactured products from that rapidly developing industrial center. The original plan contemplated the construction of a railroad 111 miles long, whose main line would extend from Indianapolis south through Marion, Johnson and Morgan counties, and southwest through Brown, Monroe, Greene and Sullivan counties to Sullivan, and also provided for the necessary branch line construction to reach the accessible mineral deposits.

Building was begun in October, 1903, and in the summer of 1904 a part of the north 50 miles was graded. But the promoters of the project encountered financial difficulties, the result of which was the acquirement of its control by the Illinois Central and the consolidation with the Effingham-Switz City line, or Effingham district. The westerly terminus of the new line was accordingly changed to Switz City, which effected a saving of 22 miles of construction over that originally planned with the westerly terminus at Sullivan.

The new owners immediately made careful surveys to secure a reduction in gradient from a maximum of 1 per cent. uncompensated, to one-half of 1 per cent. compensated, to eliminate excessive curvature and reduce the total rise and fall of grade line over those portions of the line where grading was not well under way. The country adjacent to the westerly half of the line was carefully exploited and a location worked out which showed that a new line with one-half the maximum grades, less curvature, one-half the rise and fall of grade line, and a shortening of three miles in distance, could be built, and at no increase in cost over the original plan. The new location was such as to render useless three miles of completed work and a partially completed tunnel, but it likewise avoided the construction of 3,900 ft. of tunnel through the city of Bloomington, and a very costly viaduct construction north of Bloomington over Hinckle creek. The new location caused a suspension in actual construction



Richland Creek Viaduct, near Bloomfield, Ind., 2,215 Ft. Long.



Bridge Over the White River; Indianapolis Southern.

until May, 1905. The whole line was completed and put in operation last December.

From Indianapolis to Morgantown, a distance of 30 miles, the line traverses the gently undulating valley of White river and crosses the lower courses of several of its tributaries. This region has been smoothed over by glacial action, has no abrupt breaks in the surface and yields to easy alinement and low gradients at a reasonable cost per mile. From Morgantown to Shuffle creek, a distance of 14 miles, the line crosses the water-shed between Indian creek on the north and Bean Blossom and Shuffle creeks on the south. The Indian creek approach to the summit is rough and broken and required heavy construction for 1 per cent. maximum grades, whereas the Bean Blossom and Shuffle creek approach presented no difficult or heavy work for one-half of 1 per cent. grades.

The middle portion of the line from Unionville, 49 miles from Indianapolis, to Stanford, a distance of 17 miles, occupies the Bloomington plateau, which is approximately 250 ft. higher than the valley of Shuffle creek. The north approach to the plateau, 4½ miles long, was built on a maximum grade of 1 per cent. and represents the most costly section of the district. Practically all the excavations on it were made in solid rock. The section embraces Shuffle creek viaduct, 880 ft. long, and a tunnel 525 ft. long. The westerly approach to the

Bloomington plateau extends from Stanford to Bloomfield, a distance of 18 miles. In this distance a difference of 230 ft. in elevation is overcome by using one-half of 1 per cent. compensated grades, and provision is also made for relief grades at the passing track stations of Solsberry and Tulip. Portions of this section introduced heavy grading work, and a steel viaduct 2,215 ft. long and 160 ft. high over Richland creek.

From Bloomfield to the westerly terminus at Switz City the line crosses the wide valley of White river. West of White river the surface is gently undulating and is ordinary construction work. The bridge construction across the White river is referred to more particularly in a subsequent paragraph.

The heaviest traffic originating on the district will be from the oolitic stone quarries near Bloomington, which will move both north and south, whereas a large percentage of the traffic originating from the coal mines in Greene and Sullivan counties will move north. As built, the maximum grades between Indianapolis and Unionville are 1 per cent. southbound and one-half of 1 per cent., compensated, northbound. Between Unionville and Switz City the grades are one-half of 1 per cent. in both directions, compensated for curvature, and additional compensation of one-tenth of 1 per cent. at passing-track stations.

The bridge structures are designed for Cooper's E-50 loading. All steel structures have masonry supports. In every case the details of both steel and masonry construction are so arranged as to admit of the construction of second track with minimum expenditure. The timber trestles consist of six-pile bents, or their equivalent in frame trestles, with caps 12 in. x 14 in. x 14 ft., and six stringers 7 in. x 16 in., 14 ft. spans. The bridge work was an important feature in the construction work, the more important structures deserving special mention.

The entrance into Indianapolis is on an elevated structure extending from Merrill street to Wisconsin street, a distance of 3,576 ft., and is built over the bed of the open drain known as Pogue's Run. The city already had 13 lines of railroad radiating from its center, and the promoters conceived the plan of occupying the bed of the stream with a type of structure which would offer little or no obstruction to the flow of water. Pogue's Run, for the greater part of the distance occupied, is marked by masonry walls, the face lines of which are 45 ft. apart. One line of concrete masonry pedestal supports were placed in the west wall of the Run, another line in the middle of the stream, 22½ ft. distant. The lateral girders supported upon these pedestals are long enough to admit of double-track construction, for which purpose only longitudinal girders will be required. Future track construction will require a third line of piers placed in the east wall, and when complete this construction will provide room enough for four tracks. The superstructure, except at street crossings, consists of cross girders resting on the pedestals and form the supports for 75-ft. deck girders. At the street intersections the construction consists of columns supporting through-girder spans the full width of the street, with a vertical clearance of not less than 13 ft. As the city had commenced to carry out a general plan of track elevation, it was deemed advisable to make the original construction conform to it, and the grades of all streets, except South and Raymond streets, have been separated.



Elevated Structure in Indianapolis.

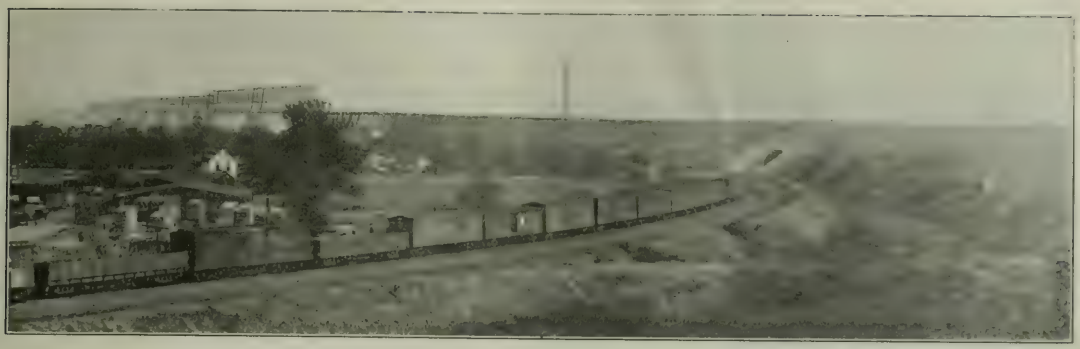
Indian creek, at Morgantown, is crossed by a deck girder bridge. The structure consists of 100-ft. span with two 55-ft. approaches. The abutments are of reinforced arch construction, similar masonry construction being used at Buck creek and at Bean Blossom bridge No. 1.

Shuffle creek viaduct is 880 ft. long and at the highest point is 80 ft. above the stream. All the supports are masonry construction except the end supports. These are of timber, which will be replaced by masonry abutments when the trestle approaches to the structure are filled. The tower spans are 40 ft. long with 60 ft. intermediate spans. The structure was erected with a derrick car in 31 days.

Richland creek viaduct is the most important bridge structure on the line. The total length is 2,215 ft., maximum height 160 ft., and the total weight of steel is 2,856 tons. The bridge is so designed that it can be converted into a double-track structure without interfering with traffic or disturbing the adjustment of the structure. The tower spans are 40 ft. long and the intermediate spans 75 ft.



Cut on Diversion near Wickliffe, Kentucky; Indianapolis Southern.



Approach to Cairo Bridge, Showing Work of Filling.



Sixty Foot Arch, Approach to Cairo Bridge; Indianapolis Southern.



Bridge Over Indian Creek, near Morgantown, Ind., Two 60-ft. and One 100-ft. Deck Plate Girders.

The structure was erected with a trolley traveler from the deck in 62 days actual working time. The erection was carried on without loss of life or even serious injury to any one employed on the work. The stone and sand for the concrete masonry was obtained at the site of the structure. The surface depression through which Richland creek flows marks the line of a fault. The limestone was obtained at the east end of the bridge and the sandstone, from which the sand was crushed, from the west end at approximately the same elevation above datum.

The White river bridge, with its trestle approaches, has a total length of 3,324 ft. The bridge is located on a six-mile tangent which extends from the westerly limits of the town of Bloomfield to Switz City. The tangent was so laid as to cross the point of intersection of the center lines of the Chicago, Indianapolis & Louisville (Monon) and Evansville & Indianapolis Railroads at Elliston. The structure as a whole has been made to serve the crossing of White river, the channel of an old canal east of the Evansville & Indianapolis, a separation of grades and a crossing of the Monon and Evansville & Indianapolis, an overhead crossing of the "Y" between the two surface railroads, and also to provide a subway for a very important public highway. The river crossing proper consists of two 150-ft. deck riveted spans and one 100-ft. deck girder span. The overhead crossing of the two railroads is a 72-ft. through I-beam floor girder supported by columns placed on masonry pedestals. The structure is given longitudinal strength by placing columns on masonry supports on one end. The overhead crossing of the "Y" is made of a 25-ft. through girder. The canal and highway are provided for by the proper spacing of pile trestle bents.

The total weight of the steel used in bridges is approximately 6,400 tons. The 100-ft. girders at Pleasant Run, Lick creek, three crossings of Bean Blossom creek, and Shuffle creek, were erected by the railroad company's forces. The larger structures were let to contractors at unit prices.

On the entire district the grades of important streets and public highways were separated from the grade of the railroad. Public passways in many instances were diverted and the crossings made either by means of a subway or overhead bridge, and in a number of places public highways were diverted and crossings of the railroad eliminated. The railroad was located in Bloomington, a city of 10,000 inhabitants, through an important resident section without a grade crossing. The track is laid with 75-lb. rail, with 3,200 6-in. x 8-in. x 8-ft. ties per mile, and is ballasted with 12 in. of gravel. Passing tracks 3,200 ft. long have been provided at average intervals of 5½ miles.

At Indianapolis passenger facilities are provided at the union station. The freight terminals occupy two squares, bounded by South and Merrill streets and Senate and Missouri avenues. Provision for local freight has been made for the present by building an inbound brick freight house, 40 ft. x 530 ft. The north 180 ft. is two stories, containing quarters for the local freight clerical force and the offices of the local superintendent.

Bloomington, the second city on the line, has separate freight and passenger stations. The passenger station is of white Bedford oolitic stone, located on College avenue on the north side. The freight station is a frame structure, located within three squares of the center of the business section. Commodious stations and ample business facilities have been established at all passing-track stations, and additional stations have been provided at other important community centers.

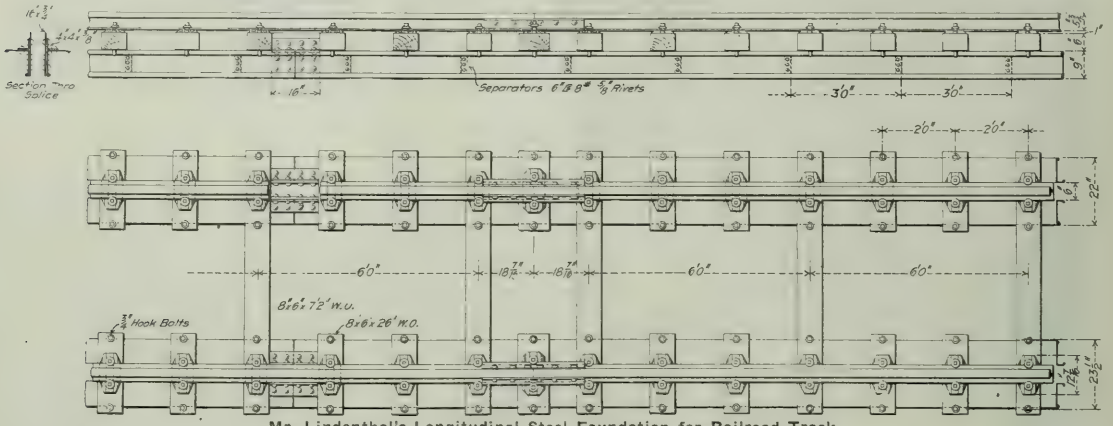
Physical connections have been made at Indianapolis with all lines entering that city through the Union Railway and Indianapolis Belt Railroad, at Morgantown with the Big Four, and at Bloomington and Bloomfield with the Monon.

We are indebted to Mr. W. J. Harahan, Vice-President of the Illinois Central and of the Indianapolis Southern, and to Mr. A. S. Baldwin, Chief Engineer of both lines, for the information and illustrations.

A Longitudinal Steel Sleeper System for Railroad Track.

BY GUSTAV LINDENTHAL, C.E.

There is at present a test being made on the Pennsylvania Railroad at Pomeroy Station on the main line between Philadelphia and Harrisburg with a longitudinal steel sleeper system about 1,000 ft. long. The steel sleepers have been riveted up temporarily of shapes to resemble the steel bulb angles shown as sleepers in the illustration hereby attached, because the special rolls for these bulb angles do not yet exist.



Mr. Lindenthal's Longitudinal Steel Foundation for Railroad Track.

The fundamental objects of the sleeper design are great longitudinal rigidity and reduction in cost of track maintenance under the extra heavy and fast train service on trunk lines.

Longitudinal rigidity on the usual track with cross ties is derived only from the two rails. On the sleeper system it is derived from two rails and four bulb angles. Two bulb angles riveted up as shown form a sleeper.

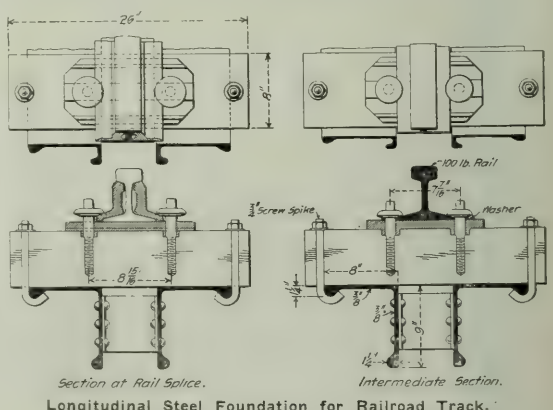
Longitudinal rigidity is approximately proportional to the moment of inertia of the steel rail. (I)

For a new 90-lb. rail A.S.C.E. section I = 34.0.

For a new 100-lb. rail A.S.C.E. section I = 43.8.

As rails become worn their rigidity decreases.

For two sleepers, each 84 lb. per yard, I, = 173.5.



Longitudinal Steel Foundation for Railroad Track.

Rigidity of one sleeper and one 90-lb. rail I + I, = 207.5, which is six times greater than for the 90-lb. rail and about five times greater than for the 100-lb. rail on the usual cross tie track.

The item of cost for surfacing may be taken as nearly proportional to rigidity of track. It follows that cost of surfacing for sleeper track will be only a fraction of the same item for cross tie track. The experience with experimental track at Pomeroy will probably prove this after the first year.

The weakest part in the cross tie track is at the rail joint. The flange plates or flange angles are exposed to the same bending up and down as the rails themselves. But in addition to the bending stresses, the flange plates must resist large shearing stresses when the wheel load passes from one rail to the other at the sus-

pended joint. The shearing stresses are usually not considered, but they are much more severe upon the flange plates than the bending stresses, and they also cause much more rapid and greater wear at the lines of contact between flange plates and rail.

This wear in suspended joints is unpreventable. But if the rail ends are supported on a solid base, then there are no shearing stresses and no wear. A cross tie is not, however, a base of sufficient solidity for such a support, and it does not meet the trouble. But in the sleeper system there is a solid support for the rail joint on the rigid steel sleepers, which distribute the pressure over a long distance and the rail joint therefore gives here no trouble.

The rail track must be so made as to permit raising and surfacing if the ballast or embankment underneath is settling. The steel sleeper system permits of such raising and tamping at a depth of 8 in. below the base of rail, which is the same depth as with wooden cross ties. But the length and amount of tamping with these sleepers is obviously less and more convenient than with cross ties.

In the experimental track at Pomeroy, the surfacing of the track has been found to be difficult, because of the large projecting bottom flange of the temporary sleeper. But this bottom flange does not exist in the regular bulb angle sleepers.

The bearing surface on the ballast of the standard cross tie track, with no allowance for a 2-ft. strip along center of track which is not tamped, is about 28 sq. ft. in a length of 10 ft.; while the bearing surface of the sleeper track is 37 sq. ft. in a length of 10 ft., or 30 per cent. greater. The space between vertical legs of sleeper angles is solidly filled and tamped with finely broken stone, which is thus wedged in like an arch and adds to the bearing width of the sleepers. The full bearing width of each sleeper is thus 22 in.

Perfect drainage is of the first importance in any track. Deep side ditches below the bottom of the stone ballast are essential. In the sleeper system drainage is provided in the manner shown on plan. The deep ditches into which to drain off the water are neces-



Section of Track.

sary with any form of good track and represent no additional cost for the sleeper system.

So that the rail may be used as an electrical conductor for block signaling purposes, the rails rest on creosoted hardwood blocks which act also as a cushion between rail and sleeper. There are gage ties of creosoted hardwood every 6 to 8 ft., which will last 40 and more years. The wear of the rail base into the wooden blocks is prevented by heavy tie plates of a special form, which cannot be displaced nor will they curl up.

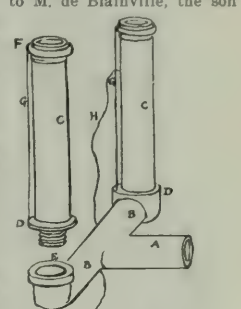
The wear of the rail head on curves can be taken up by washers "A" between screw spike and rail base, as shown on plan. With this arrangement no difference in the track fastening is required for tangents and curves, and there is only one system of fastening with screw spikes for all conditions. There is very little creeping of rails with the sleeper system; the solid bottom support and the strong rail fastenings do not permit the sinuous motion of the rails which occurs on cross tie track and which aids creeping.

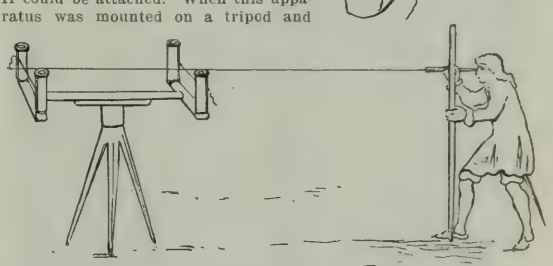
The cost at present prices for standard cross tie track with 100-lb. rails and creosoted hardwood ties is about $12,500 per mile. The cost of the sleeper system is estimated at $25,518, or say, $13,000 greater on the basis of $2^{3}/_{10}$ cents per pound for steel bulb angles. On the attached table are given the items of cost for the steel sleeper track. But when manufactured in large quantities (justifying the expense for special rolls and tools for rapid fabrication), the cost of the bulb angles should not be greater per ton than for steel rails.

The saving in all items of cost for maintenance of sleeper track over cross tie track will probably be $700 per mile, which is 5 per cent. on $14,000 per mile. Therefore, by that much, the cost per mile could economically be greater if it will give a track of greater rigidity and greater safety. If bulb angles of Bessemer steel are no more expensive than Bessemer rails, then the additional cost will hardly exceed $8,000 per mile, and in that case the sleeper system will show a great economy over the cross tie system. It is needless to say that the greater cost of the sleeper system is not justified for any other but heavy traffic.

A Level of the Time of Louis XIV.

Gobert was the engineer who acted most prominently in the construction of the reservoirs and acqueducts connected with the waterworks of that abyss of expense, as Voltaire called it, the park and palace of Versailles. In a report to M. de Blainville, the son of Colbert, Gobert says that, in 1680, M. Colbert suggested that an examination of the heights of the plains of Saclay be made and exact levels taken, as it was thought that they might be higher than the ground about Versailles. For this purpose he (Gobert) made the water level that is here illustrated. It consisted of four glass cylinders C C, connected in pairs to cross tubes B B, and these latter are placed in communication with each other by means of the tube A. Alongside each glass cylinder there was a vertical rod G G, to which a thread H could be attached. When this apparatus was mounted on a tripod and





Gobert's Level.

A—Main pipe.
B—Cross pipe.
C—Clear glass cylinders.
D—Copper ferrules attached to the elbow, *E*, with copper gaskets.
F—Ferrules at the top of cylinder, to which the rods, *G*, are attached.

partially filled with water, the latter would stand at the same height in all four of the tubes. Then by stretching the threads across from one water level to the other two perfectly horizontal lines of the same height were obtained. By taking a glass and sighting past these two threads, as indicated in the illustration, a level could be run. Comment upon the speed with which work could be done with such an instrument is unnecessary, and the wonder is that undertakings of such magnitude as that of the Versailles water works could be executed with instruments of such primitive form.—*Revue de Mecanique.*

Longitudinal Steel Foundation for Railroad Track—Schedule of Material.

Items. Dimensions.	No. of pieces per 1,000 ft.	Weight of each. pcs in lbs.	Weight (tons) —per 1,000 ft.— Gross.	Net.	Prices. Gross ton.	Lbs.	Cost of single track Per lin. ft.	Per 1,000 ft.	Per mile.
Rails (A. S. C. E., 100 lbs.) ....33 ft. long.	60.6	1,100.0	29.76	....	$28.00	.....	$0.83	$833.28	$4,399.92
Splice bars .....34 in. long.	128	42.4	.....	2.71	.....	1.75c.	.095	94.98	501.49
Splice bolts .....1 in. diam., 5¾ in. long.	378	1.70	.....	.32	.....	2.90c.	.019	18.63	100.32
Nut locks	378	.....	.....	....	.....	1.2c. each.	.0045	4.54	21.12
Together	.....	.....	.....	....	.....	.....	.....	$951.43	$5,022.85
Intermediate tieplate .....12½ x 7 x 5/16 in. thick.	970	11.65	.....	5.65	.....	2.00c.	$0.230	$226.01	$1,214.40
Tieplate at rail joint .....12½ x 7 x 5/16 in. thick.	62	11.65	.....	.36	.....	2.00c.	.144	14.45	83.40
Washer "A" .....1 11/16 x 1 13/16 x 5/32 in.	1,940	.128	.....	.12	.....	2.00c.	.005	4.93	26.40
Screw spikes .....1 3/16 x 6½ in. long.	2,068	3.16	.....	3.26	.....	2.90c.	.189	189.51	997.32
Together	.....	.....	.....	....	.....	.....	.....	$434.90	$1,322.12
Rail blks. (creostd wh.o. or y.p.) .8 x 6 x 26 in. long.	790	6.857*	.....	....	Per M. $30.00	.....	$0.206	$205.71	$1,087.68
Cross-ties (creostd wh.o. or y.p.)..8x6 in. x 7 ft. 2 in. long.	362	10.382*	.....	....	30.00	.....	.311	311.46	1,652.08
Hook bolts. .....¾ x 11½ in. long.	2,068	1.47	.....	1.57	.....	2.90c.	.088	88.16	464.66
St'l fndatn (splices & separators) .Bulb angles 8 x 9 in.	60.6	2.034	.....	61.6	.....	2.30c.	2.835	2.834.99	14,968.80
Together	.....	.....	.....	....	.....	.....	.....	$3,440.32	$18,173.22
Total	.....	.....	.....	....	.....	.....	.....	$4,826.65	$25,518.19

*Per 1,000 ft. B. M. NOTES.—For comparison of costs it is fair to compare the sum of the last four of the above items ($3,440 for 1,000 ft. of track) with cost of creosoted ties (at $1.65 per tie) or $990 for 1,000 ft. of ordinary track. The difference for 1,000 ft. is $2,450; for 1 mile is $12,936. The costs of labor for both kinds of track are assumed to be the same. The cost of drainage pipe for the track with longitudinal steel foundation is $0.034 per lin. ft. of track. This item is compensated by the saving in the quantity of stone ballast.

Method of Placing Heavy Double-Track Through Plate Girders on the Union Pacific.

In second track construction necessitated by growth of traffic, it is something of a problem to replace, under traffic, the existing single-track girder bridges with the required double-track structures, with a minimum delay to trains. The difficulty of the problem is in direct proportion to the intervals between trains, and these are of necessity short, since it is the too great frequency of trains that has imposed the change. To find an interval of as much as an hour is often not easy, therefore the method used for the bridge substitution must be as simple, efficient and expeditious as possible.

The usual method for single-track through plate girders, of course, is to erect the structure complete at one side and pull it into place on a greased rail by means of tackle worked by hoisting engines at a convenient point. But where this method is used with heavy double-track through plate girder spans, there is a tendency for the girders to cut into the rails, requiring considerable power to move the structure; also, the latter has a tendency to see-saw—that is, one end may move by jerks and the other end remain practically stationary, or move forward steadily; furthermore, there is a tendency for the girder to move past the position desired, and as no tackle is provided for pulling it in the opposite direction, considerable jacking may have to be done finally to get the bridge located properly.

The Union Pacific Railroad had a number of 80-ft. single-track through plate girders to be replaced with double-track spans of the same length, each weighing 270,000 lbs. net. In view of the objections to the old method of placing these structures outlined



Fig. 1—80-ft. Double Track Girder Span Ready to be Pulled Into Place.

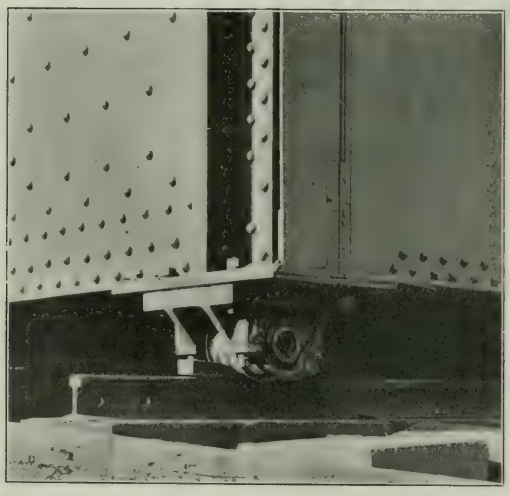


Fig. 2—Dolly in Place Under Corner of Girder.

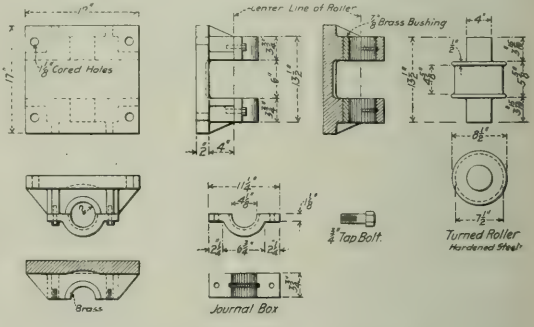


Fig. 4—Details of Bridge Erecting Dolly.



Fig. 3—New Span in Place; Old Single Track Girder Pulled Out to One Side.

in the previous paragraph, a modification of same was utilized. It was simply the substitution of rolling for sliding friction by the interposition of a suitable heavy dolly under each corner of the bridge. By this method the new span is hauled into place with approximately the same power as is required to slide out the old single-track span on a greased rail. The movement of the structure is uniform, both ends moving at the same rate, and there is no tendency to skew or see-saw. Also, there is no danger of overrunning the desired location, nor is there any tendency for the bridge to jam against the back walls of the abutments.

The time of making the change, including cutting the track, pulling out the old span and substituting the new one, and spiking the track in place again, is not over an hour. The scheme was devised by Mr. James Keys, Bridge Engineer of the Union Pacific, and the dollies were made at the Omaha shops. The castings are iron with about 20 per cent. of steel added. The rollers were turned from a scrapped 9-in. locomotive axle. The total weight of a dolly is about 450 lbs. and the cost about $20.

Reinforced Concrete Floors for Through Truss Spans.

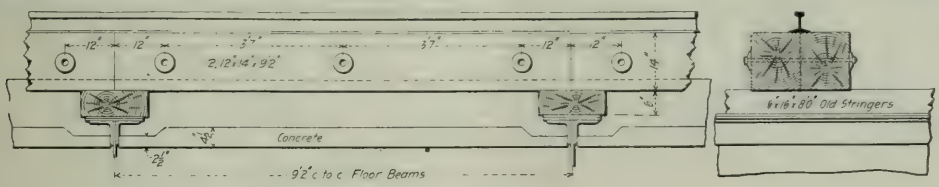
The Chicago, Burlington & Quincy first began the use of reinforced concrete solid floors for bridges about three years ago, the first design being for deck girders. The application was later extended to through girders, and more recently to through trusses. Applications of the latter sort have been made on bridges on the lines out of Kansas City and St. Louis north, and designs are now in preparation for other spans.

The floor is designed to be built in place, under traffic, on bridges already in service as well as on new structures, the detail drawings herewith showing how the former is accomplished. The cross ties are removed and the rails laid on stringers composed of two 12-in. x 14-in. pieces bolted together. These stringers rest on 6-in. x 16-in. transverse timbers laid on top of the floor-beams, the total temporary raise of grade being about 11 in. The track is held to gage by transverse tie rods between stringers, not shown in the drawings. This arrangement enables the slabs to be built between floor-beams to the form indicated in the detail. It will be noted that the thickness of the slab is reduced from 4½ in. to 2½ in. at the edges adjacent to the floor-beams to provide space for the beam covering. When the slabs have hardened sufficiently the heavy timber stringers are removed and 6-in. x 16-in. pieces 7 ft. long laid longitudinally on the concrete slabs, and track ties inserted, resting on these pieces. The floor is then completed over the floor-beams, as shown in the detail of the section across floor-beam. The deck is covered with ¾ in. of asphalt before placing the ballast. The latter is 6 in. deep under the ties.

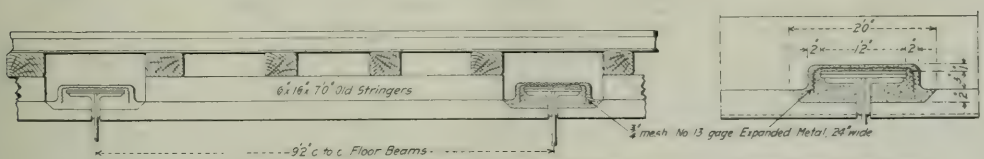
The slabs are made of 1:2:4 concrete and have a uniform thickness of 4½ in., except over the stringers and at the ends, as above noted. The parapets are 8 in. thick and 16½ in. high. The reinforcing ½-in. corrugated bars are spaced 3 in. apart longitudinally of the bridge and 12 in. apart transversely, with three additional longitudinal rods in each parapet, as shown. The floor rests on eight stringers, the outer ones carrying the parapets and providing



Brush Creek Bridge, with Reinforced Concrete Floor.

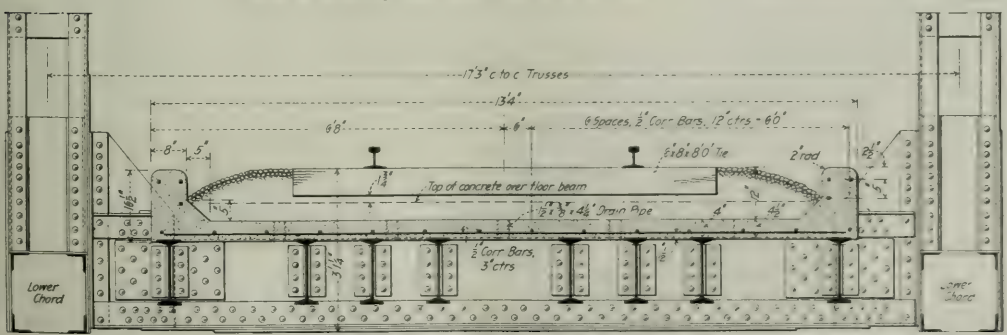


Method of Supporting Track During Construction of Floor Slabs.



Method of Supporting Track During Construction of Floor

Section Across Floor Beam.



Details of the Reinforced Concrete Floor of the Burlington's Brush Creek Bridge.

support in case of derailment. It will be noticed that the parapets are built over the floor-beam gusset plates and the necessary section of concrete provided by heavy fillets on the inside of the parapets. Drain pipes made of old boiler tube or gas pipe, 1½ in. in diameter, are placed five in a row across the floor, three rows to the slab. The deck with track and ballast complete weighs 2,500 lbs. per lineal ft. of single track and the cost is about $5 a foot.

To build the floors under traffic is pretty difficult work, of course, and takes considerable more time than with a new bridge; but once in place, they require no further attention and cost nothing for maintenance. We are indebted to Mr. C. H. Cartlidge, Bridge Engineer of the Burlington, for data for the foregoing.

The Tidewater and the Deepwater Railways.

GENERAL FEATURES.

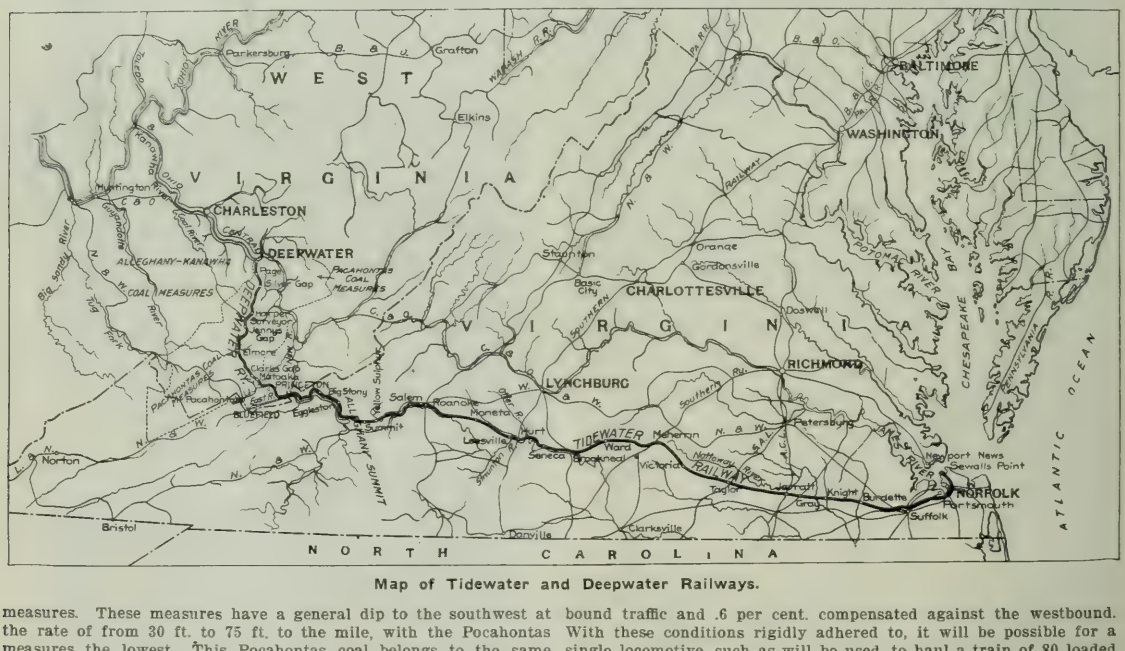
It is well-known that West Virginia is one of the richest states of the Union in the extent and variety of its mineral deposits and that among the clay, shale, silica and limestone beds with which it abounds coal stands supreme as the product upon which the wealth of the state and the traffic of its railroads chiefly depend. Roughly speaking the coal fields have an extent of from 10,000 to 12,000 square miles of workable territory, and the deposits may be as roughly grouped into the Pocahontas, Kanawha and Pittsburg measures. These measures have a general dip to the southwest at the rate of from 30 ft. to 75 ft. to the mile, with the Pocahontas measures the lowest. This Pocahontas coal belongs to the same period as the Pottsville coals of Pennsylvania, and as a steam coal is acknowledged to be unequaled. An approximate analysis of the seam may be taken as:

Fixed carbon	77.0	Moisture	0.4
Volatile matter	16.1		
Ash	6.0		100.0
Sulphur	0.5		

And it is an approximation to this high quality that an attempt is made to reach in the mixture of the anthracites and soft coals for the cheaper steam fuels used in the eastern markets.

These Pocahontas measures lie along the eastern extremity of the state and end in a fault beyond which no coal of importance is found. This line of demarkation is very distinctly marked as shown on the map of the Tidewater-Deepwater Railways. The field itself has a width of about 30 miles and runs from the northeast to southwest. To the west is the Kanawha field ranging in width from 10 to 50 miles. At the present time this great coalfield is crossed by three railroads, the Baltimore & Ohio, the Chesapeake & Ohio and the Norfolk & Western, of which only the two latter touch the Pocahontas measures, and these, at their points of entry on the eastern edge, are about 40 miles apart; the Chesapeake & Ohio coming in with the New river, and the Norfolk & Western further south near the headwaters of the Bluestone river, which flows in a northeasterly direction nearly parallel to the great Pocahontas fault already alluded to. These roads approach each other with branch lines that run as spurs to the north and south in the coal territory, but even with these there is a wide area of this exceedingly rich and productive property that is not reached. Even that already opened is not only taxing the present capacities of the railroads by which it is served to the utmost, but it is capable of a far wider and more extended development, and in this the Tidewater and Deepwater Railways are intended to assist.

Started originally as a spur of the Chesapeake & Ohio Railroad at Deepwater, West Virginia, at the head of navigation of the Kanawha river, but under an independent ownership, and intended primarily to serve the lumber interests of the region, the scheme has been developed until it has come to fruition in the building of a road from Deepwater in the heart of the West Virginia mountains to Tidewater at Norfolk, Va. Although incorporated separately as the Deepwater Railway of West Virginia and the Tidewater Railway of Virginia, the two are being built together by one management and will be operated as a single line of road. They are to be consolidated as the Virginia Railway incorporated this month in Virginia. They are being built for the express purpose of reaching and marketing what will be the products of about 150,000 acres of coal land in the Pocahontas field that have not as yet been touched. In the execution of this project it was decided that after the line escaped from the fastnesses of the West Virginia mountains and emerged into the comparatively open country of Virginia that it should be constructed with a maximum grade of .2 per cent. compensated against east-



Map of Tidewater and Deepwater Railways.

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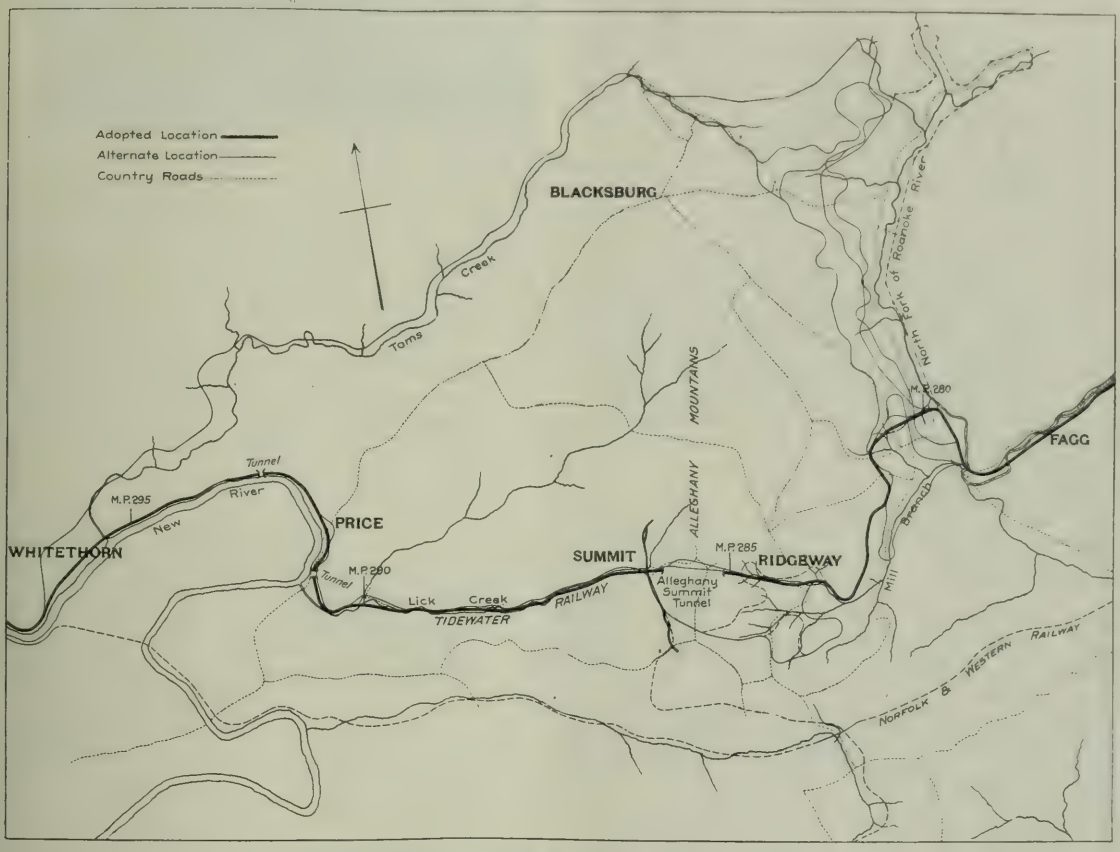
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When the character of the country is understood, not only in the mountainous portion covered by the coal fields, but the rolling lands of Virginia as the elevations drop down from the Blueridge mountains to the sea, as well as the space intervening between the Blueridge and the Alleghanies, it will be seen that the construction of such a line as that outlined is not only a task of great magnitude, but one calling for the highest grade of engineering skill.

The alinement and profile vouch for this and to this must be added the willingness of the promoters of the work to sustain the engineers and management, not only in the surveying and location of such a line as had been determined upon, but in constructing it in the best possible way and in accordance with standards

that represent the most advanced and thorough conditions of railroad building and operation. In this, bold and extensive works in the form of tunnels, cuts, fills and bridges have been required all along the line, and their execution was naturally preceded by extensive surveys that covered practically the whole state of Virginia south of the James river. In this territory four distinct locations were made with estimates of cost before the final decision was reached. This was for actual work in the field to say nothing of the studies and tentative routes that were made from the topographical maps published by the United States Geological Survey. It may be stated here, as illustrative of the methods used, that throughout the whole of the preliminary work of the surveys these maps were in constant use and served as the basis for the plotting of the general run of the lines before parties were put in the field. They even served to furnish information from which general estimates could be made, and thus avoided the expense of useless reconnaissance or preliminary work that had no chance of success.

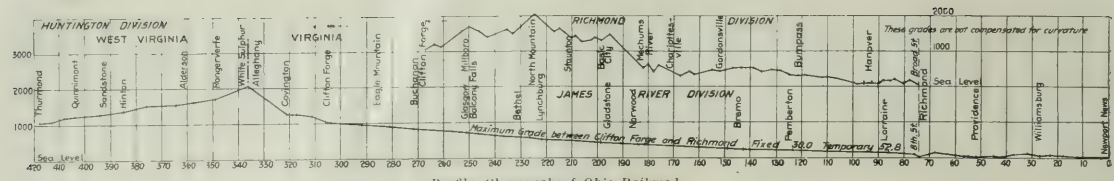
One of the characteristic features of this road, and one which



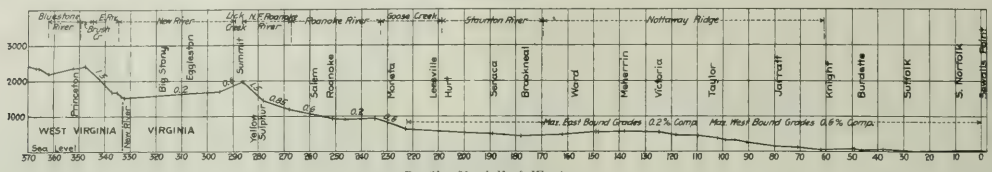
Locations Across Allegheny Mountains; Tidewater Railway.



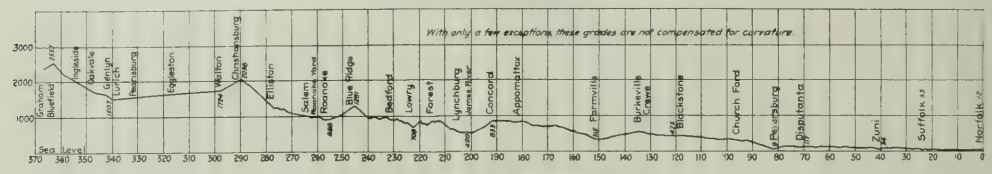
Locations of Deepwater Railway from Princeton to New River.



Profile, Chesapeake & Ohio Railroad.

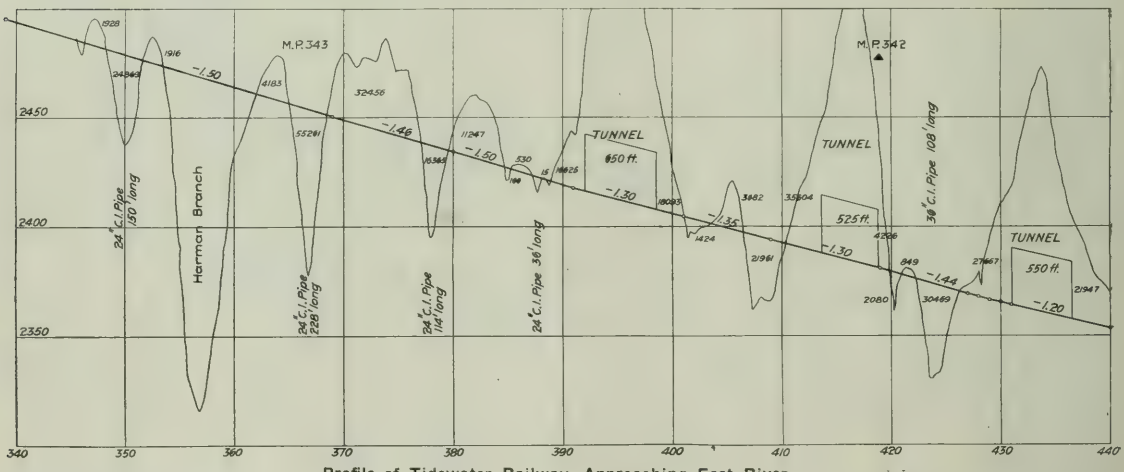


Profile, Norfolk & Western.

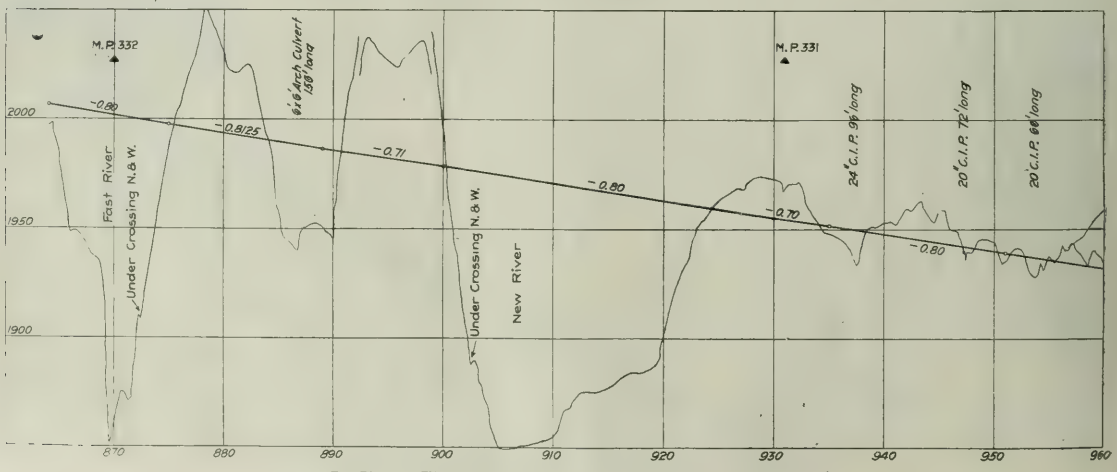


Profile, Tidewater and Deepwater Railways.

Profile of Coal Roads from West Virginia to the Sea.



Profile of Tidewater Railway, Approaching East River.



Profile of Tidewater Railway at New River Crossing.

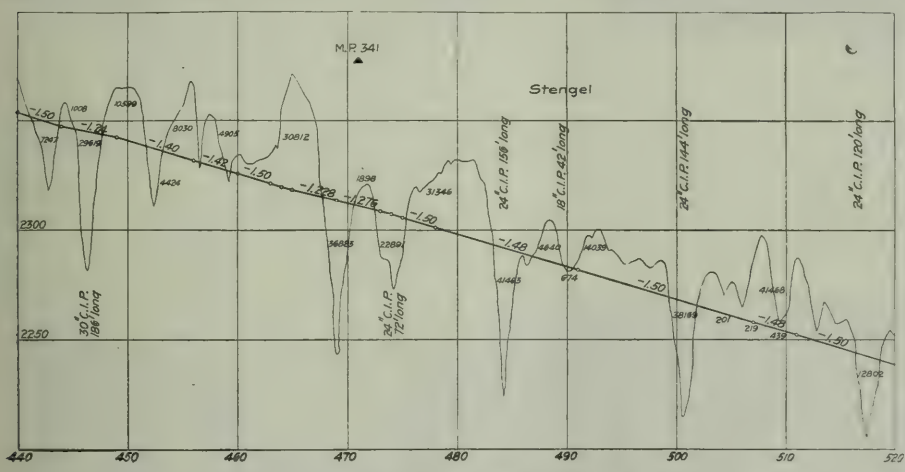


Heavy Cut at Mile Post 83; Deepwater Railway.

is merely indicative of the thoroughness and masterly manner in which all of the work has been done, is that in which the surveys have been conducted. Aside from the general rough character of the country, and the necessity of working a low-grade line with a maximum of .2 per cent. adverse grade from the mountains of West Virginia, there was placed upon the engineering department the duty of laying out the best line that the country afforded. Ordinarily the directors of a piece of line of this kind dictate the details to a greater or less extent; they insist very properly that the towns and villages adjacent to the route shall be reached on account of the immediate traffic which they will afford, and the desire to meet the demands of the public for a convenient and expeditious service. In this case, however, no such lines were laid down. The engineers were simply given two terminals, and told to connect them by a line of the exceedingly low grade specified, and by the shortest and best route that the country afforded. They were not hampered by the needs of reaching a single city or village en route and were given the whole width of the state of Virginia in which to locate the line. While this free hand placed the whole responsibility for the economical location and construction, as well as its subsequent operation, on the shoulders of the chief engineer, and showed in the most marked degree the confidence placed on his department, it added greatly to the work, in that it involved the examination of a much wider belt of territory, not only in reconnaissance and preliminary surveys, but in actual location of alternative lines than would have otherwise been required. It involved also a much heavier expenditure for surveys than would have been incurred under ordinary conditions where, from the necessity of reaching certain definite points, the belt to be examined and surveyed would be much narrower. This is undoubtedly the proper and scientific method of railroad location, and the results in this case seem to have fully justified the elaborateness of the preparation, but unfortunately it is not one that is often permitted either by commercial or operative conditions, to say nothing of the desire on the part of the directors to direct details and their haste to have some tangible results to show in the nature of construction in progress.

However, for once, this broad policy was put in force, and we have a railroad built upon the broad scientific principles of securing the best line that the country affords, regardless of cities, towns or villages adjacent or connecting railroads, and one reaching from one predetermined terminal to another.

With this understanding of the spirit in which the work was undertaken and carried on, we can turn to a review of the details of the alinement and profile and study the manner in which the work of the survey has been conducted and the class of line that has finally been located and put in course of construction.



Profile of Tidewater Railway, Approaching East River.



Cut Between East River and Hales' Gap Tunnel; Deepwater Railway.

The nature of the line to be built and the country through which it passes involves continuously heavy work from the start at Deepwater until the level country west of Norfolk is reached.

At the start it is difficult to conceive of a rougher or more unpromising territory in which to build a railroad than the mountain country of West Virginia, through which this road runs from Deepwater to Princeton, a distance of about 95 miles. The mountains are precipitous ridges, true Sierras, saw tooth in section, and the valleys are narrow and tortuous, with little or no arable bottom land, and each carrying a rapid mountain stream of dimensions varying with the season, the amount of immediate rainfall and the area drained. Location here leaves but two courses open; one to follow every bend of the stream, and the other to cut across and work on tangents. The first puts in a road that is full of curves, in fact consists of little else, and the other becomes a mere succession of bridges and tunnels. The first involves the lower first cost, but the higher expense for operation, so that there is usually a compromise between the two, and bridges and tunnels are used where it appears that the saving in cost of operation on the prospective tonnage will warrant the increased original expenditure.

When the first five miles were laid out south from Deepwater in 1894, it was the intention to extend the road eventually down through the coal regions between that point and Princeton, but it was not expected that it would ever develop into a through tidewater line. It was intended merely as a spur tributary to the Chesapeake & Ohio, and reached down to some lumber operations in the neighborhood of Robson. The location was, therefore, made along the banks of Loup creek, a tributary of the Kanawha river at Deepwater, and followed it in all its sinuosities. The idea seemed to have been to get into this territory with a minimum of original outlay, so that we have curves of 16 deg. in abundance while the grade follows that of the fall of the stream and rises 234 ft. in 21,000 ft., or on an average of uncompensated grade of a little more than 1.1 per cent., though for the first 9,000 ft. the rise is continuous at 1.5 or 1.7 per cent. On this section the profile shows

the selection of a route of minimum excavation, there being but a few heavy cuttings. This was the condition of this nest egg of this present line at the end of October, 1903.

In the meantime surveys had been undertaken for the extension of the line up into the coal fields, but without the expressed intention, at the time, of running on to tidewater. The work was, however, done in a way to somewhat modify the severity of the line already built in that the maximum rate of curvature was reduced and the grade cut down as far as practicable. Consequently immediately after leaving the end of the original line we find the alinement much straighter and the grades against the south or eastbound movement lighter.

With the exception of a tunnel 290 ft. long at station 264, there is little heavy work encountered until Hamilton is passed, about



Rock Ballast Quarries at Surveyor, W. Va.; Deepwater Railway.

11 miles from Deepwater. Then beyond that point there are a succession of heavy cuts and fills with one trestle 60 ft. high. This is on the maximum grade in this portion of the line up to Silver Gap which is turned at an elevation of about 1,850 ft. The line then follows the banks of Mossy creek on a modified grade and about the same class of alinement as before with a continuous succession of rather heavy work. This down grade continues to Lively (24 miles), and in this section there is a trestle 90 ft. high and two tunnels, one of 950 ft. and the other of 300 ft., besides two trestles lower and smaller than the one mentioned.

Again at Lively there is a reversal of the grade with a rise along Paint creek to Harper, on still easier grades, and it is on this section that the two highest trestles so far on the line are found, each about 110 ft. high. At this point the line, as finally located, skirts along the edge of the Flat Top mountain, which is about the only ground in this territory that can be considered at all easy and not set on edge. Unfortunately it was impossible to take any advantage of these conditions, on account of the general trend of the road, which it was necessary to hold. The line, therefore, bends away to the southwest and follows the water course that drops away quite rapidly. It does this running down one branch until a tributary is reached, which is followed up to the dividing ridge, which is crossed in a cut or tunnel, thus forming a rather steeply undulating line to Mullens, 58 miles from Deepwater, situated just above the junction of the Slab Fork and Guyandot rivers. In this section the grading becomes lighter, but the country is exceedingly rough. There is, however, some tunneling.

Mullens is now the head of travel, though the rails are laid for some miles further. One mixed passenger and freight train is run daily between Deepwater and Mullens, and these serve to bring in contractors' supplies and other requirements.

The exceedingly wild and picturesque country continues for 15 miles further on up to Clark's Gap, which is crossed by a 1,200-ft. tunnel. In this distance there are a number of long and high viaducts, all of which are steel of the approved standard designs. Some of them are finished and the grading all done. In this the heaviest work is found of any south of Deepwater.

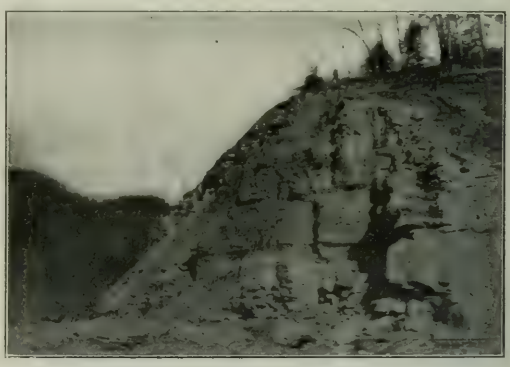
The line, as thus laid out, is an example of high grade work through an exceedingly rough and difficult country, but it must not be thought that the final location was coincident with the only preliminary run. It has been the policy throughout the whole distance from Deepwater to Norfolk to make a broad general study along both sides of the suggested line in order to locate on the best that the country affords. Accordingly the same policy was pursued in this difficult West Virginia country.

Up to Silver Gap summit there apparently seemed to be but one route to be followed and little was done on either side of the line. But on leaving this summit the road strikes into the true Pocahontas coal territory that it is intended to serve, and it became advisable to study the country thoroughly. In order to fully appreciate the necessity for this it is necessary to bear in mind not only the saw tooth nature of the country but also the fact that this very contour, with its innumerable and tortuous hollows or valleys, necessitates the placing of the coal operations upon what would otherwise appear inaccessible heights and locations. Consequently a road to efficiently serve such a country and take care of the traffic that will come when it is developed, must be prepared to reach out-of-the-way and remote places either by its main line or spurs. Hence the necessity, not only for reconnaissance but for the running of preliminaries that it is not expected to build at once, and even for the location of a number of alternate routes. This was done, in the territory under consideration, just as it was done in the more open Virginia country, and lines have consequently been located up and down the hollows leading off the main line all the way from Silver to Clark's Gap. In fact, surveys and location were made for an alternate line to the east of the one adopted, all the way from Silver Gap to the Bluestone river, at a point approximately the same distance from the starting point as the one by way of Clark's Gap. This covers a territory approximately 20 miles wide in places and reaching out into those exceedingly rich mining properties on Dunloup, Piney and Laurel creeks. This would have been a very heavy piece of line to construct and in one place a loop with an approximate diameter of about 3,000 ft. was provided for.

While these lines will not be built, except as spurs to reach operations that may possibly be opened in the future, the fact that they were run and all the data for them obtained enabled the engineers to select the route that they did, which may be considered to be the best that the country affords.

After leaving Clark's Gap there is a drop in the profile in heavy work all the way down to Matoaka, 80 miles from Deepwater. Between this point and Princeton, 350 miles from Norfolk, the territory explored was again widened and careful comparisons made for the best line. The work here is exceedingly heavy, and it is at Rock (361 miles from Norfolk) that the true main line with its easy gradients may be said to begin. The line rises out of Rock on a .5 per cent. compensated grade and there is then a constant succession of heavy cuts and fills for the 10 miles to Princeton. In this distance the cuts vary in depth from 10 ft. to 80 ft., and there is also the highest viaduct on the line with a height of 190 ft. And so Princeton is reached.

Princeton is to be the gathering point of the coal traffic, and, from this point on, the easy grades and moderate curvature that has been established for the main line will prevail. The country to the north on the Deepwater line is the roughest on the whole route and lies through the West Virginia coal measures. The material to be moved consists of a soft sticky red clay that is treacherous and apt to slide and wash down in the cuts. This overlies,



Disintegrated Rock in Elmore Cut; Deepwater Railway.

to varying depths of from 5 ft. to 40 ft., the true coal measure and rock. This and the coal has a dip to the southwest, and is of a friable nature. It is a soft sandstone that crumbles away easily and is readily broken. It is too hard to cut with a shovel, but a blast shot in it breaks it up badly and develops innumerable fissures, utterly disintegrating the rock and throwing it down in a mass without setting out any very large pieces. It can be rapidly drilled and, with the debris and loose fragments removed after a blast, it will stand well but with a constant flaking off of the surface after the manner of a shale which it closely resembles in places.

Leaving Princeton, the road rises for 2.5 miles on a maximum of .6 per cent. grade to Oney Gap, where the summit occurs in a 1,600-ft. tunnel at an elevation of 2,800 ft. above tidewater. From this there is a rapid drop with a maximum grade of 1.50 per cent. compensated for about 10

miles to the East river. From Princeton to East river the east and westbound grades are pusher grades. The road has now left the coal measures to the north and west and enters on the blue limestone country of the New river district, and at Ingleside is on the opposite side of the East river from the Norfolk & Western, but at a considerably higher elevation. Alternate surveys and locations had been made through all this country, in some of which the curvature was excessive, as must necessarily be the case wherever the natural contour of the ground is followed as shown on the detail maps. But the way was heavy and the demand for low grades imperative, so between Ingleside at milepost 345, and the crossing of the New river at 331, there is some very bold and heavy work. What it



Partly Finished Fill at Micajah Gap; Deepwater Railway.

meant to build this practically straight line of 10 miles, with heavy rock cuttings, fine tunnels and a 2,100-ft. bridge, can best be appreciated from an examination of the sections of the profile shown. Set well up on the hillside, and crossing the flow of the streams into the East river at right angles there is a constant succession of steep rise and fall of the surface of the ground. And it is here that the most spectacular piece of work on the line is to be found.

Coming down the East river, the first location followed the bank of the stream below milepost 335, as shown by the light line, and on the same side but well above the Norfolk & Western. The excessive curvature, the difficulty of construction and the expense involved in doing the work so as not to interfere with the traffic of the other road, led to a radical revision of the location. As first laid out the road would have followed the East river to its mouth and then swung across the New river at an elevation of about 45 ft. on a bridge carrying a 6-deg. curve after which it would have followed up the right bank. Induced by these considerations of location and difficulty of constructing close to the line of another road in rock work that was apt to slide, together with the excessive amount of curvature and the natural objections to crossing a broad river on a sharp curve, the engineers took the bold step of leaving the East river at milepost 335, and running almost on a tangent to the bluff on the up-stream side of the two rivers, and then by holding diagonally across the New river, strike the face of the bluff on the bend beyond by means of a 2,100-ft. bridge at an elevation of 115 ft. above low water and on a tangent for the whole distance. Certainly this is one of the boldest grapplings of a difficult problem that is recorded, and required courage not only to propose but to finance. But in its completed form it will stand as a piece of engineering work justifiable and pre-eminently fine.

The next 40 miles follows the course of the New river, whose fall is approximately that of the limiting grade or .2 per cent. This grade is compensated on curves so that frequently the actual rise is not more than 5 ft. to the mile. In this 60 miles the maximum curvature is 6 deg. except for three short curves of 8 deg. each. There is a gradual rise until at Whitethorne, 295 miles from Norfolk, the road leaves the New river and commences the serious business of crossing the Alleghanies.

In this run from milepost 330 to 290 the proper route was along the river, but for the passage of the mountains the policy of extensive surveys of alternate lines was resumed and a large number of alternatives were run and located, as shown by the fine lines on the engraving, and these were studied in all of their features with the result that the line being built was selected. This gives a practically straight run from the foot of the mountain to the summit up Lick Creek hollow, a distance of about 10 miles, in which the rise is 265 ft. with a maximum compensated grade of .6 per cent.

Throughout this division up the New river and to the crest of the Alleghanies the cutting is all in rock. The material is a hard sandstone, sometimes alternating with a limestone, for it is along New river that the limestones are first encountered. It is hard and offers a heavy resistance to the drills and stands well, but is apt to be seamy and contain pockets and fissures of clay that may come down with almost no warning. It is the material found directly east of the fault in the Pocahontas coal measures, and extends from that point to the Alleghanies which form a dividing line between the sand and limestones, the former being to the west and the latter to the east. This passage of the Alleghanies with a line built within the limits of the grade and curvature that has been imposed was one of the most serious tasks imposed, and required the expenditure of much time and labor in which a number of alternative lines were located as indicated on the map.

Passing Summit at an elevation of 1,963 ft. the road drops down to Fagg on a 1.50 per cent. grade, which is the equivalent to the .6 per cent. ascending grade for empty car traffic. These grades, of course, involve the use of pushers, and they will be used on every train each way between the foot of the grade at Whitethorne, on the western slope, and Fagg, on the east, the extra engine remaining with the train on the down grade in order to work on the return. The distance thus worked will be about 17 miles.

Beyond Fagg the line strikes the North Fork of the Roanoke river, which it follows on to the Staunton river at milepost 240, when it again leaves the waterway to strike across the Blueridge mountains. It is in this section just beyond Roanoke that the road runs definitely into a limestone country. It would have been possible to have passed this barrier by following Staunton river just as the Chesapeake & Ohio effects the passage by way of the gap of the James river, and a complete survey and location was made over this route, but the stream is so crooked and the distance so much greater that it was abandoned for the sake of the line to the north, which crosses on an adverse eastbound grade of .2 per cent. at an elevation of 942 ft. This is not only high as compared with sea level datum but is well above the river, being 150 ft. above the river where it strikes it at milepost 240. This naturally requires heavy cutting, the heaviest being at Moneta station, where there is the 260,000 cu. yd. cut, elsewhere alluded to.

Along this section the excavations and fills are very heavy, but they are generally in the red clay that is the covering mate-



125-ft. Fill at Micajah Gap; Deepwater Railway.

rial for this section of the state and is, therefore, steam shovel work. The work can be carried on very expeditiously, the banks stand well, except for the washing down of the surface that occurs in heavy rains. Beneath the clay is the strata of granite that underlies the whole at varying depths, with 40 ft. as an average. Then, as the work goes on to the east, this clay is mingled with pieces of soft, almost disintegrated granite, which finally develops into a distinct rock in the neighborhood of Brookneal. Thence on to Jarrett, 80 miles from Norfolk, work becomes more difficult and, for the last 60 miles beyond Victoria, along what is known as the Nottaway Ridge, there is a light earth covering of about 15 ft. above the rock, which is hard granite, so that, in the deep cuts the work is severe. It is along this section, also, that great pains were taken in the location, and four general lines were run before a decision as to the final location was made. With this con-

dition of the country in view, it will readily be seen that the climb to the summit of the ridge at Meherrin and the subsequent drop to the Staunton river were strenuous work.

Along this portion of the line we again come upon a section of country where alternate lines were possible and a wide reach of territory, approximately 20 miles across, was thoroughly covered by the surveys and carefully mapped. Then came the comparatively level country rolling down into the plain to the east of Norfolk and the Dismal Swamp. This level country across which it would be easy to run an ordinary line offered a good many difficulties to the location of this .2 per cent. compensated eastbound grade. Again it is desired to impress upon the reader that this means a change of elevation of never more than 10 ft. to the mile and frequently not more than 5 ft. And when this is to be done across a country at right angles to the general trend of the streams it involves long cuts and fills, not necessarily deep, but from their very length involving the removal of a large mass of material.

After leaving Brookneal the disintegrated granite mixed with the clay develops into regular ledges, and this in turn is followed by the very hard granite outcropping that runs north to Petersburg and Richmond, and from which the quarries at those places obtain their material.

All through the region alternative lines were run, sometimes covering a territory 40 miles across. For example, from milepost 135 to milepost 65 an alternative line was surveyed along the Nottaway river, which was abandoned in favor of one adopted. In the approach to Norfolk the line is run north and clear of the Dismal Swamp, so that easy connection can be made into Portsmouth and Norfolk. The latter city is avoided by a wide detour through the lowlands finally reaching the coal wharves at Sewall's Point, the terminal of the line. At this eastern end there is nothing but sand as far west as Suffolk, beyond which the country is rolling and the construction comparatively easy.

From what has been said it will be realized that the amount of excavation required along this line has been very great. Take the work in the mountains between Mullens and Micajah's Gap; there is one fill 125 ft. high that contains about 140,000 cu. yds. of material, most of which is rock from adjacent tunnels. After leaving Clark's Gap the country is easier and yet even through here the excavation amounted to from 60,000 to 70,000 cu. yds. to the mile. The profiles that are shown give a clear idea of some of the exceptionally heavy character of the work between Princeton and the New river bridge. The approach cut to the Oney Gap tunnel, for example, involved an excavation in rock of 153,000 cu. yds. at the west end and 30,000 cu. yds. at the east; and, again, at the New river, there is a cut of 100,000 yds. in rock. These are but typical of the work along the whole distance. Further to the east, after leaving the mountains and crossing the Alleghanies, there are exceptionally heavy cuts and fills. One cut near Moneta required 260,000 yds. of earth and rock excavation in a distance of 4,000 ft., and in the six miles beyond the material to be moved runs from 50,000 to 100,000 cu. yds. to the mile. Again in following the Nottaway ridge to cut off the bend of the Staunton river the grading is about 100,000 cu. yds. to the mile, through clay and rock.

To revert again to the general profile and the task involved in building this low grade line, attention is called to the map, upon which the two existing lines running from West Virginia coal fields to tidewater are shown.

In a way the Tidewater and Deepwater Railways will be in competition with the Chesapeake & Ohio and Norfolk & Western in that it runs from the Pocahontas coal fields to the sea. But, aside from this matter of general location, it does not touch the territory served by either of the other two except at a few isolated points, and will hardly compete in the sense of offering its facilities to any mine already reached by either of the other two. Its success, however, will depend upon the facilities which it can offer to proposed operations to market the output in competition with either or both of the other two lines.



Preparing to Fill at Rock, W. Va.; Deepwater Railway.

The prospect of being able to place coal upon the market in the face of this competition can be gaged by a comparison of the profiles of the three roads.

For this purpose we may start at the assembling point of the traffic of each. These may be taken as at Hinton for the Chesapeake & Ohio; at Bluefield for the Norfolk & Western, and Princeton for the Tidewater-Deepwater.

Taking the Tidewater-Deepwater, as shown in the upper of the three profiles, we have the assembling yard at Princeton from which there is a pusher grade to Oney Gap tunnel, about two miles; this is followed by an abrupt descent to the valley of the New river; with another adverse grade requiring a pusher at the crossing of the Alleghanies. This adverse grade is about nine miles long, though the pusher engines will run on to Fagg, eight miles beyond, to assist the westbound traffic. The same thing is done at Oney Gap, where there will be an overrun on the down grade of about 10 miles. Beyond this there is nothing to exceed .2 per cent. compensated grade against eastbound traffic. So that in a run of 350 miles double heading will be carried over only about 29 miles. Over the remainder of the line a single locomotive can haul the full rated tonnage of 80 loaded cars. In all the total rise of the Tidewater Railway between Princeton and Norfolk is 1,250 ft. on a run of 350 miles.



Fill on East River, Deepwater Railway; N. & W. Tracks Below.

In the case of the Chesapeake & Ohio, with Thurmond as the assembling point, 418 miles from Newport News there is a continuous rise to the crest of the Alleghanies, a distance of 82 miles. Part of the distance is on comparatively easy grades, but most of the way would require pushers for handling the proposed train tonnage, and this service would have to be carried on to Clifton Forge, 304 miles from Newport News. From Clifton Forge to Richmond the line follows the old James river canal, and is a continuous down grade. Beyond Richmond there are two places of from five

to eight miles in extent where pushers would be required if the proposed tonnage were to be moved. The total rise would be 1,347 ft. With Hinton as the point of assemblage the lift would be about 1,050 ft., and the distance 385 miles, with a pusher service approximating 90 miles. These figures may not correspond to the actual work done on the road, but they are approximately what would be required for a service similar to that proposed for the Tidewater-Deepwater.

On the Norfolk & Western, with the traffic originating at Bluefield, 364 miles from Norfolk, there is a total rise of about 2,894 ft., and a requirement for a pusher service of at least 130 miles if the same tonnage basis is to be preserved.

The following table gives a resumé of the data of these lines:

Line	From	To	Distance in miles.	Total rise in feet
Tidewater Deepwater...	Princeton	Norfolk.....	350	1,250
Chesapeake & Ohio.....	Thurmond	Newport News	418	1,347
Chesapeake & Ohio.....	Hinton	Newport News	385	1,050
Norfolk & Western.....	Bluefield	Norfolk.....	364	2,894

With these conditions in mind where distance, grades, curvature and total elevation are in favor of the new line, with the single exception of the total rise on the Chesapeake & Ohio, considering Hinton as the assembling point of originating traffic, it seems that that new line can reasonably expect to compete profitably with those now in existence. The officials who are directly responsible for the engineering features of the work are H. Fernstrom, Chief Engineer, and Raymond DuPuy, General Manager. W. N. Page is President of the Tidewater Railway and Dr. J. O. Green of the Deepwater. The other officials participating in the work and holding the same position in both corporations are: B. T. Elmore, Assistant Chief Engineer; L. R. Taylor and E. Gray Jr., are the Principal Assistant Engineers; F. F. Harrington is Engineer of Bridges, and C. H. Stengel, Designing Engineer.

The Tidewater and the Deepwater Railways.

CULVERTS, TRACK AND TUNNELS.

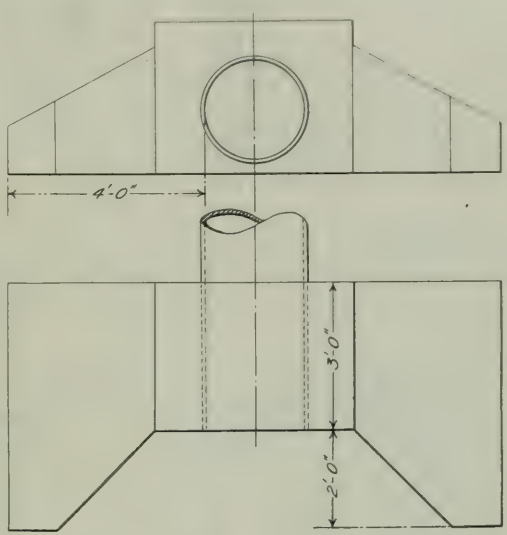
In the previous article on the Tidewater and Deepwater Railways, the general features of the line and the methods of conducting the surveys were discussed. From what has been said it will be seen that thoroughness is characteristic of the whole of the undertaking. It follows, then, that with such a preparation as that outlined, this thoroughness and carefulness should be carried into the execution of all of the work. Starting in the way it has, with no large towns except Roanoke to consider, and with the main fixed idea of obtaining low-cost hauling facilities for coal, it is natural that the adoption of standard forms of construction should have received early attention. As soon as any particular plan is determined on, a standard is developed that can be used the whole length of the line. These standards cover a wide range of items from stations to crossing signs, and from pipe culverts to viaducts, many of which will be illustrated in detail. In addition, standard methods of executing the work were prescribed.



Arch Culvert; Tidewater Railway.

The permanent way and that which pertains to it naturally received the first consideration, and so there have been developed an elaborate system of standards for culverts, viaducts and bridges. Starting with the smaller types of culverts that can be formed of cast pipe, a complete table of the lengths of the various sizes of pipes that would be required for different heights of fill was drawn up.

In laying pipe culverts it was specified that the grade should not be less than 1 in 100, and that the pipe should be cambered under the center of the fill so as to allow for settlement; the amount of this camber to be dependent upon the depth of the fill over the pipe and the character of the foundation. In no case, however, was the camber made so great that the central portion of the pipe was higher than the inlet. In other words, the camber must be less than 1 in 100. Ordinarily the pipe was laid in 12-ft. lengths, but where it was necessary half-lengths were used. The ends of all pipes of 18 in. or more in diameter were protected by rip rap laid by hand and to the approximate dimensions shown in the engraving. Further than this, the joints were made thoroughly watertight by the use of 1:2 Portland cement, mortar and oakum. These pipes were also carefully coated with asphaltum before being laid, and were well tamped in place, excavations being made to receive the bell projections.



Concrete Heading for Pipe Culvert.

Length of Pipe in Feet for Various Heights of Fill and Sizes of Pipe.

Height of bank.	Diameter of pipe in inches										
	10	12	14	16	18	20	24	30	36	42	48
3 ft.	24	24	24	24	24	24	24	..	..	..	..
4 "	30	30	30	30	24	24	24	24	24	..	..
5 "	30	30	30	30	30	30	30	24	24	24	24
6 "	36	36	36	36	30	30	30	30	30	24	24
7 "	36	36	36	36	36	36	36	30	30	30	30
8 "	42	42	42	42	36	36	36	36	36	30	30
9 "	42	42	42	42	42	42	42	36	36	36	36
10 "	48	48	48	48	42	42	42	42	42	36	36
12 "	54	54	54	54	48	48	48	48	48	42	42
14 "	60	60	60	60	54	54	54	54	54	48	48
16 "	66	66	66	66	60	60	60	60	60	54	54
18 "	72	72	72	72	66	66	66	66	66	60	60
20 "	78	78	78	78	72	72	72	72	72	66	66
22 "	84	84	84	84	78	78	78	78	78	72	72
24 "	90	90	90	90	84	84	84	84	84	78	78
26 "	96	96	96	96	90	90	90	90	90	84	84
28 "	102	102	102	102	96	96	96	96	96	90	90
30 "	108	108	108	108	102	102	102	102	102	96	96

Where the drainage area was too great for the flow of water to be cared for by 36-in. pipes, box or arch culverts were used and these were also standardized. These standards ranged from 2 ft. by 2 ft. to 4 ft. by 6 ft. for the box type, after which comes the arch construction in sizes running from 4 ft. by 6 ft. to 15 ft. by 15 ft.; the intermediates being 6 ft. by 6 ft., 8 ft. by 8 ft., and 10 ft. by 10 ft.

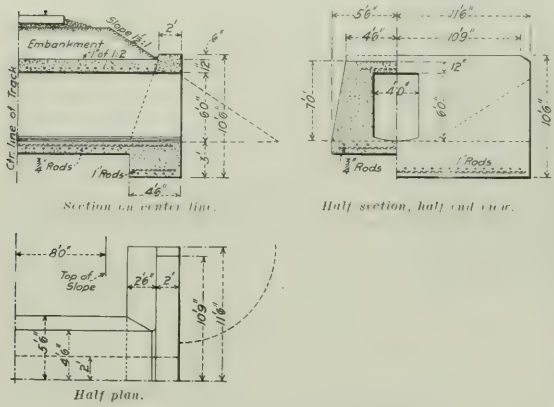
These box culverts are all of concrete and are of the general design shown in the illustration of the 4 ft. by 6 ft. box culvert. In this the dimensions shown for the foundations are the minimum allowed, and they are carried deeper where the nature of the soil requires. The reinforcing consists of 1 in. rods laid in both directions, as shown, near the base of the foundation. The cover and sides are made of 1:3:6 concrete with a somewhat poorer invert, which is of 1:4:7½ with a coating of 1:2 cement mortar 1 in. thick. The top and sides of the barrel of the culvert are waterproofed with a coating of straight run coal tar pitch ⅛ in. thick. All exposed edges of the concrete are rounded to a radius of 1 in. to prevent chipping, and the tops of the parapet walls are sloped inward. It may be added that, in the reinforcing of these culverts, the contractors were allowed to use old rails instead of the rods if they so desired.

The arch culverts were developed with the same completeness of detail. They conform, in a general way, to the scheme followed in the design of the box culvert, in that the reinforcement of the foundation is formed by rods at right angles and extending the whole length near the bottom. In the 12 ft. by 12 ft. culvert, illustrated, the arch is reinforced with a galvanized wire mesh, made

of No. 8 wire laid in a 1-in. by 2-in. mesh. The arch is formed of 1:2:4 concrete on a foundation of 1:3:6, and this latter mixture is also used for the invert, which is made thin and not carried down to the bottom of the foundation. Where the bearing soil is poor, piles are driven to carry the load. As in the case of the box culverts, the top of the arch construction is coated with a layer of straight-run coal tar pitch ⅛ in. thick for reinforcing at the bottom of the foundation, 1-in. bars are shown, but the contractor was at liberty to substitute old rails if he preferred.

For open drains one general plan was followed, that of laying up side walls of 1:3:6 concrete upon suitable foundations, using piles where necessary and carrying the track upon two stringers, each made of three I beams, bolted in nests, and placed directly beneath the rails, as shown in the illustration. These carry the ties to which the rails are spiked. This is a somewhat more expensive construction than that used on many older roads where old rails are substituted for the I beams, but in this new road old rails are not available.

In deciding upon the type and size of culverts to be used at any



Section on center line. *Half section, half end view.*

Half plan.

Standard 4 ft. x 6 ft. Box Culvert.

particular place, the engineers were guided by a very carefully compiled table drawn up in accordance with the flow produced by a maximum rainfall over the drainage area involved. This is based not only upon the area drained but also the character of the country. The line from Norfolk to Princeton is, therefore, divided into sections, to each of which a coefficient is assigned. Of course, as in all cases, these are not hard and fast conditions from which there can be no variation, for the judgment of the engineer must be exercised in the selection of the coefficient to be used in the determination of the size of the opening. For large openings greater than that of 10 ft. by 10 ft. culvert, the decision as to what it should be was made by the chief engineer. Then, too, there might readily be a variation from the coefficient laid down for any particular section, because of local information regarding the flow of streams and their high-water marks.

Bearing in mind the character of the country through which the road passes, as set forth in the previous article, it will be seen that the coefficient by which the final area of the opening is determined increases as we move west from Norfolk. In other words, as the country becomes rougher, and the flow of water more rapid, the area of opening to care for a given watershed increases twofold. The table, as it stands, is therefore adapted to water openings in the comparatively level country immediately west of Norfolk, but is insufficient for the rougher country. Hence the coefficients used, with variations subject to the judgment of the engineer, are as follows:

Section.	Coefficient.
Norfolk to Jarratt	1.00
Jarratt to Meherrin	1.50
Meherrin to Brookneal	1.75
Staunton River, Goose Creek, Roanoke and New River sections, with a few exceptions where a higher coefficient may be used	2.00

The method of using the table and coefficient is this:

For any given drainage area, select the opening given in the table as a base and multiply it by the proper coefficient using the product as the area of the opening actually to be used. For example:

Norfolk to Jarratt, area drained, 20 acres—3.1 sq. ft. x 1 coef. = 3.1 sq. ft. opening = 24-in. pipe.

Jarratt to Meherrin, area drained, 20 acres—3.1 sq. ft. x 1.5 coef. = 4.7 sq. ft. opening = 30-in. pipe.

Meherrin to Brookneal, area drained, 20 acres—3.1 sq. ft. x 1.75 coef. = 5.4 sq. ft. opening = 2 ft. x 3 ft. culvert.

Staunton River, etc., area drained, 20 acres—3.1 sq. ft. x. 2.00 coef. = 6.2 sq. ft. opening = 36-in. pipe.

Sizes of Culverts and Pipes for Various Drainage Areas.

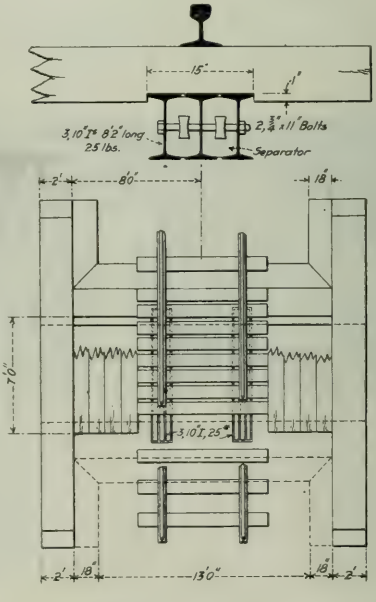
Area drained.	Area opening required—In sq. ft.	Size clvrt or pipe.	Area drained.	Area opening required—In sq. ft.	Size clvrt or pipe.
1 acre.	0.4	.....	126 acres.	9.6	.....
1.3 acres.	0.5	10-in. pipe.	140 "	10.2	.....
2 "	0.7	.....	152 "	10.9	3x4 or 4x3 ft. cul.
2.7 "	0.8	12-in. pipe.	160 "	11.1	.....
3 "	0.9	.....	180 "	12.0	.....
4 "	1.1	.....	198 "	12.6	.....
6 "	1.4	16-in. pipe.	200 "	12.7	.....
8 "	1.7	.....	240 "	14.3	4x4-ft. culvert.
8.4 "	1.8	18-in. pipe.	280 "	15.5	.....
10 "	2.0	.....	320 "	16.6	.....
11.2 "	2.2	20-in. pipe.	360 "	17.8	4x5-ft. culvert.
12 "	2.3	.....	400 "	19.0	.....
14 "	2.6	.....	500 "	22.0	4x6-ft. culvert.
16 "	2.8	.....	600 "	24.2	.....
20 "	3.1	24-in. pipe.	1 sq. ml.	25.0	.....
25 "	3.5	2x2-ft. arch clvrt	1.4 sq.mls.	30.4	6x6-ft. culvert.
30 "	4.0	.....	1.5 "	32.5	.....
35 "	4.4	.....	2 "	39.0	.....
40 "	4.8	.....	2.5 "	44.0	.....
42 "	4.9	30-in. pipe.	2.7 "	46.0	8x8-ft. culvert.
45 "	5.2	.....	3 "	49.0	.....
50 "	5.5	2x3 or 3x2 ft. cul.	3.5 "	54.0	.....
60 "	6.0	.....	4 "	60.0	10x8-ft. culvert.
70 "	6.6	.....	4.5 "	65.0	.....
78 "	7.1	36-in. pipe.	5 "	70.0	.....
80 "	7.2	.....	5.2 "	72.3	10x10-ft. culvert.
90 "	7.8	.....	6 "	75.0	.....
100 "	8.3	3x3-ft. culvert.	7 "	85.0	.....
120 "	9.3	.....			

The above table is based on coefficient — 1.

The importance of this standardization of culvert construction can hardly be exaggerated for, by this careful study of the character of the country, it made it possible for the division engineer in the field to decide as to the size and character of all minor openings as they were reached without the necessity of referring them to headquarters, and yet with the assurance that the practice both as to size of opening and character of the construction should be uniform throughout the whole extent of the line. When it is remembered that the road is carried across innumerable small streams, as it cuts across the natural flow, the value of such uniformity is very great.

THE TRACK.

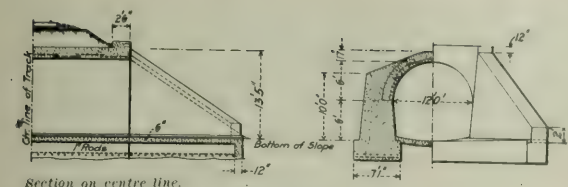
It is seldom, even on old and well established lines, that the degree of excellence in track construction is required that there is in the case of the Tidewater-Deepwater, and it is almost never



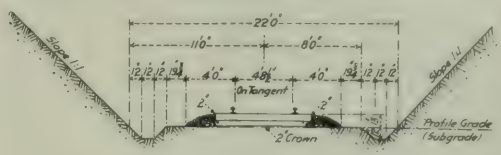
Standard Open Drain.

required for a new road through a sparsely settled country where there are no large centers of trade.

To start with, the width of the grade in cuts is 20 ft., and in fills, 16 ft. On fills the slopes come down at the rate of 1 in 1½. In cuts there is a 12-in. ditch beyond the grade slope, from which the bank rises at the rate of 1 in 1. This is common construction, but it is not common for a road to be ballasted with broken stone from end to end even through districts where no stone is to be found. This is being done in this instance. After the track has been laid on the subgrade it is raised about 3 in. and blocked with flat spalls until the ballast can be spread and tamped beneath the ties. When



Standard 12 ft. x 12 ft. Arch Culvert.



Standard Single Track Roadbed.
Earth excavation

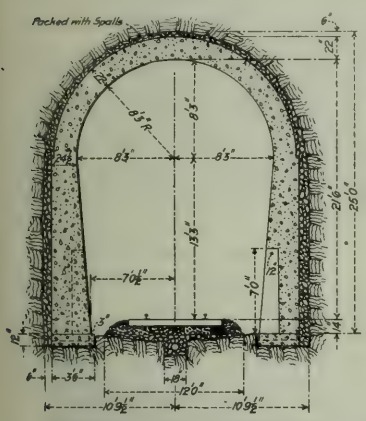
this has been done, the track will be allowed to stand and settle under the traffic of the construction trains until everything has come to a bearing. It will then be jacked up and the ballast tamped beneath the ties until the top surfaces of the latter are 15 in. above the subgrade. The ballast will consist of crushed rock that will pass through a 2½-in. ring, with all screenings and particles less than ¾ in. in diameter removed.

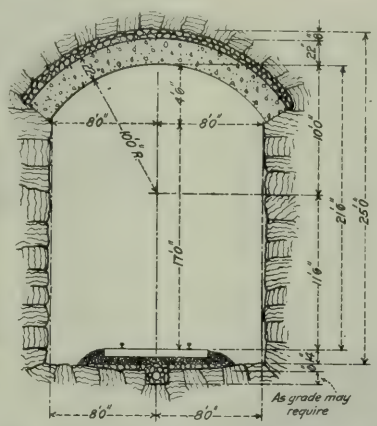
The track will be laid with 85-lb. rail of the A. S. C. E. section on ties of 9-in. face. The latter will be piled in accordance with the standards adopted as shown in the illustrations. The open method will be used for ties to be used by contractors, with the alternate layers removed to facilitate inspection or where the ties are to remain in the pile for more than three months. After the ties have been accepted and distributed they will be piled in crib work, provided they are not to remain in the pile for three months.

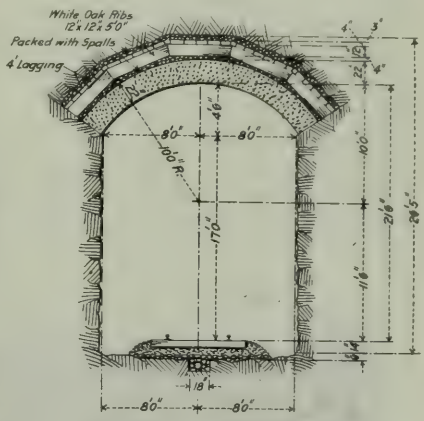
The alinement of the track, of course, follows the grade, and this has been laid out with an easement approach at both ends of every curve. These easements form a spiral curve that approaches that of a parabolic arc though the method of laying it out is much simpler. This easement curve has twice the length of the circular arc which it replaces, though the angle subtended remains the same. In laying it out, the spiral curve is divided into as many stations as there are degrees in the curve for which it forms the approach, and each of these stations increases one degree in curvature above the preceding one. It will be seen, too, that by varying the length of the stations the spiral may be made as sharp or as easy as the tangent conditions will allow. For example, if the stations are made 50 ft. long the approach will have but half the angular sharpness that it would have were the stations to be given a length of 25 ft.

The principal advantage of this method of easement approach lies in the fact that it leaves the tangent in its original position instead of shifting out to meet the spiral when the latter is substituted for the circular arc connecting the two tangents. At the same time the center of the curve is drawn into the angle, as shown by the sketches. In one the easement throws the tangents out but leaves the center of the original curve unchanged in its position. In the other the tangent remains fixed and the connecting curve is drawn in.

There is a slight difference in the character of the easements on the Deepwater and Tidewater sections of the line, on account of the difference in the character of the country through which they run. On the Deepwater, spiral approaches are used for all curves of 5 deg. or more, while on the Tidewater this rule holds for all curves of 2 deg. or more. Further spirals are used to connect any two adjacent sections of a compound curve where the difference between them is 2 deg. or more, as in the case of a 4-deg. and 6-deg. curve. Finally, wherever there is a break in the grade of more than $^{2}/_{10}$ per cent. a vertical curve is used to connect the two sections, but where the break is $^{3}/_{10}$ per cent. or less no vertical curve is used.







TUNNELS.

It follows, as a matter of course, that in building a low-grade



Method of Laying Out Curves; Tidewater and Deepwater Railways.

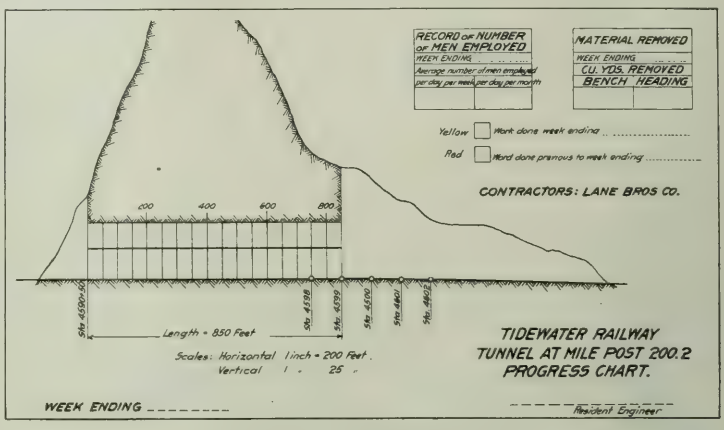


Track and Cut near Elmore, W. Va.; Deepwater Railway.

line through such a country as southern and western Virginia and West Virginia, tunnel work must be frequent. It has been remarked that a low grade air line can be built through any country if you will only stay under ground enough of the time. So while tunnel work has not been courted in the work, it has not been avoided at the expense of grade or alinement. As in the case of other details of the road, the tunnels have been standardized to as great an extent as the nature of the work would allow.

In much of the work west of the Alleghanies the treacherous nature of the rock is such that a facade is required for the entrances and one has been designed and is used wherever it is directed by the chief engineer. It is of concrete and for a single track; slightly oval in section with a diameter of 16 ft. 6 in. at the spring of the arch and 14 ft. 1 in. wide at the subgrade. The top of the parapet is 13 ft. 8 in wide and is backed by a paved ditch that empties into a circular catch basis from which a pipe whose size depends upon the area to be drained leads down to the ditch at the bottom of the tunnel. The catch basis has a depth of 2 ft. and a diameter of 18 in., and is fitted with a perforated cast-iron cover to keep out the coarse material. The ditch itself is paved with cobbles. Finally waterproofing is applied to the crown of the arch as indicated, the concrete used being the standard class B or 1:3:6 mixture, while a 1:2:4 mixture is used for the cap of the parapet.

For the tunnel sections themselves, five standards have been adopted, to be used according to the nature of the material through which the excavation is made. These sections are known as types A, B, C, D and E. In all of these the clear height of the crown of the arch above the base of the rail is 21 ft. 6 in. Of these types, A is the simplest. It is applied in rock where there is no danger of cave-ins. It has a semi-circular roof with a radius of 8 ft. with vertical sides 16 ft. apart and is not lined. The bottom beneath the ballast is paved with coarse stones, and there is a pump and drain pipe as with type B. Type A requires about 12.63 cu. yds. of excavation per lineal foot. Type B is also used in rock where the sides



Progress Chart; Tidewater Railway.

timbered for support and before the concrete arch is laid. The main support is in the 12-in. by 12-in. timbers that are cut to 5 ft. lengths and formed into an arch over which a 4-in. lagging is placed. The space above the timbering, as well as that between it and the concrete, is packed with spalls. In other respects this section corresponds to the type B both in the quality of the concrete and the general dimensions used. Owing to the space occupied by the timbering the amount of excavation is greater than in type B, it being 16,233 cu. yds. per lineal foot. The concrete remains the same at 1.435 cu. yds. and to this must be added 171 ft. of timber, board measure, based on a rib spacing of 5 ft. centers, a spacing that is varied with the nature of the cover.

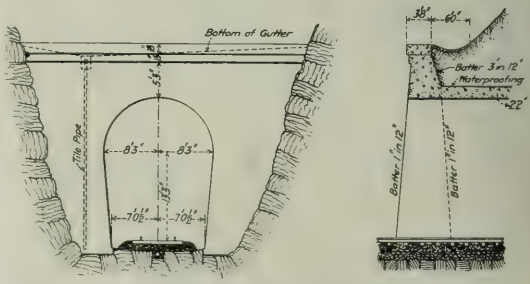
The D section is one lined with concrete and is used in materials that are firm but not self-sustaining. The cross section of the opening is identical with that of the concrete portal, and the method of draining is the same as that of the other tunnel sections. The concrete used is poorer in cement than that used for the arches



Jenney's Gap Tunnel; Deepwater Railway.

are firm, but where there is danger of the roof coming down. In this the sides are vertical, as in class A, up to a height of 17 ft. above the base of the rail, at which point a concrete arch of 4 ft. 6 in. rise and 10 ft. radius is sprung. This arch is of 1:2:4 concrete, of a thickness varying with the character of the cover to be held, but which is made 22 in. as a minimum. The space above the arch and beneath the rock is packed with spalls as a protection against sudden falls upon the concrete itself. On curves the section is widened according to the degree of curvature of the track. The drainage at the bottom is of the same character as that of type A, vitrified pipe with open joints being laid beneath the ballast, as shown in the section. The quantities required for this section are 14.809 cu. yds. of excavation and 1.435 cu. yds. of concrete masonry per lineal foot.

Type C is the section that has been adopted where the sides of the tunnel are firm and the roof yielding. In this the roof is



Facade, Standard Single Track Tunnel.

of types B and C, it being a 1:3:6 mixture. The thicknesses of the lining, as given in the engraving, are the minimum dimensions that are allowable, and these are increased as occasion may demand. In this section refuge niches 3 ft. wide with circular tops are provided every 200 ft. on each side and staggered so as to provide a refuge at half that interval throughout the whole length of the tunnel. Weep holes are also provided, leading from the sides to cross drains, as local conditions may require. The space between the concrete and the material on all sides is packed with a layer of 6 in. of spalls. In this section the excavation exceeds that of any



Ingleside Tunnel; Tidewater Railway.

of the others, it being 18.537 yds. per lineal foot, with 1.955 cu. yds. of concrete masonry in the arch and 3.085 cu. yds. in the side walls

The E section is used in yielding material, and is a timbered tunnel lined with concrete; the dimensions of the latter corresponding with those of the D section, though a richer or 1:2:4 mixture is used. The timbering is of the same character as that used in the C section, except that it is carried down the sides instead of being confined to the roof. This section requires 21.82 cu. yds of excavation and 489 ft. board measure of timbering per lineal foot. The masonry for the same distance consists of 1.955 cu. yds. in the arch and 4.323 cu. yds. in the side walls.

In driving these tunnels various methods have been employed in the detail of the work. Sometimes it has been from shafts sunk from above with a heading driven in each direction, though usually the work has been by approach from the two ends. In a number of cases elaborate preparations had to be made in the way of building roads, sometimes laying rails on them for the transportation of material and supplies, and in many instances this also involved the erection of expensive compressor plants to supply air to the drills.



Portal of Tunnel at Mile Post 58; Deepwater Railway.

A very complete system of progress charts was also provided by which the condition of the work could be exactly determined at any time. This was quite essential to a proper supervision from headquarters since, in the distance between mileposts 103 and 362, there are twenty tunnels with a total length of 18,786.3 ft., the longest being the one at the summit crossing the Alleghany mountains, with a length of 5,139 ft., and the shortest at milepost 291, which is but 450 ft. long. The system by which the reports of progress were kept consisted of a blueprint upon which there was a longitudinal section of the tunnel divided vertically by lines 50 ft. apart on the scale and by a horizontal line to separate the bench from the heading. Two sets of these prints were provided, one for the week ending and one for the month. These were colored red and yellow, as directed, and sent to the office of the chief engineer at the end of each week and month by the resident engineer, with the other data called for. In this way a complete record was obtained of the number of men employed and the material removed as called for on the blank. The two blanks are identical in every particular, except that one is for the month and the other for the week.

It is this portion of the work that will probably fix the time for the opening of the road, and the tunnel that will be the last to be completed will undoubtedly be that at the summit of the Alleghanies, and this is now being pushed as rapidly as possible.

The prosecution of this work may be taken as a sample of that done elsewhere, though it is on a larger scale than is ordinarily required. The contractors have installed a very complete power plant near the opening of the shaft that is about midway between the two portals, besides having built a standard gage railroad from a connection with a local mining road up to the power-house. In this way a direct connection is made with the Norfolk & Western and all supplies are brought in over the line, which is about 2½ miles long. Four headings are being driven, and the advance is at the rate of about 380 ft. per month, through rock.

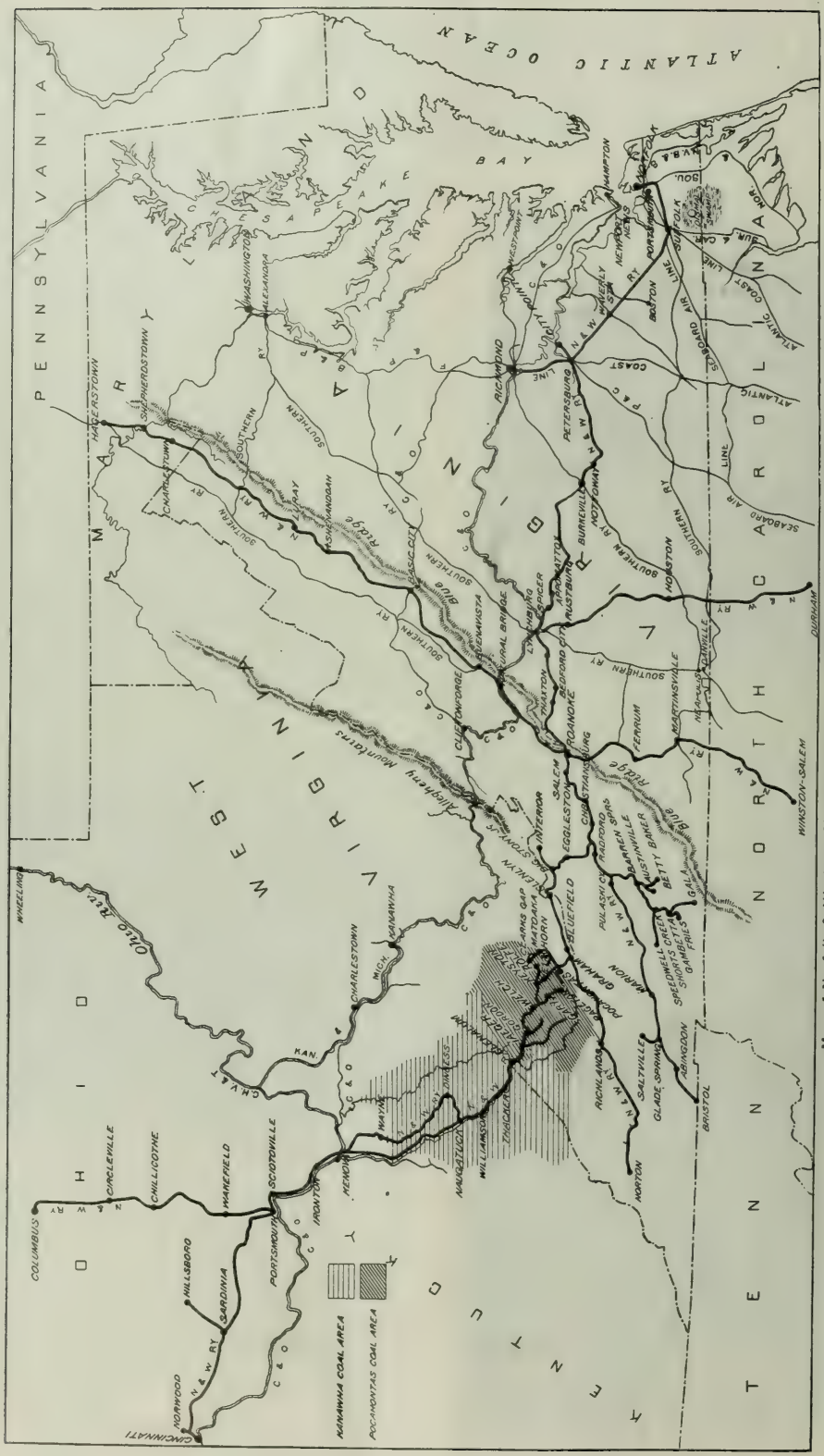
Norfolk & Western Improvement Work.

BY GEORGE L. FOWLER,
Associate Editor of the *Railroad Gazette*.

GENERAL FEATURES AND IMPROVEMENTS.

In the issues of the *Railroad Gazette* for July 3, July 24, September 25, and October 2, 1903, there was published a series of articles relating to the physical and operating conditions of the Norfolk & Western Railway as they existed at that time. The coal traffic from the Pocahontas and Thacker districts was increasing rapidly and the company found that unless the facilities for handling this traffic were at once increased there would be a congestion which it would be impossible to relieve. Already conditions of this sort had been encountered on the westbound work, which had been relieved by building the Big Sandy line from Naugatuck to Kenova, by which a low-grade track for westbound traffic had been obtained and the distance shortened by about 24 miles. This had not, however, afforded any relief at division points where the yards were too small for the demands made upon them, to say nothing of the requirements of the future. Accordingly, at the time of the publication of the articles referred to the company had planned an elaborate range of improvements in the form of yards at Roanoke, Va.; Bluefield and Williamson, W. Va., and Portsmouth, Ohio, in addition to a straightening of the exceedingly crooked portion of the line lying in the midst of the West Virginia mountains between Vivian and Naugatuck. A considerable proportion of this work has now been completed. But, while none of the yards is entirely finished, the work has been executed to such an extent in all of them that they are in operation, and a great deal of the double-tracking on the mountain portions of the line has been finished or is under contract. Not only has this been done, but much additional work made necessary by increase in traffic has been planned and partially contracted for in double-tracking the main line on improved alinement and grades. The principal part of these additions are to be found in the reconstruction and double tracking of the line on the Norfolk division between Montvale and Forest, a distance of 27 miles, and the construction of a low-grade line on high ground around the city of Lynchburg from Forest to Concord, a distance of about 21 miles, while the distance between these points by the present line is about 23½ miles.

In order to appreciate the true significance of these improvements and why these new alinements were not used in the first place, a few words regarding the general topography of the country

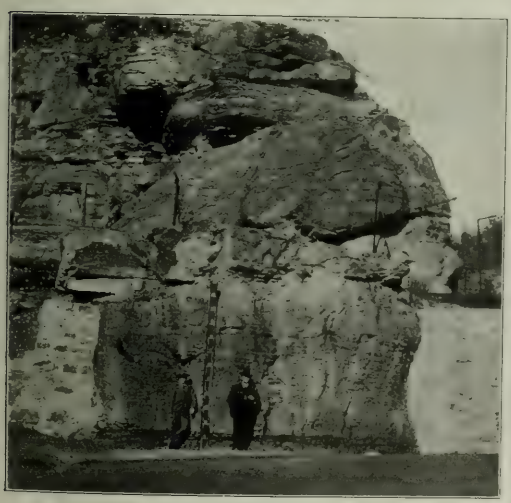

ATLANTIC OCEAN
CHESAPEAKE BAY
PENNSYLVANIA
OHIO
WEST VIRGINIA
VIRGINIA
MARYLAND
DELAWARE
NORTH CAROLINA
SOUTH CAROLINA
TENNESSEE
KENTUCKY
Ohio River
Alleghany Mountains
Blue Ridge
Kanawha Coal Area
Pocahontas Coal Area
Norfolk & Western
Chesapeake & Ohio
Southern
Atlantic Coast Line
Seaboard Air Line
Map of Norfolk & Western, Showing Section of West Virginia Coal Fields Served.

and the conditions governing at the time of construction will be in place.

The Norfolk & Western Railway was not built or even planned in its entirety at the start. It exists as the result of a number of consolidations and extensions that have required nearly 60 years to complete. It did not even start from the seaboard at first. The nucleus of the road lay in the Petersburg Railroad, built from Petersburg to City Point in 1851. A second and disconnected section known as the Virginia & Tennessee Railroad was built from Lynchburg to Liberty, now Bedford, in 1852, and this was extended to Roanoke, then known as Big Lick, in 1855. This was carried on to Bristol, Tenn., in 1858. In 1854 the Norfolk & Petersburg Railroad was opened between those points, and then run on to Burkeville the same year, as the Southside Railroad, and thence to Lynchburg in 1857. The Virginia & Tennessee, the Norfolk & Petersburg and the Southside railroads were consolidated in 1870 as the Atlantic, Mississippi & Ohio Railroad, and, in 1881, when it had 408 miles of main line and 20 miles of branches, the name



View on Norfolk & Western Railway near Glenalum, West Va.



Pocahontas Coal Seam at Pocahontas, Va.

was changed to the Norfolk & Western Railroad, from which time dates the extensions into the coal regions of Virginia and West Virginia. The New River Railroad was acquired in 1882 and opened for business a year later to Pocahontas, Va., where the first development of Pocahontas coal took place. In the next three years, extensions were made into this field on the eastern side of the mountains.

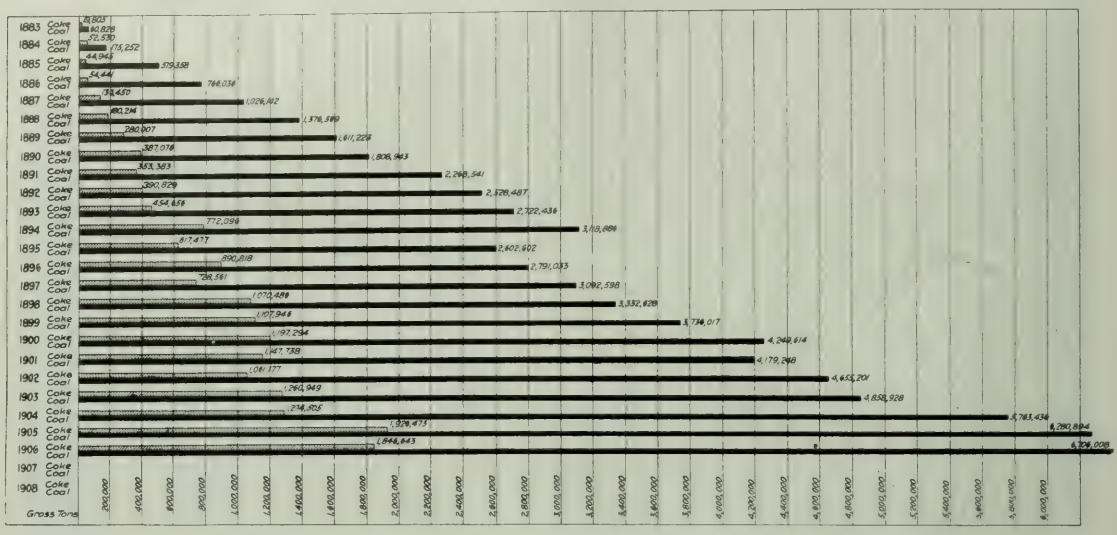
In 1886, the Cripple Creek Extension, from Pulaski, Va., 26 miles to Foster Falls, Va., in the direction of North Carolina, opened a territory of great mineral wealth. In 1887, the Elkhorn tunnel was started through the Flat-Top mountain and the Elkhorn Pocahontas coal field was opened in 1888. This was the initial step toward the route to the Ohio river. The Clinch Valley Extension, affording an outlet via the Louisville & Nashville, through Norton, Va., was finished in 1891. During the same year the Norfolk & Western began building into the Elkhorn Valley. The Shenandoah Valley Railroad, between Roanoke and Hagerstown, Md., was absorbed in 1890, and two years later the Roanoke & Southern, between Roanoke and Winston-Salem, N. C., and the Lynchburg, between Lynchburg and Durham, N. C., were leased.

At the same time the main line was being pushed on to the west until it reached the Ohio river, and then the acquisition of the Scioto Valley Railroad gave a through route from Norfolk to Columbus, by way of Kenova and Portsmouth.

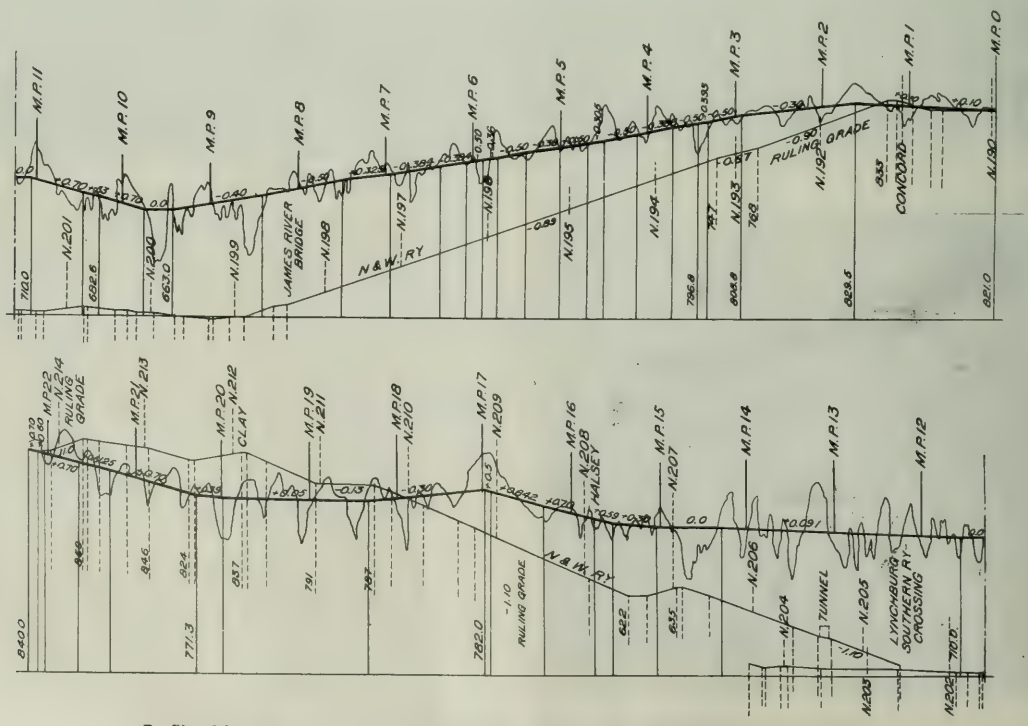
The system, thus built up, was reorganized in 1897 as the Norfolk & Western Railway Co., and now owns more than 1,800 miles of main line and branches.

At the time of the building of the early lines that formed the nucleus of the system there was little or nothing beyond the

purely local traffic to be expected. Nothing specific was known regarding the coal fields of West Virginia, and what was known was not of such a character as to attract capital. Indeed, it is said that, when the Pocahontas fields were first placed upon the market they could not find a buyer, so firm was the conviction that no coal could compete with that from the Pittsburg district. All this had its effect upon the original alinement, which naturally sought the large towns and centers of population. So, after the coal had been brought to the attention of consumers and was found to be of an exceptionally high character, and it was decided to push the line through to the Ohio river, there was still not enough in sight either in the form of the then present or future output to warrant the bold piercing of mountains and the construction of bridges that has recently been undertaken. After entering the mountains and reaching the level of Elkhorn Creek, which is done a short distance beyond the eastern boundary of the Pocahontas field, the natural and economical course to be pursued, both in cost of survey and construction, was to follow the banks of this stream down to its junction with the Ohio, which would give a low-grade, constantly descending line, but one which was exceedingly tortuous, as will be seen by reference to the map of a portion of the alinement where straightening is to be done. This was the course pursued as far west as Naugatuck, 484 miles from Norfolk. At this point there is a detour of the old line running back into the hills, for the purpose of reaching the coal properties that were known to exist and regardless of the extra cost of haul-



Graphical Illustration of Annual Coal and Coke Shipments; Pocahontas Flat-Top Field.



Profile of Lynchburg Belt Line & Connecting Railway and Norfolk & Western Railway.

age, so that it was not until 1904 that it was found to be necessary to add to the facilities and build the low-grade line down the Big Sandy river to the Ohio.

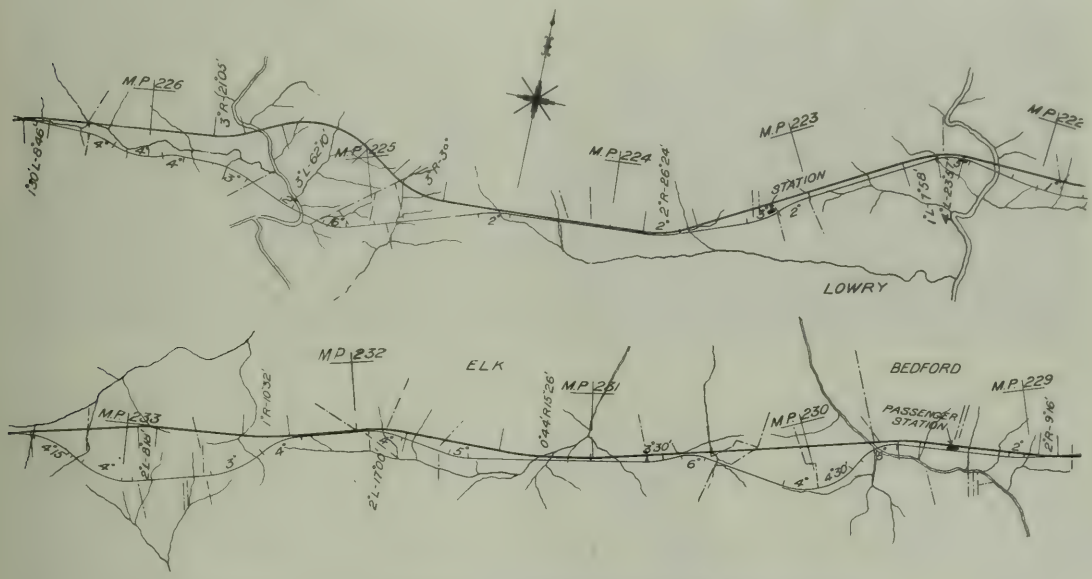
The Norfolk & Western is, then, essentially a coal road and serves a territory in which are located the richest veins of the world. The center of this territory lies in the heart of the mountains of West Virginia, on what is known as the Pocahontas division of the road. It is here that probably 62 per cent. of all of the tonnage hauled by the road originates.

So, too, this particular district stands pre-eminent in coal. Tonnage is obtained all along the line west of Roanoke. There are a few anthracite mines west of that place on the Radford division, with quite a large operation at Christiansburg. There are also a number in the Clinch Valley which really produce a Pocahontas coal. Next to this comes the great Pocahontas field itself, followed by the Tug river, then the Thacker and Kenova, while in Ohio there are two operations.

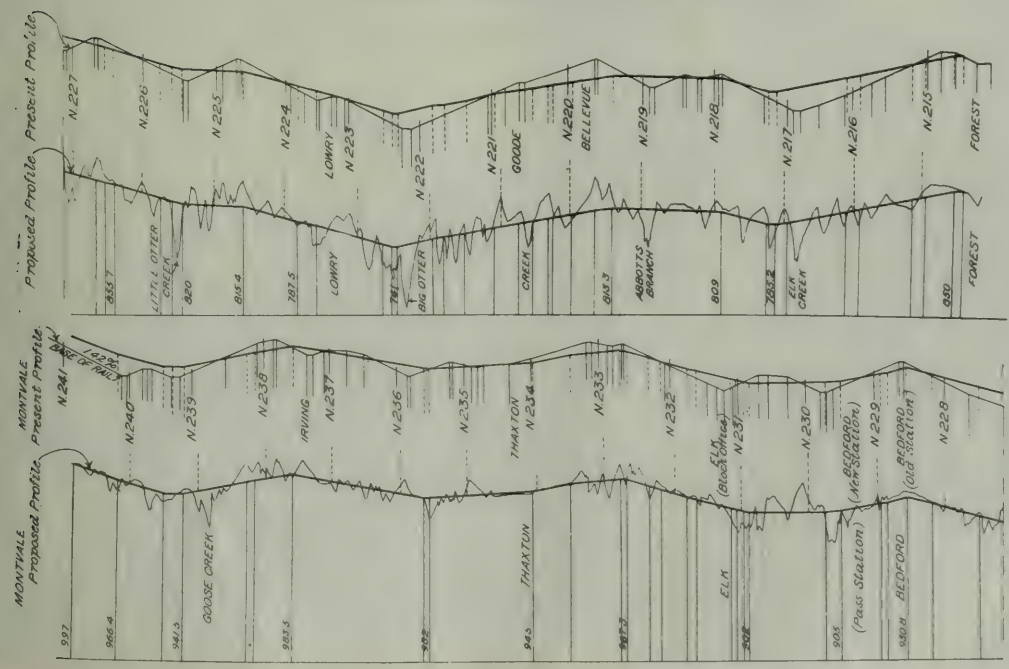
Divided by districts, the number of operations served by the Norfolk & Western is as follows:

District.	No. of operations.	Shippers of
Radford (Va.)	8	Coal.
Clinch Valley.	28	"
Clinch Valley	2	" and coke
Pocahontas . .	11	"
Pocahontas . .	51	" and coke
Tug River. . .	16	"
Tug River	1	Coal and coke
Thacker	26	"
Kenova	12	"
Scioto (Ohio) . .	1	"
Total	157	

There are thus 157 mining operations along the line, and as it frequently happens that from one to five or more mines are



Typical Re-location on Forest-Montvale Improvement; Norfolk & Western Railway.



Profile Forest-Montvale Improvement; Norfolk & Western Railway.



Cut near Bedford, Forest-Montvale Improvement; Norfolk & Western.

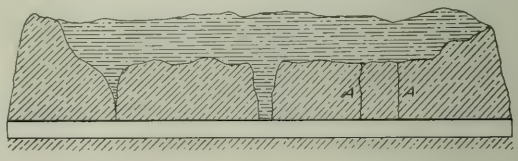
included in a single operation, it will be seen that these are many times greater than the figures given.

That portion of the railroad between Elkhorn tunnel and the Ohio river is within the boundaries of West Virginia, except in one case where it takes a short cut, by way of two bridges and a tunnel, across a bend of the Tug river, and thus runs for a few hundred feet in the state of Kentucky. The mining operations are not, however, wholly confined to West Virginia. From about 437 miles west of Norfolk, or near Glenalum station, the Tug river forms the boundary line between West Virginia and Kentucky, and here a number of operations have been opened along the heights on the Kentucky side. The output of these mines is comparatively small at present, but the properties are good and it is on the increase. Transportation across the river is by means of an aerial tramway reaching from the headhouse on the mountain to the tipple alongside the track, with spans ranging from 1,000 ft. to 1,500 ft.

As for the quality of the coal, it is, as already stated, among the best of the world, and the seams are remarkably free from impurities. The Pocahontas vein proper, or the one that is known



Trestle for Little Otter Creek Fill, Forest-Montvale Improvement; Norfolk & Western.



Typical Section of Rock Along New River; Norfolk & Western.



Tunnel on Laurel Branch, West of Pocahontas.

as the Pocahontas No. 3, is the richest and thickest. It ranges in thickness from 6 ft. to 12 ft., and an analysis shows it to be very high in fixed carbon, with from 15.75 to 19.5 per cent. of volatile matter; very low in phosphorus and sulphur, and with from 2.34 to 9.5 per cent. of ash, with an average of about 6 per cent., and it has a heat content of about 15,000 British thermal units.

The Pocahontas seams are the lowest, geologically speaking, and have a dip of about 50 ft. to the mile. As they disappear below the water the higher strata come to the outcrop to the west, and we find the Tug river and Thacker coals in the western part of the state. There is nothing in these fields that can compare with the great Pocahontas vein. The main Thacker seam runs in thickness from about 4 ft. 6 in. to a little over 5 ft., and is of a remarkable purity, though somewhat inferior chemically to the Pocahontas. An average analysis of this coal would be about as follows:

Moisture	0.41	per cent.
Volatile matter	36.33	"
Fixed carbon	58.09	"
Ash	5.17	"
	100.00	per cent.

There will be about 0.9 per cent. of the whole in sulphur and the heat content will be about 14,700 heat units.

With such coal as this along the line, it follows as a matter of course that the tonnage should be large and rapidly increasing. For the four fiscal years ending June 30, 1906, the total output of the several districts along the line is given in the accompanying table. From which it appears that, in four years, the total tonnage has increased 42.02 per cent. and the coke tonnage 12.25 per cent:

Statement of Coal and Coke Production, N. & W. Ry., by Districts for the Years Ending June 30 (net tons).

		District					
		Pocahontas.	Tug River.	Thacker.	Kenova.	Ohuch Valley.	Total.
1903.	Coal	5,560,735	230,134	884,392	84,099	868,322	7,627,682
	Coke	1,288,307	12,753	.....	.....	341,219	1,642,279
1904.	Coal	5,652,540	394,280	1,267,129	78,809	737,248	8,130,006
	Coke.	1,432,462	6,443	.....	.....	262,417	1,701,322
1905.	Coal.	6,809,887	556,154	1,340,056	190,747	762,193	9,659,037
	Coke.	1,751,877	52	.....	.....	213,221	1,965,150
1906.	Coal.	7,499,523	802,750	1,678,901	368,364	788,501	11,138,039
	Coke.	2,112,268	22	.....	.....	223,917	2,336,207

The total tonnage carried in the year ending June 30, 1906, was 19,266,534, of which 11,875,300 was coal or coke, or about 62 per cent. of the whole. The road has, therefore, a very good reason for its existence; and this is still further emphasized by the graphical representation of the annual coal and coke production of the Pocahontas field from 1883 to 1906, inclusive, as compiled by John J. Lincoln, Chief Engineer of the Crozier Land Co. In this it is shown that the coal production rose from 60,828 to 6,706,008 gross tons, and the coke production from 19,805 to 1,846,643 gross tons, or an increase of more than a hundred-fold.

From an engineering standpoint the road traverses a territory as widely different as its products. Starting at sea level it first crosses the northern part of the Great Dismal Swamp and the low ground of eastern Virginia; then rises to a height of about 1,280 ft. in its passage of the Blue Ridge mountains; dropping thence into the valley of the Roanoke and rising again to 2,040 ft. in its passage of the Alleghanies. It then follows the New river for a few miles, and finally plunges into the wilds of West Virginia, where it rises to a height of 2,560 ft. at Bluefield.

The reason for the first location of the road has already been discussed, and the necessity for the improvements that are being made was based upon the inadequacy of the original construction to take care of the constantly increasing traffic that was offered. While not in the chronological order of the work as it was undertaken, it will be convenient to consider what was done on the line from east to west.

At the tidewater terminal we have the Lambert's Point wharves that were described in



Abbott's Creek Arch, Forest-Montvale Improvement; N. & W.



Laurel Branch, near Pocahontas; Change of Creek Bed Saves Two Bridges.

the *Railroad Gazette* for July 24, 1903, to which merely minor improvements have been added since that time. At South Norfolk a large receiving yard is in course of construction, which will be described in another place.

Moving west, the first large undertaking that is encountered is that of the construction of a low-grade line around the south side of the city of Lynchburg, from Concord to Forest. Under the present conditions the single-track line passing through Lynchburg, with the heavy grades upon each side of the city as the road drops down from the heights to the level of the James river, is the limiting point of the traffic and the place where congestion is most apt to occur. In order to meet this difficulty, and, at the same time obtain a better grade and alinement, the detour about the city has been planned and is about 43 per cent. completed.

As already stated, this detour starts from Concord, about 14 miles east of the Lynchburg station, and turning to the south, remains on the high ground until the city is passed, and it reaches the main line again at Forest, about 11 miles west of Lynchburg station, as measured on the present line. On this detour the maximum curvature is fixed at four degrees, and the ruling grade for eastbound traffic will be 0.5 per cent. as against 1.25 per cent., including curve resistance on the present line. For westbound traffic the maximum adverse grade will be 0.7 instead of the 1.45 per cent., including curve resistance of the present line. It will be seen from the profile that is shown of this work, that the excavation required is very great; in fact, for the 22 miles of the line the excavation amounts to 2,625,000 cu. yds., or at the rate of about 120,000 cu. yds. per mile. The greater portion of this work is that which can be done with the steam shovel, but as Lynchburg is approached from the west the rock comes closer to the surface, and where the cutting is more than 15 ft. in depth blasting is required.



Tunnel No. 1 near Welch, W. Va.



Norfolk & Western Railway near Antler, West Va., Showing Old and New Main Lines.

The estimated cost of this portion of the work of improvement is placed at $2,485,000.

The value of such a detour as this can be readily appreciated in that it will afford a low-grade double-track passage around the city of Lynchburg for all freight traffic, and thus not only reduce the cost of haulage, but make it possible to maintain a faster schedule. In this connection the experience of the road in the construction of the Big Sandy line will be of interest.

This is built down the banks of the Big Sandy from Naugatuck to the Ohio, and was, as stated, for the purpose of relieving the congestion of traffic on the old line. It was found that at the end of the first year of its operation the saving that it had effected amounted to $237,912, and for 1906 it is estimated that it effected a saving of from $300,000 to $350,000 in comparison with what would have been the cost of hauling the traffic over the old line, even though that could have been done. This line cost $4,939,724, and it has made it possible for the road to handle far more business than could have been done over the old line.



Big Otter Creek Viaduct, Forest-Montvale Improvement; N. & W.



Tunnel No. 2, near Welch, W. Va., Norfolk & Western, Showing Old and New Tracks.



Old and New Main Line at Antler, West Virginia: Norfolk & Western.



Old and New Tracks at Short Creek; Norfolk & Western.

In fact, the relief was so noticeable at first that, shortly after the line had been put in operation, the manager received a call from the representative of the engineers asking for a change in the running arrangements for the men, on the ground that business had fallen off to such an extent that they could not make full time. He was told that not only had business not fallen off, but that it had very perceptibly increased, and that the reason for the apparent fall was that the crews were getting over the road in from ten to twelve hours, instead of twenty.

Immediately west of Forest, where the detour joins the main line, there is a section that is being double-tracked as far west as Montvale, 27 miles. Although this is called double-tracking, it is really the construction of quite a new line, and for the greater portion of the way is of an entirely new location. Sometimes it uses the old right of way, and again it is removed from it some distance. Two characteristic sections of the line are shown in which the old line is represented by a fine, and the new location by a heavy line. In this the maximum curvature is placed at four degrees, and the maximum grade against eastbound traffic is 0.5 per cent. and 0.7 against the westbound, all compensated for curvature, or the same as that maintained on the Lynchburg Belt Line and Connecting Ry. above referred to.

The excavation throughout nearly all of this piece of work is steam shovel work and amounts to 3,277,000 cu. yds., and it is estimated that the cost will be about $2,625,000. In this revision, the shortening of the line will be comparatively slight, but the advantages will lie in the straightening of the alinement by the elimination of sharp curves and the reduction of the opposing grades to east and westbound traffic from about 1.48 per cent. to the figures given. The profile and the photographs of this part of the line, as well as those of the Lynchburg line branch, will give a fair idea of the general character of the work.

With this work completed and a double track down, the capacity of the road will be greatly increased, and the necessity for double-heading through the whole section of which Lynchburg is the center will be entirely avoided. The next point to the west where important improvements are under way is at Roanoke, where the final work is being done on the great yard. This, with the other yards at Bluefield, Williamson and Portsmouth, is a matter of such magnitude that the system of yards for the whole road will be treated separately, and in a future issue.

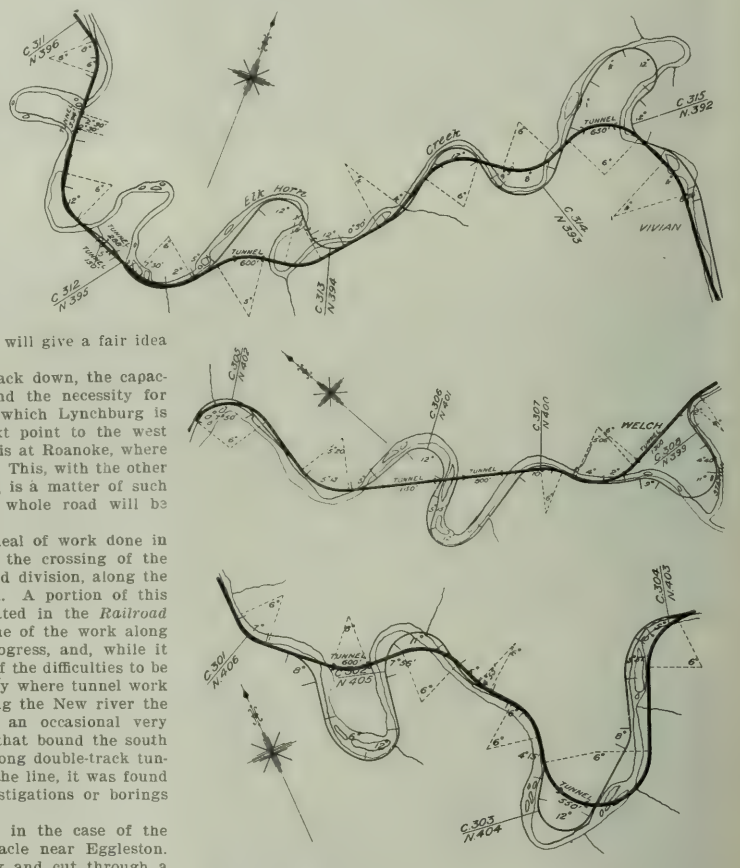
Beyond Roanoke there has been a great deal of work done in the straightening of the line, commencing at the crossing of the Alleghanies and continuing on over the Radford division, along the New river and on the East river to Bluefield. A portion of this work has already been described and illustrated in the *Railroad Gazette* for October 2, 1903. At that time some of the work along the New river was under contract and in progress, and, while it was known to be difficult, the full significance of the difficulties to be encountered was not fully appreciated, especially where tunnel work was concerned. In the original alinement along the New river the banks had been closely followed, with only an occasional very short tunnel through the limestone pinnacles that bound the south side. When it came to driving comparatively long double-track tunnels through this rock in the straightening of the line, it was found that no dependence could be placed upon investigations or borings in the matter of the stability of the cover.

A marked sample of this is to be found in the case of the new tunnel that was driven through a pinnacle near Eggleston. The original line had followed the river bank and cut through a spur by a short tunnel, as shown at the right of the engraving. This has now been abandoned for the one through which the rails are run, and by which a straightening of the line was effected. In the construction of this tunnel, however, unexpected difficulties were encountered. The cover was apparently a considerable thickness of rock, with a hill of earth above, that was practically a series of clay pockets filled in between the ridges and pinnacles of the limestone rock and rising to a height of about 125 ft. above grade. At a short distance back of the western portal, the bore struck the lower part of a pocket and there was a cave-in that crushed all timbering that could be used, and so the material from this funnel-shaped pocket reaching to the top of the hill about 200 ft. across, had to be taken out through the portal.

A similar cave-in, at another tunnel that is being cut a mile or so west of this, has occurred near the center, with only 90 ft. between the ends of the completed tunnel lining at the time of the fall, and this is now being removed by steam shovels from each face and by excavation from above. Again, at Pembroke the whole face of a mountain into which a cut-off tunnel was being driven, came down and buried the portal. The debris was removed and a stone portal built.

The immediate cause of these cave-ins is the seamy character of the rock. This is illustrated by a typical diagram in which a pocket of the earth cover is shown extending nearly down to the tunnel line. Such a pocket as this can, of course, be detected by systematic borings, but such seams or cracks as are shown at A A cannot be found unless a core drill is used and this happens to strike exactly on the line of one of these cracks. The result is that when the heading has been driven into the apparently solid rock between two such defects, the whole roof comes down, and with it the superincumbent water-saturated earth. For mutual protection the contracts for work in these pinnacles along the New river are drawn so as to protect both the contractor and the railroad company for all extra yardage resulting from this disintegration in the form of unavoidable falls, contractors being paid ordinary excavation prices. In these cases the material was used in building high double track fills along the river bank near the tunnels.

While trouble has not been experienced to the same extent in

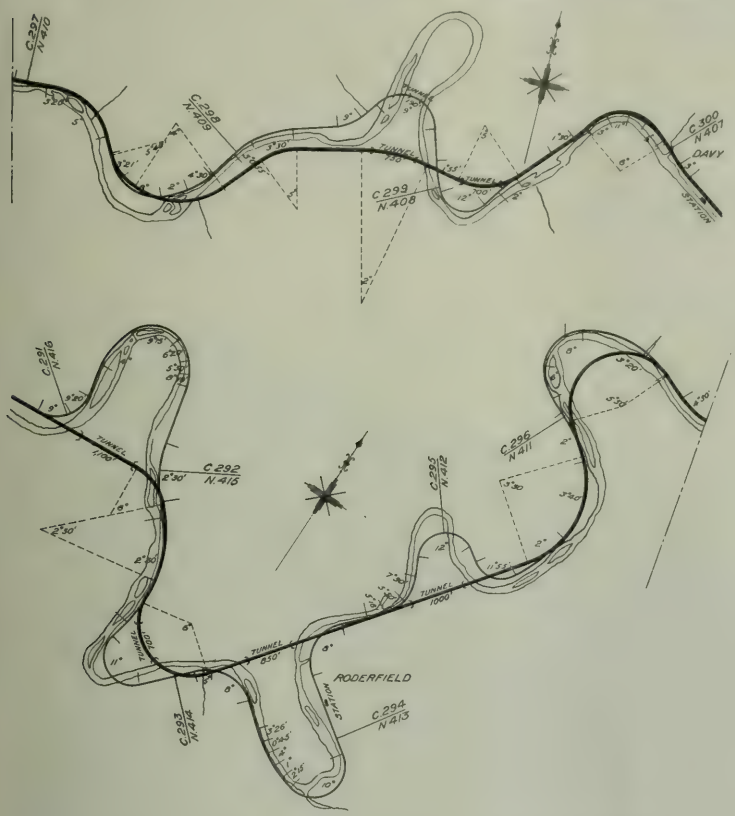


Re-location Between Vivian and Davy; Norfolk & Western.

West Virginia, still all through the mountains the rock is readily disintegrated and comes down in small fragments after a shot. This will be seen by an examination of the reproductions of the photographs of the several pieces of rock work along the line, and is especially noticeable in the case of that of the cut near Keystone, W. Va. The work is a sort of shaly sandstone associated with the coal measures, and while it stands well in cuts, it scales off continually and comes down into the ditches and, in the tunnels, needs lining in order to protect the track; although there is little danger of its coming down in large pieces or quantities, as in the case of the rock along the New river.

The character of the country through the West Virginia mountains is such that the line of cheapest construction, following the banks of Elkhorn and the Tug river down to the junction of the latter with the Big Sandy, is exceedingly crooked. The mountains, while not rising to a great height above the stream, are very steep and are a succession of saw-tooth ridges, separated by narrow valleys or hollows at the bottom of which there is usually a stream. The original alinement followed all the bends

and turns of the river, with only an occasional tunnel, where the curvature would have been so excessively sharp as to exceed working conditions. The grades were easy and in favor of the westbound traffic, which is that predominating west of Welch, or 36 miles west of Bluefield, the assembling point of the eastbound traffic. At about this point the road enters a district of the Thacker coal fields, whose market is mostly in the west, while the greater portion of the Pocahontas coal goes to the seaboard and eastern points. It is a case of traffic following the lines of least resistance, and though large quantities of coal are taken out west of Welch, it is between that point and Bluefield, or rather Bluestone, 11 miles further west, that the center of the coal and coke industry



Re-location of Norfolk & Western Railway Between Davy and Roderfield.

may be said to be located, and from this center it moves in both directions, east and west.

It is along this exceedingly crooked line between Welch and Naugatuck, or rather between Vivian and Naugatuck, a distance of 92 miles, that much of the work of straightening has been done and is in progress, sections of which are shown to illustrate the character of the change of alinement that has been undertaken. In these the heavy line indicates the new and the light line the old alinement.

At Vivian there is an assembling yard for westbound traffic. It is small, and no attempt is made at classification. Starting at this point the old line follows Elkhorn creek in nearly all of its windings down to its union with the Tug river at Welch. The new line, in the first four miles of the distance, will cut across five bends of the creek that are now followed, and in this distance adds two tunnels and shifts the center of a third, and requires five new bridges across the stream. The amount of excavation required, including that for bridges and tunnels, in the 7 miles to Welch, is estimated at 458,000 cu. yds., and the cost is placed at $1,260,000.

At Welch there will be another cut-off, with a tunnel 1,300 ft. long beneath the upper portion of the town, beyond which the line will join the already completed section to Davy, in which there was 722,400 cu. yds. of excavation, and which cost $1,543,000, inclusive of the bridges and tunnels. It will be seen from the map that after leaving Welch the road strikes across two bends of the river on a tangent, upon which there are three bridges and two tunnels, the latter being 800 ft. and 1,150 ft. length, respectively. The curvature for this distance is entirely eliminated, and the new line crosses the old at nearly right angles as it emerges from one tunnel to enter the bridge between the two. This also appears on the reproduction of the photographs. Between Davy and Thacker, a distance of 49 miles, it is estimated that there will be required 1,900,000 cu. yds. of excavation and this double-track will cost $5,140,000. For the greater portion of the way there will be little or no change of alinement, but in certain places the plans call for the construction of practically a new line. An instance of this is shown on the section of the map from Davy to a short distance beyond Roderfield, at milepost 416. In this distance of nine miles there will be six tunnels, with an aggregate length of 5,100 ft. and ten bridges. This is, to all intents and purposes, a new line, and contains at least one repetition of the scheme of the work near Welch, where there is a tangent location near Roderfield involving three bridges and two tunnels of 1,850 ft. total length in a distance of a little more than a mile. To the east of this the line is thrown across the river at a wide divergence from the original, as shown both on the map and the reproduction of the photographs of the work in progress near Antler.

In this distance of 49 miles from Davy to Thacker there will be 16 tunnels with an aggregate length of 13,000 ft. and ten bridges. The bridges will all be in the first nine miles west of Davy and on that portion shown on the engraving. West of Thacker there is no exceptional work as far as Naugatuck, except at Williamson, where the large yard is being built, part of which is already in service. The double track on the improved line is now in operation between Thacker and Naugatuck.

The main object in the expenditure of these large sums of money in securing a change of alinement is to obtain a line upon which passenger trains can be run with safety at high speed and freight trains be handled with less resistance and delay. Very little improvement was possible in grade, nor was this essential, as the descent of the present line is in the direction of loaded traffic; but the amount and rate of curvature has been greatly reduced. On the old line 12-degree curves were in use, and those of eight degrees were quite common, whereas on the new alinement a six-degree curve is the maximum, and in many cases it is much less. With this, train resistance will be greatly lessened, and it will be possible to increase the maximum tonnage rating accordingly. The grade along this section of the road is that of the drop of the Tug river, and averages about 0.40 per cent., with a range of from 0.125 to 1.00 per cent. along the upper portion, and an average of about 0.07 per cent. at the lower, where the grades do not rise above 0.10 per cent.

When this work of improvement was undertaken it was estimated that it would be carried on at an expenditure of about $1,500,000 annually, and that this amount would keep the road up to all of the requirements of its rapidly increasing traffic. But the output of coal and coke has increased so rapidly in recent years, and the facilities for its transportation have been so taxed to the utmost, that it has been necessary to greatly exceed this rate of outlay. In this the object kept constantly in mind has been, not the securing of an immediate relief to meet present necessities, but a permanent betterment of the property, so that what is done shall be final and of such a character as to require the minimum expense for maintenance and place the road to take care economically of whatever traffic may be offered in the future.

(To be continued.)

The Wide-Awake Station Agent.*

Cultivate the power of observation. It may be difficult at first but never let up, no matter where you are. I had a car clerk that could come through the yard sound asleep. At least I could never find out what he knew if awake. I have found it a common failing that new men in this work are prone to look for just one car and see nothing else.

I have in mind, though, a little fellow left to hustle for himself and everlastingly bobbing up around the station in unexpected

*From a paper by C. R. Henderson in the *North-Western Bulletin*.

places, who could keep tab on "who was braking for Jones" and "whose caboose they had out last trip" or "what train took that steel." He was all eyes. He is keeping a busy yard straight today, and I daresay that some day he will keep more than a yard straight. Did you ever try to see just how much you could notice of what was going on in your yard and then recall it all when you got back into the office? It's a big help. After a while there will be very little going on that you will not be right onto. And you're the man that's responsible, you're the man on the ground and should know how and will be called upon to explain. It's better to be able to see for yourself, otherwise they'll soon be saying, "Oh, he'll never know the difference." I don't suppose that we have any idea how much improvement it makes when they learn by experience that your eyes are open. Let careful observation be your method and let it be so generally understood that no clerk or yardman can feel that it is personal.

On recently trying to impress on a man that if there are only two boxes of crackers in the car and they are placed crosswise they would in all probability tip over and one knock the cover off the other, I was told that this rule applied only to cases of eggs. There it was again. The old general method to apply instructions, word for word, and go not a step farther.

We receive, say a letter from Mr. Richards, relative to a certain shipment. Does it not pay better than to just answer the questions or give him our record forms, to see the consignee and get at the bottom of the thing? It may change the situation entirely and save the company a few dollars besides. It is those things we rate as little ones that so frequently surprise us when investigated. When the special agent comes along, he doesn't take anything for granted; the warehouseman may have checked "one short," but he goes to the man's store just the same and finds the box.

Bear in mind that the men all want something better. Be their friend and give them a boost when you consistently can. If you cannot give a man a promotion when a vacancy occurs try to explain to him in a way that he will appreciate. It will not only keep him from getting grouchy, but if he is the right kind of material he will immediately "get busy."

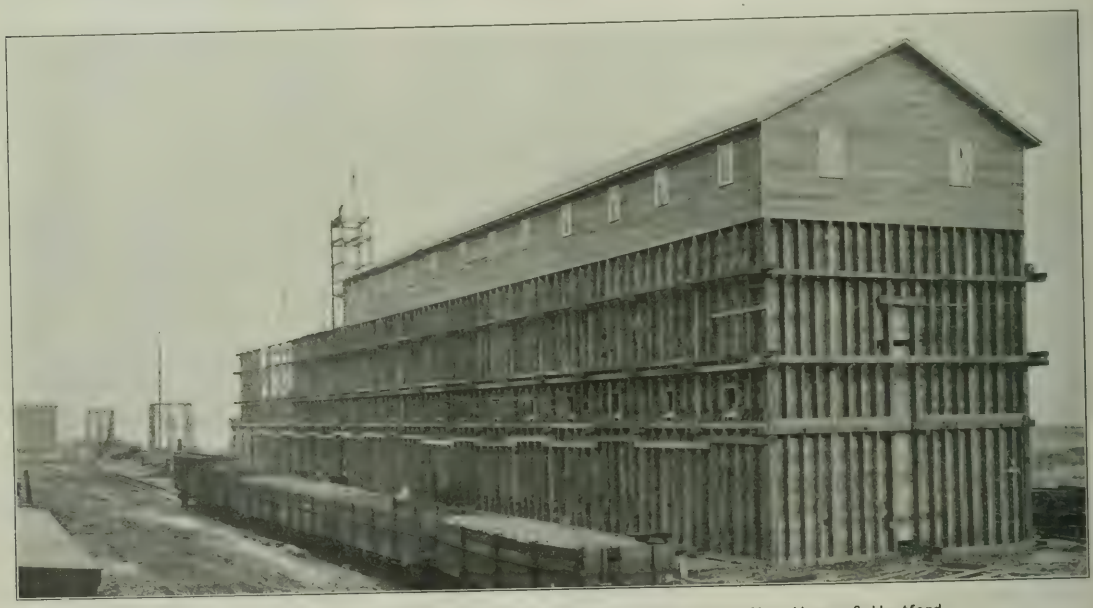
We should beware lest we find ourselves agreeing with the public in their various criticisms. They are wont to heap abuse on the railroad and they will think a whole lot more of you if you take your stand and be loyal. Be careful and use tact with the public. Nothing will drive a man away quicker than the use of disrespect. Always make it a point to have time to give him polite and courteous treatment. While the information wanted may appear trivial to you, it's much to him. And the busier you are, the more he'll appreciate it. While I regret to say it, I honestly believe that the public get shorter and more indifferent answers in the railroad service than they get in any other business. They altogether too frequently get snapped up in a manner that fairly takes their breath away. I have heard it and so have you.

South Boston Coaling Station of the New York, New Haven & Hartford.

One of the largest locomotive coaling stations in the United States is being built for the New York, New Haven & Hartford at Northern avenue and B street, South Boston, Mass. The storage capacity of the main pocket will be 13,000 tons. A wharf 40 ft. wide and 480 ft. long has been built, and on this wharf, running its entire length, is to be a trestle 20 ft. wide and 30 ft. high, of heavy timber construction. Several of the trestle bents can be seen in the accompanying progress view of the plant taken February 15. Coal from the Virginia fields will be received by vessel, and two Mead-Morrison Boston type unloading towers will be built on the top of the trestle and arranged to traverse its entire length, for convenience in unloading these vessels. The coal will be removed by means of Rawson grab buckets dumping into a small hopper in each tower. From the hoppers the coal will be discharged to three-ton cable cars running on the trestle. One of the towers will have a movable crusher so that coal may be crushed or not as desired.

The central 250 ft. of the trestle contains bins holding 500 tons. These bins will have gates and chutes to enable coal to be discharged directly from the cable cars into the bins and thence to a train of gondola cars standing on a track on the wharf. A car haul is provided for moving the cars while being loaded.

The main storage pocket, which is shown in the photograph, is 379 ft. long and arranged for overhead and under storage. Between the wharf and the main pocket will be a steel bridge of 175 ft. clear span and 46 ft. of trestle. An endless cable railway extends the entire length of the wharf, across the bridge and over the entire length of the storage pocket. This railway will transfer the coal from the unloading towers to the shipping bins, or carry it across the bridge and distribute it in the overhead storage compartment of the main pocket.



Construction View of South Boston Coaling Station; New York, New Haven & Hartford.

The lower part of the main pocket is enclosed and forms a large ground storage space. Coal is discharged into this space through openings controlled by rack-and-pinion gates in the floor of the overhead bin. At the center of the main building is a Holmen elevator, and underneath the ground storage in each end of the building is a conveyor system. Coal may therefore be removed from ground storage by the conveyors, discharged to the Holmen elevator, and transferred to the cable cars overhead, by which it may be redistributed in the overhead bin or transferred to the shipping bin on the wharf.

The plant will be complete in every respect. A large power house will contain two 125-h.p. Atlas boilers, and a 50-h.p. cable-road engine, a pump, etc. At the center of the main building will be the hoisting engine for the elevator and the driving engine for the rehandling conveyors. The plant was designed and is being built by Roberts & Schaefer Co., Consulting Engineers and Contractors, Chicago.

Track Deformations and Their Prevention.*†

BY G. CUENOT,
Chief Engineer of Bridges and Ways for the Board of Control of the Paris, Lyons & Mediterranean Railway.

The question of the proper length to be given to cross ties has been before the American Railway Engineering and Maintenance of Way Association for the past two years, and, doubtless, the same question has been presented to maintenance of way officers by the managers of their companies in the hope of buying at less cost an article of supply which is ever increasing in price, and at the same time is such a necessary part of the construction of a railroad.

Up to the present time, the problem has not been very scientifically treated in the United States, and there is some divergence of opinion relative to the matter, usually based on the practice under which the individual expressing it has grown up.

Upon reading the account, therefore, of Mr. Cuënot's painstaking experimental work, it occurred to the translator that the description and results would be interesting to the English speaking engineers who are occupied with such questions in their own work, and he therefore made arrangements with the author for introducing the work to them. The author has been very kind and liberal in the transaction, by reason of his truly professional and scientific spirit, and the translator takes this opportunity for expressing his appreciation.

American engineers can learn a lesson for themselves from the scientific spirit and great care with which their foreign colleagues attack a problem to be solved and carry on the work of investigation and experiment.

W. C. CUSHING.

NATURE AND OBJECT OF EXPERIMENTS.

The Minister of Public Works expressly charged me with experimenting with a composite cross tie (wood and steel), and to make him a report on the result of the experiments. I did not believe that it was sufficient to place a cross tie in the track and to observe the manner in which it behaved. It seemed to me that, in order to discuss with some competence the results of the experiments, it was necessary to examine what takes place in the case of a normal track provided with ordinary cross ties or with steel cross ties employed on the State System, and to compare the results obtained with those which were found in the case of the same track provided with composite cross ties.

It was a question then of a collection of tests bearing on all the movements to which the track is submitted, and of the study of all the deformations to which it is subjected. The manner in which the fastenings behaved, with the systems tried, ought also to have my attention; it was interesting to give an account whether or not the methods of fastening (employment of treenails) would be able to render the service on which one has a right to count. The outline of the study, which we have undertaken, comprises nearly all the questions concerning the track, including the joint, which has given occasion for numerous solutions.

It has been possible up to the present time to study the influence of reinforcement of the track by the enlargement of section of rails, of screw fastenings, and of rail joints, but I do not believe that any one has, up to the present, examined the influence of a stronger section given to the cross tie. This study presented then, apart from the special mission which had been intrusted to me, a general interest which I immediately recognized, and which will, without doubt, justify the relatively important work which I have done.

The rails employed were of the type used on the Paris, Lyons & Mediterranean, either the P. M. type of a weight of 39 kilograms per running meter (78.6 lbs. per yd.), or the P. L. M.-A. type, of a weight of 34½ kilograms per running meter (69.5 lbs. per yd.).

The rail joint was made up of angle bars. The screw spikes, No. 6, had a diameter of 20 millimeters (51/64 in.). Between the rails and the cross ties are metallic plates of the type used on the P. L. M.

CROSS TIES TESTED.

All my experiments, during nearly three years, have been made, first on a side track, then on track No. 2 of the line from Mouchard to Bourg, traversed by the express and fast trains, comparatively with oak cross ties employed on the P. L. M. system, and with composite cross ties (wood and steel). Finally, a special track for experiments was laid at the Bourg station, and there was tested, at the same time as the two types of cross ties recited, the metallic cross tie in use on the State System.

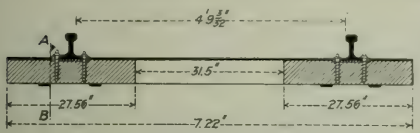


Fig.1- Transverse Cross Section on C-D.

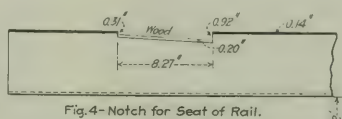


Fig.4-Notch for Seat of Rail.

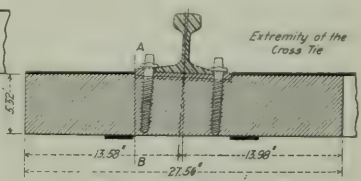


Fig. 2- Longitudinal Cross Section.

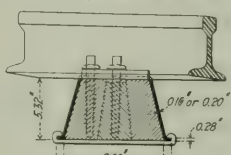


Fig.2-Cross Section A-B with Block of 3 Wedges.

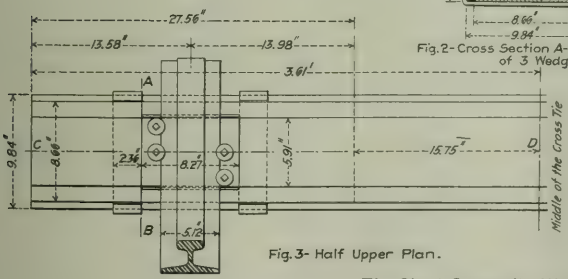


Fig.3- Half Upper Plan.

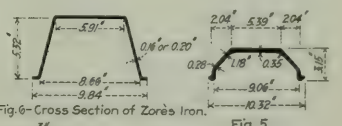


Fig.6-Cross Section of Zorès Iron. Fig. 5.

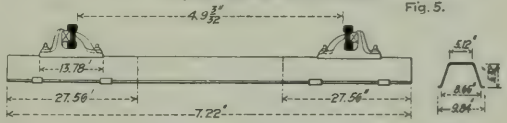


Fig.7- Track with Double Head. Fig.8.

The Short Composite Wood and Steel Crosstie.

But before making these tests known it is essential to describe the cross ties employed.

The wooden cross ties of wood were oak, creosoted, and of the following dimensions:

Length	2 m. 60 (8 ft. 6.36 in.)
Width	0 m. 22 to 0 m. 25 (8.66 in. to 9.84 in.)
Depth	0 m. 14 to 0 m. 15 (5.51 in. to 5.91 in.)

Composite cross tie, system of Devaux, Michel and Richard.—This is composed of a metallic skeleton in the form of an inverted trough, provided in the interior with two symmetrical blocks of wood solidly fixed, and leaving between them an empty central space.

The upper surface of the skeleton presents, on removal of the track, two rectangular openings, leaving exposed on the blocks the seatings intended to receive the supporting plates for the rails. It is at once seen that this plan of cross tie permits the use of ordinary screw spikes as the method of fastening for the rails.

The metallic skeleton is of the type of iron section known in commerce under the name of Zorès iron, as the section ab shows it. The trapezoidal section is of interior dimensions:

Width at base	0 m. 22 (8.66 in.)
Width at top	0 m. 14 (5.51 in.)
Depth	0 m. 135 (5.32 in.)

The thickness of the metal ought to be 5 m/m (13/64 in.) but in reality it is only 4 m/m 6/10 (3/16 in.), and the total length is 2 m 50 (8 ft. 2.4 in.). In later experiments the length was reduced to 2 m 20 (7 ft. 2.64 in.). The side walls terminate in a flange along the lower edges. The object of this arrangement, which is found in the greater number of metallic cross ties, is to render the

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†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines, Southwest System.

cross tie better able to resist the blows of tools during tamping, to increase the moment of inertia in the vertical direction, and also to permit the clamping of the cross bars.

The metallic skeleton is provided in its lower part with four cross bars, two under each block. These cross bars are fixed without bolts or rivets, their extremities are simply curved and clamped on the flanges of the skeleton. Their object is to hold together the side walls of the metallic envelope, and to thus insure the wedging of the blocks in the interior of this envelope. The metallic part weighs about 60 kilograms (132.28 lbs.).

Each wooden block is composed of three wedges joined together, whose dimensions are given by the sections ab and CD.

The rails are fixed on the blocks through the intermediary of a plate with shoulder, by means of ordinary screw spikes. The supporting surface of the plate is inclined at $^1/_{20}$ in order to give the desired inclination to the rail, and the mortise is made in such a way that the plate should be well supported on the exterior side of the track by the corresponding edge of the notch in the metallic skeleton in order to oppose, in case of need, all lateral movement. The object of this arrangement is to prevent the spreading of the track, to which there is a tendency on curves.

The heads of two screw spikes of each middle wedge press the rail on the cross tie, and ought to act strictly as an adjusting screw on the middle wedge; for this effect a play of about 10 m/m ($^{25}/_{64}$ in.) is taken up between the upper face of the wood and the bottom of the metallic skeleton.

This arrangement allows a strong pressure of the lateral wedges against the sides of the skeleton to be obtained, a pressure which the passage of trains only increases by reason of the reaction of the ballast, which tends to push up the blocks and press them against the lateral walls.

The three wedges as a whole form, under pressure, a true block, solidly maintained by the metallic skeleton and the cross bars, and under which one can tamp as under a wooden cross tie.

It has been recognized in the course of experiments that the wooden part was like a monolith; that the middle wedge once in place could no longer be pushed up, which, upon the whole, is an advantage, and inventors have substituted for the three wedges a single wedge pressed into the skeleton by means of cross bars, presenting, besides the advantages of the three-wedge system, a better supporting surface for the plate, and the possibility of employing the chair for track with double headed rail. This latter system offers, besides, easier methods of manufacture.

The length of either of the blocks is regulated by the conditions under which they distribute the pressure on the ballast; it is about om 70 (27.56 in.), a length which has been recognized as sufficient to assure the bed of the cross tie on the ballast.

The separate wedges of the blocks are cut by saw, according to patterns made with care, so as to fit exactly in the interior of the skeleton.

The shoeing (adzing and fastening the plates to the ties) can be done by machine by previously confining the blocks in a special matrix, which will hold them under the tools of the planers in the desired place and afterwards serve for drilling the holes for the screw spikes, by the aid of augers driven by steam.

The blocks weigh about 32 kilog. (70.55 lbs.), and the weight of the cross tie is nearly 78 kilog. (171.96 lbs.).

The steel cross tie used on the State System is shown in the section herewith. It is 2 m 50 (8 ft. 2.4 in.) long and weighs 58 kilog. (127.87 lbs.).

The various characteristics of the cross ties experimented with are summarized in the following table:

1	2	3	4		5	6	7	8	9	10	11	12
Designation of the cross tie.	Resistance to extension, per cm^2	Elongation to elastic limit, per cent.	Weight of the cross tie in kilos.		Width of surface, in cm.	Thickness in centim.	Length in meters.	Moment—Of inertia in cm.4.	Moment—Of resistance in cm.3.	Position of neutral axis in centim.*		Rigidity of the cross tie.
Oak cross tie	200	2		70 (154.3 lbs.)	22 (8.66 in.)	14 (5½ in.)	2.6 (8 ft. 6.36 in.)	5,030	718	7.0	7.0	503,000,000
Modulus of elasticity of wood: E = 100,000.												
Composite cross tie .. Steel.	3,100[2]	22	46 (101.4 lbs.)	78 (171.9 lbs.)	..	..	2.5 (8 ft. 2.4 in.)	533	61	5.24	8.76	[3]821,000,000
Composite cross tie .. Wood	200	2	32 (70.5 lbs.)		25 (9.84 in.)	14 (5½ in.)		229[2]	29	6.05	7.95	[4]1,429,000,000
					..	..	1.4 (4 ft. 7.08 in.)	3,630	504	6.03	7.2	[5]1,066,000,000
In the armored part	.....	..	..	..	..	..	...	4,163	87[7]	5.90	8.1[6]	.....
In the middle	.....	..	..	..	..	..	...	533	61	5.24	8.76	.....
Right at the fastenings	.....	..	..	..	..	..	...	3,859	60	6.16	7.7	.....
State cross tie	3,000	20	58 (127.9 lbs.)	..	24.05 (9.47 in.)	8 (3.15 in.)	2.5 (8 ft. 2.4 in.)	168	30	2.447	5.533	336,000,000
Modulus of elasticity of steel: E = 2,000,000.												

*In reference to the lower and upper planes of the cross tie.
[1] Limit of resistance to rupture, 4,500 kilos.
[2] Moment of inertia right at the openings in the metallic skeleton.
[3] Right at the openings.
[4] Right at the furrings (blocks).
[5] At the extremities and in the central part.
[6] These figures have reference to the neutral axis of the cross tie forming a whole with the furring (blocks).
[7] The beam being supposed of steel.

The composite cross tie is from 1½ to 3 times as rigid as the wood cross tie, even at the notches prepared for the seating of the tie plates, varying according to whether the part notched, which is the weakest section, or the armored metallic part is considered. This cross tie is also 2 to 4 times as rigid as the steel cross tie of the State Railroads.

It is possible to give an account in another way of the difference in resistance of the beams considered. In fact, if the condition is imposed that their deformation be the same for a like force, that is to say, that they each take an equal elongation, it is found, by designating L this elongation, by R, R′, R″, the stress per unit of surface of these beams, E, E′, E″, the coefficient of elasticity of the material of which they are made:

$$L = \frac{R}{E} = \frac{R'}{E'} = \frac{R''}{E''}$$

whence is deduced, by representing by $\frac{I}{Z}$ their moment of resistance, which is inversely proportional to R:

$$\frac{E\,I}{Z} = \frac{E'\,I'}{Z'} = \frac{E''\,I''}{Z''}$$

To appreciate the difference of resistance of cross ties submitted to a like deformation, it will be sufficient to compare between them the products such as $E\,\frac{I}{Z}$, or else, if the resisting moment of the steel beam is taken for a term of comparison, it will be necessary to multiply $\frac{I}{Z}$ by the ratio $\frac{E'}{E}$. The following results are thus arrived at:

Comparative resisting moments of different cross ties supposed of steel.

Cross tie of wood	36
Composite cross tie:	
In the armored part	87
In the middle and at the extremities	61
Right at the fastenings	60
Steel cross tie of the State	30

The part of the metallic skeleton cut out to permit fixing the fastenings on the wooden blocks, which is necessary for the placing of the plate, or the chair, is of short length, about 0 m 15 to 0 m 30 (5.91 to 11.81 in.). This weakening is compensated, and more, by the plate, or chair, which forms part of the armored beam.

The above results have been obtained while seeking the mean coefficient E of the armored part by the condition $EI = \Sigma\ ei$, E being the coefficient of elasticity of the two materials considered, I their moment of inertia, $I = \Sigma\ i$; and the neutral axis of the composite beam being determined by the condition that each element is stressed proportionately to its coefficient of elasticity.

The composite cross tie offers, then, in all its sections, a resistance superior to that of the steel cross tie of the State; it will then be stressed much less and will be more resistant, under much more advantageous conditions.

EXPERIMENTS ON THE SIDE TRACK AT BOURG-EN-BRESSE.

The object of these first experiments was to ascertain the stability of composite cross ties and observe the manner in which the blocks behaved. It was essential to be assured of these two points before placing them in a main track.

The metallic skeleton of the composite cross ties was made of soft steel coming from dephosphorized meltings, and its form obtained by hammering.

The blocks were cut with a saw from new cross tie timber, but from waste which could not be otherwise utilized. The elements of 50 composite cross ties were thus obtained; 46 were made of oak and 4 of beech. The wood was injected with creosote at the work shop of the P. L. M. Co., at the station of Perrache 2.

These 50 composite cross ties were placed in track 5 at the station of Bourg-en-Bresse. Their spacing, with three fastenings, two were exterior and one interior, was one meter (39⅜ in.), except at the joints of the rails, five meters long (16.40 ft.), where the spacing was reduced to 0 m 70 (27.56 in.) and 0 m 60 (23.62 in.).

This laying was done on February 3, 1902, at a period little favorable for making track. The earth was covered with snow, and it was necessary to break up the subsoil in order to proceed with the laying of the experimental cross ties. In spite of these unfavorable conditions, it was only on the 13th of March following that the first repair was made, consisting of a general tamping necessitated by the thawing, and at the same time of a raising of all the track. Since then it has not been retouched.

When the cross ties were brought to their place, the plate was placed above the blocks, and the two fastenings of the central wedge were tightened alternately to avoid any dislodgement of that piece.

The ballast in track 5 was rough gravel; one of the cross ties, provided with two sections of rail, was placed apart from the tracks in broken stone in order to see in what fashion the pieces of wood would behave in that ballast. The metallic skeleton was left visible in the interior of the track, except for 12 cross ties, which were covered by ballast.

From the time of their placing, the cross ties were subjected to the successive effects of heavy rains, which have lasted during the greater part of the spring, and of excessive heat, which has ruled during the summer.

We examined at different visits the condition of the track, and found each time that the condition was excellent; that notably the fastenings were always thoroughly tight, and that the passage of the heaviest engines (93 tons; including the tender and the load of water and coal, 102.5 net tons) did not cause any apparent deflection of the metallic part binding the two lines of rails.

About 40 engines per day passed over the track, which represents a total passage of 1,200 per month, and of 7,200 during the six months of experiments, reaching to the 3d of August.

Before proceeding with the experiments on the resistance of fastenings, we took the track to pieces and removed some cross ties. We found that the tamped bed under the ties was absolutely intact; that the wood offered no trace of crushing, and that the tightening of the wedges was absolute; that the central wedge had not been raised by the tightening of the screw spikes, and that the allowance existing after placing was maintained without variation, as is shown in the table below:

Number of cross-ties.	Interval included between the bottom of the plate and the upper face of the wedge.			
	—To right of axis—		—To left of axis—	
	Millimeters.	Inch.	Millimeters.	Inch.
26	8	5/16	6	1/4
27	15	19/32	12	15/32
28	10	13/32	10	13/32
29	6	1/4	5	3/16
30	3	1/8	10	13/32
31	10	13/32	10	13/32
32	20	25/32	20	25/32
33	12	15/32	10	13/32
34	15	19/32	5	3/16
35	8	5/16	14	9/16
36	5	3/16	8	5/16
37	15	19/32	7	9/32
38	12	15/32	14	9/16
39	12	15/32	12	15/32
40	17	21/32	16	5/8
41	16	5/8	22	7/8
42	15	19/32	13	1/2
43	12	15/32	17	21/32
44	21	27/32	18	23/32
45	16	5/8	19	3/4
46	20	25/32	18	23/32
47	16	5/8	17	21/32
48	14	9/16	18	23/32
49	9	11/32	17	21/32

EXPERIMENTS ON TRACK NO. 2 OF THE LINE FROM MOUCHARD TO BOURG, BELOW SAINT-ETIENNE-DU-BOIS.

The composite cross ties which were placed at the Bourg station were replaced in the month of January, 1903, (from the 5th to the 8th) in compliance with the ministerial decision of December 12, 1902, in track 2 of the line from Mouchard to Bourg* between kilometers 494,417 and 494,465 in proximity to the station of Saint-Etienne-du-Bois, above an embankment of argillaceous nature, about 1 m 50 (4.92 ft.) in height. This part of the line is located at the origin of a curve of 600 meters (1,968½ ft.) radius, following a tangent alinement of 6,604 meters (21,666.6 ft.) long, at the extremity of a series of grades (4 m/m 6, 9 m/m 5, 2 m/m 8) (0.47, 0.94, 0.28 ft. per 100), which follows a level. It resulted from this situation that the cross ties were at a point where water accumulates and causes the ballast and the embankment on which it rests to soften. The ballast came from the Ambronay quarries (near Ambérieu). It was composed, like the greater part of quarry gravel, of silico-calcareous gravel and of loam in quite a large quantity. The characteristic of this ballast is to form a conglomerate very hard in dry weather, and in wet weather to make a sort of mud more or less fluid, according to the moisture with which it is impregnated.

The cross ties were placed at the rate of 12 cross ties per rail length of 8 meters (26.25 ft.) of the P. M. type, weighing 39 kilogs. per running meter (78.6 lbs. per yd.), over 4 lengths of rail. This type of rail was chosen because the width of its base was adapted to a plate whose dimensions were precisely those of the notch.

*This line is used by fast trains, such as the Berlin-Nice and the Indian Mail; the mean density of traffic of this line is about 20 trains a day on each of the tracks.

The rails thus employed had been taken from the track after a long service†, which explains their exceptional deformation, and made conspicuous by the unevenness of 3 millimeters (⅛ in.) which they present in a short length (about 1 meter) (39⅜ in.). They rested on the cross ties, as we shall see further along, by means of P. M. plates; the fastenings placed unsymmetrically, and composed of screw spikes No. 6, were to the number of 8 per cross tie, 2 outside and 2 inside each of the rails. There was placed at the beginning, and at the extremity of the track thus laid on composite cross ties, a length of rail of the P. M. type on wood cross ties with the same laying, in order to be able to establish a comparison.

All of these cross ties were inclined toward the center of the curve of 600 meters (1,968½ ft.) radius turning to the right, with a superelevation of 0 m .083 (3²⁹/₃₂ in.). This inclination had further the disadvantage of throwing all the surface water of the track in the inter-track space, where it was held by the impermeability of the ballast.

Left under these conditions for more than a year, the cross ties have been submitted to the successive effects of heavy rains, which lasted during a large part of the time, and of the period of warm weather.

The condition of the track was examined at different visits, and it was proved each time that the condition was excellent; that there was never occasion for retightening the fastenings, and that the cross ties under the passage of trains (about 8,000) did not undergo any apparent bending. Thus there was placed on the composite cross ties, the same as on the neighboring wood cross ties, a bed of gravel over the whole surface; it was proved that not a grain of gravel was detached by the passage of express train 682 from the edges of the composite cross ties, whilst there existed cracks in the surface of over a third of the wood cross ties. This difference in the stability of the gravel evidently arises from the pronounced bending of the wooden ties.

As a result of the super-elevation and grade, argillaceous nature of the ballast and of the subsoil, the composite cross ties, principally those of the even-joint, rested on a muddy bed, and the water visibly churned at the passage of each train. This bed was then essentially elastic, and this elasticity varied with the quantity of water. The cross tie was not unwedged, as one would suppose, for it always rested on its blocks, which were buried more or less considering this condition. The wood cross ties were found in nearly the same situation, with this difference, however, that their bed was more solid by reason of the ballast being less argillaceous.

On the other hand, the defective profile of the rails employed, which has been pointed out above, produced disagreeable unevenness in the stability of the cross ties which underwent the shocks. The joints were particularly bad in consequence of the flattening of the ends of the rails, to such an extent that it was necessary to sustain them by wedges placed between the splices and the under part of the rail head; these defects were but little corrected. The experiment was therefore made under the most unfavorable conditions, but, nevertheless, the results obtained have been excellent. The fastenings have held without our having been obliged to retouch them. The tamping was maintained on a horizontal bed over the whole length of the blocks, whilst it has a tendency to form under the wood cross ties either a concave basin, on the edges of which they rest in a state of repose, or a convex cap, on the summit of which they find support. The rewedged joints no longer presented a sensible unevenness at the passage of vehicles; the rolling was then very much improved.

EXPERIMENTS ON THE BOURG TRACK, SPECIALLY LAID FOR THE TESTS.

Mr. Ferry, Sub-Engineer of the company, had caused a track to be extended in a cul-de-sac of the Bourg station, along the loading quay for animals, in order to permit experiments on the length of cross ties and of their tamped bed, and to join them with the tests executed up to that day, by means of loads perfectly defined, acting always under the same conditions.

The subsoil, specially cleared away for the laying of the track, consisted of an argillaceous conglomerate, enclosing small pebbles of gravel; it was not therefore perfectly homogeneous. The ballast was fine gravel. There were successively placed in the track thus established composite cross ties, wood cross ties and cross ties wholly metallic.

EXPERIMENTS ON TRACK NO. 2 OF THE LINE FROM MOUCHARD TO BOURG, ABOVE SAINT-ETIENNE-DU-BOIS.

In order to be able to better appreciate the difference of stability of composite and wood cross ties, and to eliminate all influences on this stability, independently of their own resistance, such as inclination on the curves, the elasticity of the road bed, the argillaceous nature of the ballast, we deemed it a duty to remove the cross ties which were laid, as we have pointed out, below the station of Saint-Etienne-du-Bois, and to put them above at the entrance

†These rails had endured a density of traffic of 150,000 trains; we had not been able to find new rails of the same length in the stock of the company.

of that same station, on tangent, on a very solid road bed, and finally to ballast them with gravel purged as much as possible from clay. I had, in advance, the ends of the cross ties cut off, in order to leave them exactly of the length of 2 m 20 (7 ft. 2.64 in.), corresponding to the minimum bending, and to the distance between the extremities of the blocks. The metallic skeleton projected, in fact, beyond the wood by 0 m 15 (5.91 in.) at each end, and this excess of length was quite useless.

The wood cross ties were laid at each of the extremities of the section thus selected to serve for terms of comparison. They were of the ordinary dimensions and length. All these cross ties were provided with P. M. rails, absolutely new, whose rolling surface was consequently as good as possible. The ends of the rails laid on composite cross ties were joined by ordinary splices; on the wood cross ties, angle bars were used.

When the track had taken its bed, the curves of flexure of the cross ties were determined anew; then account was taken of their tamping and of their depression in the track after the passage of the same number of trains. Finally the study of the joint, so interesting and so difficult, was commenced.

These experiments, which have already been pursued for a year, have not yet sufficiently advanced for me to have made known the results. I can, however, already affirm that everything has happened as I had foreseen, and that the composite cross ties of 2 m 20 (7 ft. 2.64 in.) have a stability in the track much superior to that of the ordinary cross ties, other things being equal. That is due to their greater rigidity and to the tamped bed which is maintained in the condition in which it was placed.

It will be interesting, after a longer period in the track, to make known and explain the facts which will be found.

Economy in Track Work.*

Do not carry a large amount of surplus or emergency material on each section, but keep a full supply at a few important points from which shipment can be made quickly.

The general impression is that all scrap is sorted at the shops and that none of the usable material is lost sight of. While this is probably true, the proper place to do the sorting is on the section, where the material can be used. Material not suitable for main track can be used to advantage in unimportant sidings.

If you have a gang of 12 or 15 green laborers on a section, give the foreman an assistant and do not expect him to raise track, put in ties and do other work to advantage without, for there are some things that even a section foreman cannot do. If the gang is increased to 70 men, give him a timekeeper and all the assistant foremen your superintendent will stand for. A common mistake is to have too little intelligent supervision. This is what we must have, and it is money well and economically spent. If you have a work train doing any kind of work, assemble all the men you can work to advantage. If you have 30 carloads of ties to distribute on your division, instead of working two days with a small gang of men, get together men enough to finish in one day. You thus save the expense of the engine and crew for one day and incidentally give the train despatcher one day's use of the engine and free the 15 cars one day earlier. In these strenuous times this is a big item.

On the other hand, if you have a few rails to load at some point, send just enough men to handle the rails, but no more. A track-laying gang to work economically should be just large enough for the work to move along smoothly all the time, each man doing the same work all the time. The exact size of the gang will depend to some extent upon the kind of men.

In gaging track in the fall and winter it is not necessary to spend time in plugging spike holes in ties that will be taken out of track the following spring. If you are working six or eight men, do not keep them all on the handcar in your daily trip of inspection over the section; you can surely leave part of them where the day's work is to be done and outline enough work to keep them employed until you return. If, when you have the entire crew on the handcar, you discover a broken fence board or wire, broken bolt in frog or switch, or any of the numerous small things you find every day, do not go at the work with the whole crew, but leave one or two men to make the repairs and go on to your regular work with the balance of the men. Some men will accomplish little enough if they are placed where work is staring them in the face, and the foreman is pounding them on the back. We should certainly avoid placing them in positions where they cannot find work if they are looking for it. I venture to say that we have all seen four and even six men trying to put a pair of angle bars on a joint or replace a broken bolt, in most of these cases the foreman doing the greater part of the work. In rare cases we see a tendency on the part of the foreman to exercise too much supervision. It is poor economy for a foreman to stand around in the winter and direct the work of one or two old, experienced men in cleaning out switches and crossings, gaging and shimming track, or other work. This is one of the cases where the roadmaster puts in his oar and pulls for economy.

*From a paper by C. H. Bowen in the *North-Western Bulletin*.

Preparation for Electrification of the New York Central Terminal.

The studies made; the years of preparation; the employment of critical independent engineers as members of a commission; their continued study of facts and discussion until in each doubtful item unanimous judgment was secured; a series of experiments on the six-mile experimental track at Schenectady at all speeds up to 75 miles per hour; and finally the precautions suggested to the operating department—this work, begun in August, 1901, and made practicable for train movement at the close of 1906 is a monument of engineering skill and precaution. It is in these hasty days, a credit to the company and to Mr. Wilgus, the Vice-President, who has had charge of it.

Six months before the regular train movement began, detailed information was given of the new conditions to be met, and all these have since been thoroughly dealt with by the operating officers in the preparation of instructions and in the training and examination of the trainmen and those engaged in the maintenance and operation of the signals, power stations and track. The following suggestions, made by Mr. Wilgus on June 7, 1906, are worth recording as an instance of foresight and precaution:

(1) *Instructions for Motormen.*—In order that those engaged in handling the electrical apparatus may thoroughly understand it, the Electrical Engineer has prepared an instruction book for motormen. * * * It is extremely important that this book shall be in the hands of the men intended for electrical service not later than July 1. * * *

(2) *Operating Department Instructions.*—I am not certain that any alteration is required in the Operating Department instructions for Electric Zone service, but I suggest that this matter be considered so that if any changes or supplemental instructions should be issued to conductors, trainmen, enginemen, etc., operating wholly or partly in the Electric Zone, they may be issued in time to be thoroughly understood before the change of motive power.

(3) *Signal Instructions.*—The electric automatic signals now being installed in the Initial Zone make necessary the preparation of a book of instructions governing Operating Department employees, and it seems wise to prepare a book of this character that will be separate from the operating book above referred to. It would seem unwise to prepare a special book for the Electric Zone only, and I therefore suggest the wisdom of preparing at this time a new up-to-date book of instructions for signals covering the entire system, of course, specialized where necessary to cover the Electric Zone. * * *

(4) *Maintenance of Way Instruction.*—It would seem to me wise to prepare a new issue of the book governing the Maintenance of Way Department that will be expanded to provide for the proper maintenance not only for regular steam railroad practice, but also of special work in the Electric Zone, such as power stations, substations, transmission lines, working conductors, signals and possibly equipment. * * *

(5) *Power Station, Transmission Line, Sub-stations and Working Conductors.*—In order to assure the company a working electrical installation in first-class condition I have arranged for the organization of an operating force, and the men are being employed and placed as fast as the construction work permits. By this arrangement the men will be educated to their respective duties and a competent organization will be in readiness to turn over to the Operating Department when I feel assured that all parts are working smoothly and ready for final acceptance. The employment of these men is being conducted with great care and in each case the advice of Mr. McCormack is secured so that the force when turned over to him will be satisfactory. It is my understanding that I will continue to exercise jurisdiction over these operating forces until matters are running smoothly, which I believe will be shortly after the change is effected from steam to electricity.

(6) *Equipment.*—Locomotives and cars will soon be delivered to the Electric Zone and I will arrange for the necessary watchmen and also for the operators on the locomotive and motor car testing tracks between Morris Heights and Marble Hill. It therefore would appear proper for the Operating Department to now arrange a programme whereby men may be in readiness for the operation and maintenance of this electrical equipment when it goes into service in the early fall, including shopmen, inspectors, repairmen, etc., * * * so that these forces may be trained in advance of the change of motive power. * * *

(7) *Motormen, Conductors and Trainmen.*—We now have between Schenectady and Hoffmans an experimental track on which locomotives are being tested as they leave the shops. We are also installing so as to have in readiness for service about July 20, two test tracks between Morris Heights and Marble Hill, on which an electric locomotive and motor car will be in service for the educa-

tion of the men to be used as motormen, conductors and trainmen in the electric zone. I suggest that a definite programme be adopted as soon as possible whereby classes can be established under proper tutorage at Schenectady and later at Morris Heights, for the education of men that will be called upon to operate trains in the electric zone. It would seem wise to have trainmen and conductors go through practically the same course as the motormen, so that they may be available for the running of trains when necessary and also so that they may be capable of promotion.

(8) *Signals and Interlocking.*—The interlocking plants and automatic signals in the electric zone will in many respects be radical departures from existing practice, and therefore those who are to operate and maintain these features should be thoroughly trained in their use before next fall. I suggest that the representative designated by you confer with Mr. Ames to arrange a programme whereby a proper course of instructions may be adopted for these men well in advance of the time when they may be called upon to operate and maintain the apparatus.

Railroad Liability for Damage by Fire.

BY JOHN EDSON BRADY.

It is a principle, firmly fixed in the law, that he, who by his negligence or misadventure creates or suffers a fire upon his premises, which spreads or is communicated to the property of another, is liable to the latter in legal damages to the extent of the injury occasioned. The rule, however, is subject to certain qualifications and limitations which have grown into the law, and is one which must be applied to the facts of each individual case as the case arises.

In some states statutes have been enacted under which a railroad company is made absolutely liable for the value of property along its right of way damaged or destroyed by fire communicated in the course of the operation of the road. It is usually provided by these statutes that the railroad may insure for its own benefit the property along its route and so protect itself against the liability imposed by the statutes. Under such statutes, where it is sought to hold a railroad company liable for a loss by fire, the question becomes one merely of proving the loss and the origin of the fire. But in jurisdictions where there are no legislative enactments of this character the courts are often called upon to solve intricate problems and draw fine distinctions in determining the existence and the extent of the liability of a railroad company for damage to the property of others by fire originating on the premises of the company. In the absence of statutory provision, in order to hold a railroad company responsible for such a loss, it must be established, not only that the fire complained of was brought about by the act of the company, but also that the company was guilty of negligence therein. In fact, it has been said that negligence or wrongdoing is the very gist of the action. Thus, where a building standing near a railroad right-of-way is set on fire by sparks from the smoke stack of a locomotive and the company is shown to have acted without negligence, and to have exercised due skill and care, the owner is not entitled to recover from the company for his loss. What is or is not negligence is, of course, a question which must be determined upon the particular facts and circumstances of each case. While to establish negligence on the part of a railroad company is an essential step in making out a case for damages, it is not necessary to show that the company was grossly negligent; Railroad Company vs. Noel, 77 Ind. 110. The plaintiff is required to show only that the company was guilty of a lack of ordinary and reasonable care in order to establish this important element of the right to recover and the company may escape liability if it can show the presence of ordinary and reasonable care. Hagan vs. Railroad Company, 49 N. W. Rep. 509.

To render a railroad liable for loss by fire resulting from the negligence of the company it must be shown that the loss was the natural and proximate consequence of the negligence of the company. Liability does not extend to consequences which are remote, incidental or exceptional. And "proximate," as here used means closeness of casual connection, and not nearness in time or distance, and it is intended to qualify the generality of the idea expressed by the word "natural." In the case of Kuhn vs. Neeb, 32 N. J. Eq. 647, an action brought against the receiver of the Erie Railroad, a fire originated in a disaster, which occurred at Paterson, N. J., through the negligence of the company's agents, in which 25 cars loaded with petroleum collided with a locomotive attached to a freight train. The force of the collision threw some of the oil tanks from the cars, causing them to burst and to discharge their contents. The oil, thus released, spread over the roadbed and was set on fire by the coals shaken from the locomotive. The burning oil ran down an embankment into a small brook, over which the road was constructed at that point, and was carried by its water to the Passaic river, and thence to the plaintiff's building, which stood on the bank of the river, firing the building and destroying it. The general rule was stated to be that, where a fire originates in the negligence of a defendant, and is carried directly by a material force, whether it be the wind, the law of gravitation, combustible matter existing in a state of nature, or other means, to the plaintiff's property and destroys it, and it appears that no object intervened between the point where the fire started and the injury, which would have prevented the injury, if due care had been taken, then the defendant is legally answerable for the amount of the loss. Under this rule the defendant company was held liable in damages for the destruction of the plaintiff's building. The question of proximate consequence was involved in the case of Metallic Compression Casting Co. vs. Railroad Company, 109 Mass. 277, it appeared that an engineer knowingly ran his locomotive over a fire hose and cut off the supply of water from a burning building which the firemen were attempting to save. There was no urgent reason why the train could not have waited for the hose to be uncoupled and the building would, in all probability, have been saved had the hose not been severed. In deciding in favor of the owner of the building the court said: "What kind of damage can be a more proximate consequence of the want of water than the destruction of a house by fire which a proper supply of water would have saved?"

Another rule of liability is that a defendant railroad company is responsible for such losses only as might have reasonably been anticipated as a result of the negligent or wrongful act. However, it is not necessary that the precise result should have been foreseen or anticipated; it is sufficient if events follow in ordinary sequence. The working of the rule is illustrated in the case of Miller vs. Railroad Company, 90 Mo. 389. It there appeared that fire was negligently permitted to escape from one of the defendant's locomotives and was communicated from dry material on the railroad right-of-way to the plaintiff's fence which was consumed. The destruction of the fence created an opening through which cattle gained entrance to the plaintiff's field and damaged his crops. The damage to the crops was regarded as one which might have reasonably been anticipated by the railroad and the company was held responsible for that damage as well as for the value of the fence which was destroyed.

It seems that, in order to hold the railroad company responsible, it is not necessary that the fire complained of be directly communicated to the property destroyed and time and distance appear to play no material part in determining the question of liability. In the case of Poeppers vs. Railroad Company, 2 S. W. Rep. 439, sparks escaping from a railroad locomotive set fire to the grass on the prairie adjoining the railroad's right-of-way at a point where the grass was very dry. During the day a high wind carried the fire some three miles and it continued to burn slowly through the night after the wind had fallen. The following morning a violent wind, though not an unusual one for the part of Missouri where the fire occurred, swept the fire five miles further to the plaintiff's farm, where it crossed a fire line of 16 ft. of plowed ground and destroyed the plaintiff's property. It was held that the fire was a continuous conflagration, notwithstanding the lapse of time and the great distance over which it traveled, and that the company was liable for the damage suffered by the plaintiff.

Proposed Kansas City Union Station.

The announcement that the proposed union passenger station at Kansas City would be built on the Kansas City Belt Railway near Twenty-second street and Grand avenue was made February 18, 1906. Since then the Kansas City Terminal Railway Company has been organized for the purpose of taking over the property of the Kansas City Belt Railway and building and maintaining the union station and tracks leading to it. The capital of this company is at present $30,000,000, but this is to be increased to $50,000,000 in the near future. Ten railroad companies are represented in the Terminal Company, and it is reported that three additional companies, the Kansas City Southern, the Kansas City, Mexico & Orient, and the Chicago Great Western, desire to gain entrance to the proposed station.

Mr. Jarvis Hunt, of Chicago, has been engaged as architect, and is said to have prepared several sets of plans for the passenger station, but these have not yet been made public. The delay in proceeding with the work has been largely due to the difficulties encountered in reaching an agreement with the city in regard to provisions to be incorporated in necessary ordinance. An agreement has just been reached by representatives of the Terminal Company and a committee of the City Council. The main points of this agreement are that the Terminal Company is to complete a $2,000,000 union passenger building within three years, build or re-build and maintain viaducts or subways at 49 street crossings and provide five union freight depots; and that in exchange the city is to grant a franchise for right-of-way for additional tracks along the line of the Kansas City Belt Railway along the south side of town for a term of 999 years, the life of the present Belt Line franchise, and grant a franchise for four freight tracks along the Chicago & Alton

on the north side of town for a term of 50 years. Charter amendments will be necessary to authorize the City Council to grant these franchises, as the present city charter limits the life of such franchises to 30 years. In general, such streets as are to be closed across the Terminal Company's tracks will be vacated by the city, but such streets as are to be carried across on viaducts or by means of subways will not be vacated.

The points on which it was most difficult to reach an agreement were the term of franchise for freight tracks on the north side of town and the vacation of streets. The representatives of the railroads contended for a 999-year franchise for the freight tracks and for the relinquishment by the city of all control over such portions of streets as are to be replaced by viaducts or subways, but a compromise was finally reached as outlined above.

Mr. John M. Egan, President of the Kansas City Terminal Railway Company, has recently resigned to connect himself with some railroad interests of Sir William Van Horne in South America. It is expected that his successor will be elected this week.

Upward-Inclination Three-Position Signals, on the P., B. & W.

The installation of automatic block signals, arranged largely according to the new ideas proposed at the last annual meeting of the Railway Signal Association, which was recently put in service on the Central Division of the Philadelphia, Baltimore & Washington, was described in the *Railroad Gazette* of October 19 last, page 341, but without illustrations. The press bureau of the Pennsylvania Railroad System—which includes the P., B. & W.—has now sent out photographs and drawings, with some additional descriptive matter, and these we give herewith.

The installation is on the Central division, running southwest



Fig. 1—"Stop and Stay" Signals. Clear Indication for Moderate Speed Into Side Track.

from Philadelphia. Forty-ninth street (see diagram) is a reporting station, being at the terminal of the Central and Philadelphia Terminal divisions, and train orders are frequently necessary. Signals Nos. 32C and 33C are ordinarily operated as automatic signals, but may be placed in stop position by the operator when necessary. The lights are therefore vertical instead of staggered and the signals are "Stop and Stay," instead of "Stop and Proceed."

Fernwood is a junction point with a branch line. It was thought that the business hardly warranted the employment of operators and installation of an interlocking immediately, but an advance signal eastbound was required for trains leaving the branch, and was located in its proper position for use if an interlocking were installed later. It was also desired to demonstrate the ease of control of a distant signal by two home signals. Signal No. 62 at Lansdowne can only be cleared when signal No. 56 is cleared and No. 54 is at caution or clear. The "wireless" circuit is used.

Under ordinary circumstances the pole changer on a given signal reverses as soon as the signal moving from stop reaches the caution position, thus clearing the signal in the rear which has assumed the caution position on the passage of the train from its block. A pole changer of this kind is placed on advance signal No. 54, but as signal No. 62 at Lansdowne must be cleared only when advance No. 54 is at proceed and consequently when home signal No. 56 is clear, the pole changer on this home signal does not shift until the arm attains the clear position, and there is no



Fig. 2—Bridge Between Morton and Swarthmore "Stop, Wait Time and Proceed" Signals.

necessity for wires such as are commonly used for distant control by two home signals.

Between Clifton and Swarthmore the right-of-way was so limited that the telegraph line interfered seriously with the view of the signals and two-track signal bridges were used. The hand rails were not entirely completed when photographs were taken. Fig. 2 shows the bridge between Morton and Swarthmore. The battery and relay shelters are built as inconspicuously as possible in the bridge leg, which is especially designed to hold them.

The treatment of signal No. 156 is one of the debatable points. This being the commencement of the block system and track circuit controlled, three courses were open. The lower arm is the distant for the signal at "D K," and is consequently two-position. If treated as an automatic block signal, the top arm with tracks occupied would also show stop, and a stop signal would be displayed with no warning distant signal in the rear, which would violate the principle of advance information for every stop signal.

If treated as is the custom at the beginning of an automatic installation on the Pennsylvania Railroad, namely, as a distant signal, simply, and not indicating the condition of the track, it obviously should not have the lower arm at stop and the top arm at caution, normally, as this is the aspect of the other signals when next signal is at stop and track clear. Hence, the top arm was fixed at caution and the lower arm moves only from caution to clear. This can only be cleared when track is unoccupied, so that this latter aspect does not conflict with the other signals, and in the normal indication (two arms, at 45 deg.) it is a different aspect from any other displayed.

It is still an open question whether or not this should be made a "Stop and Proceed" signal, the arguments in favor being that then the caution position would always mean track clear and next signal at stop on every signal, and the stop indication would never be displayed unless track were occupied when a stop is required.

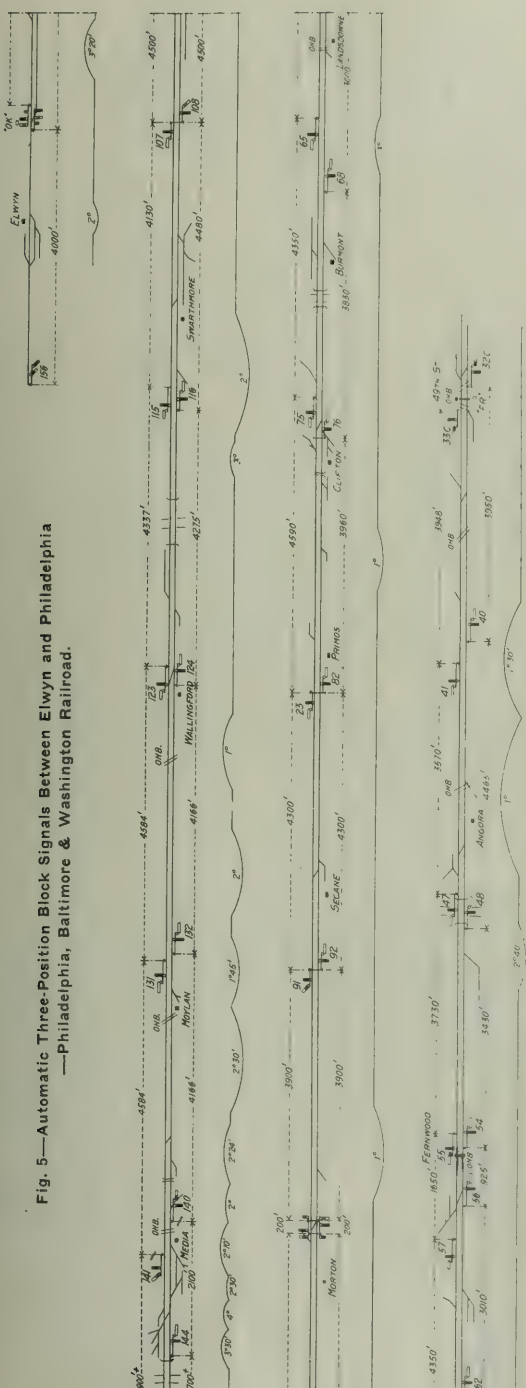


Fig. 5—Automatic Three-Position Block Signals Between Elwyn and Philadelphia —Philadelphia, Baltimore & Washington Railroad.

The argument against is the lack of distant signal, in turn, for it. This point and one other are practically all that are to be decided to complete and perfect the system.

The second point has developed in working out the details of the signaling at the new Washington terminal, where this system is to be installed jointly by the Baltimore & Ohio and the Pennsylvania.

With all interlocking signals semi-automatic, as on the Central division, it is impossible to attach cars or switch engines to trains, or to close trains in, except under hand signals. The same difficulty exists on all roads in automatic limits, when the interlocking home signals are semi-automatic. It is now proposed to make the low speed arm semi-automatic, from caution to clear only, and to so arrange the locking and circuits that it may be displayed at caution for any route, including the high-speed routes, if the latter are blocked by cars within the interlocking limits.

In other words, if a high-speed route is clear and next signal clear, the top arm will clear. If the track is clear and the next signal at stop, it will assume the caution position. If the track is occupied the top arm will indicate stop, but the low-speed arm may be shown at caution, thus combining the safety of the semi-automatic feature for high-speed movements, and the elasticity now attained where at outlying interlockings, the signals are not semi-automatic, and hand signals are the exception rather than the rule.

The decimal system of numbering is used. Each signal is numbered in tenths of miles from Broad Street Station, Philadelphia, odd numbers for westbound signals, corresponding with the odd



Fig. 3—Same Functions as Fig. 2.

numbered trains, and even numbers for eastbound, the nearest tenth being taken. By this system, signals can be added without inserting half numbers, etc., and the location is quickly determined by despatchers. The affix "C" on the signals at Forty-ninth street indicates "Central division," as they are located on the terminal division.

The signal cylinders are tandem and the arms are pulled "Clear" by a $^{3}/_{16}$-in. rod instead of being pushed "Clear" by a ¾-in. pipe or a 1-in. rod. This new construction saves considerable power. The relays are 5-ohm universal, neutral polar and the pole changers are pneumatic. It has developed that an ordinary mechanical pole charger would probably be as well suited to the work.

All switches are equipped with rotary circuit controllers which shunt the track circuit through two No. 6 B. & S. wires when switches are open. All boot-leg wires are No. 6 B. & S. plugged

through web of rail with channel pins and running direct to battery, relay or pole changer without splices.

All sidings are equipped with pipe connected derails, a number of the Hayes type, operated from the main track switch lever. Both ends of the main line cross-overs are operated through switch and lock movements from one ground lever placed in the middle of the cross-over tracks, making it impossible for careless trainmen to close the switches and clear the signals with an engine standing on the cross-over, and avoiding the use of special circuits to protect this danger point.

At first, trainmen unfamiliar with the device used too much force on this lever, and connections were sprung, or switch timbers moved. This trouble has practically ended, but it is thought that in future installations it will be preferable to use this lever to lock the points only for main track, operating them from ordinary switch stands, and thus making flying switches possible while insuring that switches must both be locked before the signals will clear, the circuit closer being operated by the lock itself instead of by the switch.

All interlocking home signals are power operated, semi-automatic controlled through stick indicators so arranged that they go to stop on the passage of train, and cannot be operated again until the train has left the circuit, and the operator restored his lever normal and again reversed it. Approach indicators and approach locking are provided, taking effect one block in the rear of the distant, and so arranged that if the home lever latch has been raised it cannot be put down to release the machine locking until a period of two minutes has elapsed. The circuits are so arranged that if a portion of the train is left on the approach circuit, the locking automatically releases when engine enters the home signal circuit, so that no hand or time release is required for ordinary trailing drill movements; but if a second train enters the section, the approach locking will become effective as soon as the home signal is cleared for it to proceed. The circuits are simple and ingenious and have been employed at many points in the system with great success.

The slow hand release, so called, is really a time release, operated pneumatically and so arranged that it is out of control of the operator. This is another ingenious device and its first application was made at Morton.

Special lamps and brackets were provided, as it is known that with those in ordinary use the lost motion between the lamp socket and bracket are sufficient to allow the lens in many cases to angle so much to the side as to prevent its focusing properly along the track.

The principles which govern this arrangement of signals are set forth as follows:

1. Two arms and two lights will be displayed on every high signal. With ordinary signal arrangements if any arm were broken or a light extinguished an engineeer would probably not notice it, as he could not be expected to remember how many there were on each particular post, while if there were always two he would notice the slightest derangement of either of them.

2. Day indications are given by three positions of the arm in the upper right hand quadrant, and at night each position is indicated by a different colored light.

3. Class A Signals. "Stop and Stay" signals. At these if a train is stopped it must stay until the signal is changed allowing it to proceed. This class includes interlocking, train order, controlled manual and telegraph block signals. The lights are vertically over one another and the arms appear the same length.

Class B Signals. "Stop, Wait Time and Proceed" signals which authorize or restrict train movements and past which a train, if it is stopped, may proceed after waiting time, even though the signal has not changed and still indicates stop.

This class includes automatic signals (and incidentally distant signals when the latter are used as independent indications). The lower arm and light are not directly under the upper arm and light, but located toward the left, so that the lower arm appears about 2 ft. shorter than the upper one and the lower light shows on the left-hand side of the post, while the upper one shows on the right-hand side. This staggered relation of the two signals is very noticeable both in daytime and at night.

Class C. Signals which give information only and do not authorize or restrict train movements: Switch indicators, both home and distant; flag station, water tank and stop and slow signals, indicated by horizontal lights and special designs for day indicators. These signals are all low and do not interfere with the two-signal principle used on the high poles.

4. Signals designate the speed of the trains rather than the routes, at points where interlocking systems are used.

The top arm governs the high-speed track, provided no cross-over movement is included in the route. It indicates proceed at highest speed permissible, modified, of course, by curves or any arbitrary order placed upon the speed.

The second arm governs medium speed movements, and refers to a divergence from the high-speed routes, such as an easy cross-over upon which a speed of 40 or 50 miles an hour is proper.

The third arm governs low-speed movements; over short cross-overs or against traffic, or into sidings, etc. This arm is shorter than the other two, has a short range light and is placed much lower down the post than the two main signals.

On signal posts where no high-speed route exists, the top arm is fixed in the horizontal position and the light is always red. At signal posts where no cross-overs or moderate-speed routes exist the second arm is fixed in the horizontal position and the light is always red. The only case where the top and second signals would both be out of horizontal position at the same time is on an automatic signal post where the lower arm would act as a distant signal for a medium speed route controlled by an interlocking tower ahead.

The system has been in service about two months and its opera-

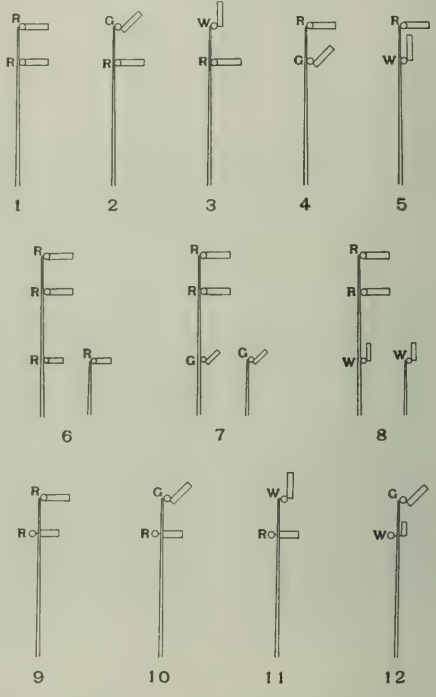


Fig. 4—Classification of Signal Indications—Central Division Philadelphia, Baltimore & Washington.

Numbers 1 to 8, inclusive, are Class "A," "Stop and Stay." The first five show the proceed indications for high and moderate speeds, and the other three show the proceed indications for low speeds, as follows: 1—Stop and stay; 2—Proceed with caution to next signal, on high-speed track; 3—Proceed at high speed, on high-speed track; 4—Proceed with caution to next signal, on moderate-speed track; 5—Proceed at moderate speed, on moderate-speed track; 6—Stop and stay; 7—Proceed with caution, on low-speed track; 8—Proceed at low speed, on low-speed track.

Numbers 9 to 12, inclusive, are Class "B," "Stop, Wait Time and Proceed" signals. These are for the automatic system and also for distant signals when the latter are used to give an independent indication; 9—Indicates stop, and proceed after waiting time; 10—Proceed to next signal, prepared to stop; 11—Proceed at speed, next high speed signal at caution or clear; 12—Proceed at moderate speed, next moderate-speed signal at caution or clear.

In all the figures R indicates a red light; G, green; W, white.

tion has been highly satisfactory. During the rush hours in the morning there are 10 trains east in two hours and eight minutes, or a train every 13 minutes, while two freights are working their way west with work to do on the eastbound track at various stations. In the evening, when the heavy travel is westbound, there are nine trains in less than two hours, or a train every 13 minutes, with generally one freight west and two east with work to do. Under these conditions the operation of signals is very frequent and the requirements for their proper operation to prevent delay and insure safety are very exacting. There are 40 signals in service, equal to 80 home and distant. During December there were three failures in operation—one due to broken wire, one due to weak battery and one cause unknown. The percentage of failures on the home and distant basis is, therefore, .038 per cent.

It is probable that if the system goes into general use on the Pennsylvania the colors of lights will be changed as recommended by the committee. Then indication "clear" will be given by green instead of white, and the indication "caution" will be given by yellow instead of green.

GENERAL NEWS SECTION

NOTES.

An elaborate railroad commission bill has been introduced in the legislature of Pennsylvania.

The Los Angeles Limited over the Chicago & North-Western, Union Pacific and San Pedro, Los Angeles & Salt Lake has been discontinued.

The Norfolk & Western has increased the pay of telegraph operators 11 per cent., and at 88 offices the work day has been reduced to eight hours.

An officer of the Chicago, Milwaukee & St. Paul says that the report of a reduction in freight rates by the State Railroad Commission of South Dakota is unfounded.

The Secretary of Agriculture is said to have 700 lawsuits prepared against western railroads for violation of the cattle transportation law, which he will soon begin to prosecute.

The new Alabama State Railroad Commission organized March 4. The members are Charles Henderson, of Troy (President); John G. Harris, of Montgomery, and W. D. Nesbit, of Birmingham.

The enginemen of the Lake Shore & Michigan Southern announce that after extended negotiation with officers of the road they have been granted an increase of pay ranging from 10 to 18 cents.

The State Railroad Commission of Vermont, in its report on a butting collision which occurred on the Central Vermont near South Royalton, recommended that in all cases of this nature the persons found responsible for the collision should be criminally prosecuted.

The Chicago, Milwaukee & St. Paul bridge across the Missouri at Chamberlain, S. D., has been wrecked by ice. More than 600 ft. of bridge and trestle work were swept away. This makes a break in traffic over the new line from Chamberlain west toward Rapid City, of which 75 miles are built.

The fast freight lines of the Grand Trunk are to be consolidated, and at the beginning of next month the offices of the different lines in each city will be put together. The lines included are the National Despatch, the Commercial Despatch, the Reading Despatch, the Lackawanna-Grand Trunk and the Great Eastern.

E. F. Hoesen, of Buffalo, N. Y., a Civil Engineer of extensive railroad experience, has been engaged by the New York State Railroad Commission to investigate three recent railroad accidents. Accidents have been occurring so frequently that the regular inspectors of the board are unable to keep up with the work.

The Pennsylvania Railroad has made an advance of 19 cents a day, from $2.11 to $2.30, in the wages of the brakemen on the Philadelphia and the Schuylkill divisions. It is said that this advance was made to put the pay of these men on a level with that of similar grades on other parts of the Pennsylvania system.

The Railway Commission of Canada has issued amended rules governing the use of interlocked signals at crossings of railroads, in which there is a requirement that passenger trains must be run over crossings at not over 35 miles an hour, and freight trains not faster than 20 miles an hour. Drawbridges must be crossed by passenger trains at not over 25 miles an hour and by freight trains at not over 15.

According to a press despatch from Houston, March 9, the Sunset Limited express of the Southern Pacific, having arrived at that city 50 minutes late, was annulled for the rest of its journey in order to avoid disobedience of a recent order of the Texas State Railroad Commission requiring passenger trains to run within 30 minutes of their schedule time. Passengers on the train, bound for the Pacific coast, had to wait in Houston 12 hours.

It is announced in Des Moines that the Iowa Railroad State Commission intends at once to order a reduction of about 16 per cent. in the rates for the transportation of cattle. The Commission says that present cattle rates, which have been in effect for seventeen years, were fair when they were established, but should be reduced now. It says that rail transportation costs more for livestock than for almost any other commodity, and that expenses of operating railroads have largely increased, but that in spite of these facts there is too great a difference between livestock rates in Iowa and Illinois (23½ per cent. less in Illinois). Assuming that in justice to the roads Iowa rates should be slightly higher than those of Illinois, the Commission thinks the difference in rates between the two states is still too great.

An officer of the Pennsylvania Railroad says that the company must have more college men. Hitherto about 20 technical graduates have taken service with the company each year, but the needs of the service demand many more than this number annually, and measures will be taken to more widely publish the company's invitation. The "special apprentice" class, to which the graduates are assigned, now has a four years' course. The line of promotion is not determined by any rigid rule, but care is taken to see that each individual is fully trained in all the departments of the work with which he is likely to have to deal when he becomes an officer. The Altoona yards, where the novice takes his first lesson in railroad operation, now contain 210 miles of track; and the Altoona shops, as everyone knows, constitute in themselves one of the best technical schools in the world.

Press despatches from Lincoln, Neb., say that Governor Sheldon changed his mind and approved the 2-cent passenger fare bill in that state, for without his signature it could not have gone into effect soon enough to please the people. The same despatch says that every railroad in the state has announced that it will comply with the law. The legislature of North Dakota has passed a bill limiting passenger fares to 2½ cents a mile. The legislature has adjourned, and the bill is now in the hands of the Governor. The lower house of the Illinois legislature has passed a 2-cent fare bill, and it is regarded as certain that the measure will become a law, though there are details on which the House and Senate have yet to agree. In the constitution of the new state of Oklahoma, which is now being prepared, there is a provision limiting railroad fares to 2 cents a mile, with certain exceptions where that rate can be shown to be unreasonably low.

A controversy between the Southern Pacific Railroad and its telegraph operators has been referred to a board of arbitrators, who are requested to act under the federal law of 1898. The arbitrator named by the railroad is R. H. Ingram, of Los Angeles; the one named by the operators is H. B. Perham, of St. Louis, and the third, who has been named by the chairman of the Interstate Commerce Commission and the Commissioner of Labor, is Prof. Emory R. Johnson, of the University of Pennsylvania. Mr. Ingram is General Superintendent of the southern district of the Southern Pacific, and Mr. Perham is the chief of the Telegraphers' Brotherhood. The arbitrators are to meet in San Francisco. The questions to be submitted to arbitration are given in the newspapers as follows: "First, whether members of the Order of Railroad Telegraphers in the employ of the railroad shall legislate for train despatchers respecting rates of pay, hours of service, etc.; second, whether the hours of service on Sundays shall be reduced to five hours; third, whether there shall be an increase in the salaries of the telegraphers." Consideration will also be given the question of eliminating from the operation of the schedule certain important agencies where the duties of soliciting traffic are paramount. Under the law both parties agree to abide by the decision of the board of arbitration, which shall continue in force for a period of one year.

The premium for absurdity in railroad rate legislation seems likely this year to go to Alabama. Up to a recent date we have expected that the award would go to Texas. The law makers of Texas have had long experience in the concoction of tricks for juggling railroad rates, while still preserving an appearance of fairness, and in former years have easily distanced all competitors; but this year, with the fountain of free rides frozen up, and two-cent fare bills under discussion in nearly every state in the Union, there is no monopoly of ingenuity in this line, and many states have come well to the front. The Alabama example, to which we refer, is a bill limiting the charge per 100 lbs. for extra baggage to 10 per cent. of the ticket fare. In a protest against this bill, which has been sent to the legislature by President Milton H. Smith, of the Louisville & Nashville, it is shown that under the proposed law the charge for extra baggage will, for short distances, be much less than half the charge for carrying the same goods on a freight train, while for distances as high as 200 miles there is still a great difference. Mr. Smith gives eight examples, in all of which the prices for both freight and baggage are based on rates fixed or proposed to be fixed by the legislature. Taking the baggage of a certain drummer, who carries ten pieces, weighing 2,000 lbs., Mr. Smith shows that for five miles the passenger and his baggage (all but 150 lbs. being charged for) must be carried for $1.06; by freight, at the rate fixed by the Senate bill last month, the charge for the baggage would be $2.40. For 59 miles the passenger's ticket, at 2½ cents, would be $1.48; baggage—1,850 lbs. at 14¾ cents—$2.73; total, $4.21; charge for 2,000 lbs. of freight, same distance, as per statute, $8.20.

Some New Scherzer Bascule Bridges.

The double-track Scherzer rolling lift bridge built for the Newburgh & South Shore Railway across the Cuyahoga River at Cleveland, Ohio, was described in the *Railroad Gazette*, Dec. 16, 1904. The location plan of the new bridge showed closely adjacent thereto a single-track center-pier swing bridge of the Cleveland Terminal & Valley Railroad, a constituent of the Baltimore & Ohio. The good results given by the Newburgh & South Shore bridge induced the Baltimore & Ohio to replace its swing bridge with a double-track bridge of the Scherzer type to accommodate the rapidly increasing traffic. The new bridge is virtually of the same dimensions as its neighbor on the Newburgh & South Shore, the principal difference between the two being in the method of counterweighting. In the later bridge the counterweight consists of a concrete composition enclosed and protected by steel plates. The bridge is a simple truss, the movable span being 160 ft. center to center of bearings. It is designed to carry the heaviest railroad loadings and is moved by electric motors.

Fig. 1 shows the bridge during erection when nearing completion, it being erected in the upright position. The bridge in the foreground is that of the Newburgh & South Shore. The new bridge was placed in service last fall. Its construction was in charge of J. E. Greiner, Assistant Chief Engineer of the Baltimore & Ohio. The Scherzer Rolling Lift Bridge Company, Chicago, furnished the designs, plans and specifications for the superstructure, operating machinery and operating equipment; also consulting engineering services. The King Bridge Company, Cleveland, is the contractor for the superstructure.

A duplicate of this Baltimore & Ohio bridge is now being built for the Government Railways at Port Soudan, Africa. Two similar double-track Scherzer bridges are being built for the Buenos Ayres Great Southern Railway at Buenos Ayres, Argentine Republic; also a long-span double-leaf bridge for the Burma Railways, India.

The New York, Chicago & St. Louis is likewise building a similar double-track Scherzer bridge across the Cuyahoga river at Cleveland to replace a single-track swing bridge on its main lines through the city of Cleveland. The base of rail of this bridge will be 70 ft. above the river; only a partial opening of the new bridge will therefore be required for even the tallest masted vessels.



Fig. 1—Scherzer Rolling Lift Bridge at Cleveland, Ohio; Baltimore & Ohio.

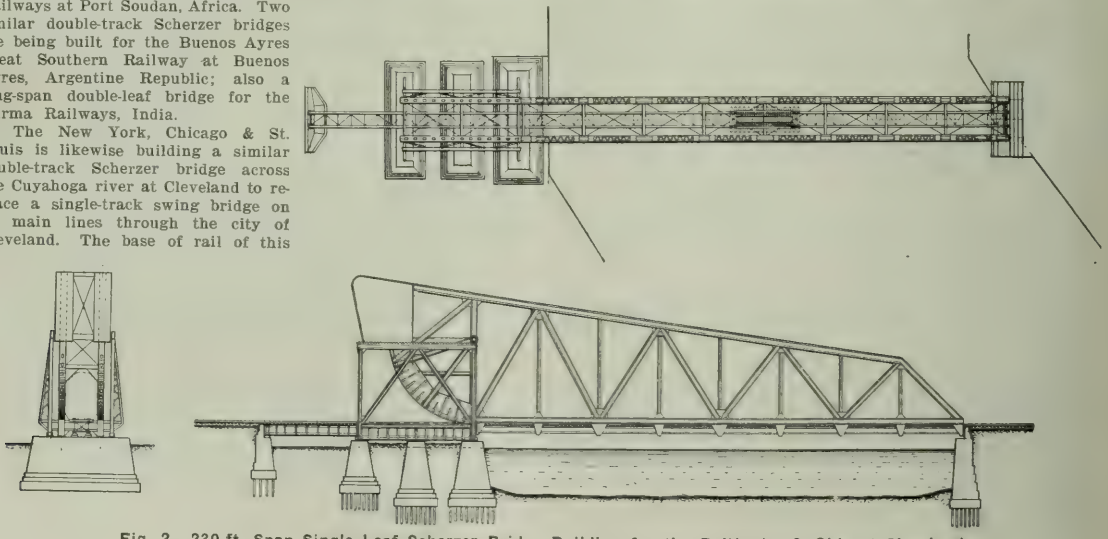


Fig. 2—230-ft. Span Single Leaf Scherzer Bridge Building for the Baltimore & Ohio at Cleveland.

The Baltimore & Ohio is building a very long span single-leaf Scherzer bridge to replace a center-pier swing bridge across the old channel of the Cuyahoga river. It is being erected in open position, thereby avoiding interference with or delay to either the railroad or the water traffic through the old swing bridge. The movable span of this bridge is 230 ft. long, center to center of bearings. The general design and dimensions are shown in Fig. 2, herewith. It is the longest span single-leaf bascule bridge yet built, and is only exceeded in length of span by the double-leaf Scherzer bridge across the Chicago river at the entrance to the Grand Central station, built in 1900, the movable span of which is 275 ft. The long spans in both instances are necessitated by the railroad tracks crossing the channel at an acute angle.

The four-track Scherzer bridges of the New York, New Haven & Hartford at Cos Cob and Westport, Conn., and the first double-track portion of a four-track bridge across the Housatonic river, have all been placed in service within the past year. Other four-track bridges of this type are building for this railroad across Neponset river, Massachusetts; Niantic river, Connecticut; Seekonk river, Rhode Island, and six-track bridges across the Bronx river and across Eastchester Bay, New York. All of these new bridges replace center pier swing bridges. They are designed to carry with increased safety the heavy passenger and freight traffic of this road and also facilitate traffic over its electrified lines. Substantial progress has been made on two double-track Scherzer bridges for the Norfolk & Western Ry. over the eastern and southern branches, respectively, of the Elizabeth river at Norfolk, Va., and upon two similar bridges for the Brooklyn Rapid Transit System. The company is also furnishing designs for numerous other railroad, electric railway and highway bascule bridges both in the United States and abroad, the present year promising to be more active than any previous year.

Street Car Fenders in Massachusetts.

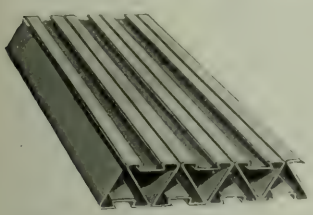
Circulars have been sent by the Massachusetts railroad commissioners to every street railway corporation in the state requiring them to make selection of the fenders preferred by them for use on their cars. Then these fenders will be examined by the commission and will be approved if they are believed to meet the conditions. Of the 27 different kinds of fenders tested by the railroad commissioners last year the commission is ready to approve several, and it will not shut up any corporation to the use of any

particular design. The Boston & Northern is making experiments of its own to determine which of several good inventions shall be adopted.

Cellular Steel.

Cellular steel is a new fireproof building material for floors, doors, partitions, decks, cars, etc. It is usually made of No. 24 galvanized sheet steel, pressed into triangular cells, as shown by the accompanying engraving, each side being about 2 in., and the triangles touching continuously. It is made either plain, or countersunk top and bottom for the reception of plaster or cement. The units are interchangeable and are made to form a continuous surface by slipping adjoining edges or cells one within the other. This affords a double-web reinforcement every few inches. The sheets or sections are 6 ft. long or less, as desired, and 7 in. wide. The weight is 4½ lbs. per square foot and the strength is given at over 600 lbs. per square foot for 6 ft. spans, without concrete or flooring.

For flooring, the sections are laid directly on the floor beams, the ends being tied together by metal straps on top of the sections, which are secured to the beam flanges by clips held to the floor by screws. The cellular steel may be covered with concrete as a preservative and as a base for terrazo, mosaic or other finished flooring. The under surface of the cellular steel may be plastered and finished as any other plaster ceiling.



Cellular Steel Building Material.

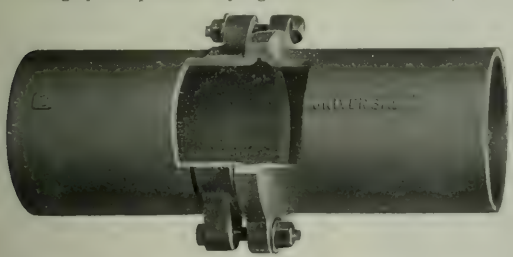
Cellular steel may be used for beam or column coverings, and for roofing, in the latter case being covered with pitch and clay, or tar and gravel, and will not shrink or crack. The purlins may be 6 ft. centers or less. It is also used for sewer covering. Other advantages are, saving of time in construction, saving of weight, and ease of loading for transportation.

Its use in floor construction has been approved for the City of New York, after suitable fire and water tests. Among the buildings in which it has been used is the Second National Bank building of Cincinnati, Ohio, a new ten-story structure. The National Steel Co., New York, is maker, and S. P. Holmes & Co., Chicago, are Western representatives.

"Universal" Cast Iron Pipe.

"Universal" cast iron pipe was designed to overcome the troubles experienced with, and the consequent objections to, the ordinary form of such pipe and the packed joints used with same. These joints are a constant source of leakage, either through themselves or because of their rigidity causing fractures due to their inability to adapt themselves to withstand the forces of expansion and contraction, vibration and settling.

The joint of "Universal" pipe has no packing and is formed by the contact of iron on iron. A true and slightly tapered spigot end fits into a taper, slightly smaller, in the hub of the adjacent length, the two being drawn together by bolts passing through lugs on opposite sides of the pipe. It is claimed that the joint will make up thoroughly and permanently tight under all conditions; and that



"Universal" Cast Iron Pipe Joint.

leakage of the main through fracture and like damage is minimized. A soft iron of high tensile strength is used in making the pipe to permit machining and give greater strength to the body of the pipe. The machined tapered joints take up the expansion and contraction in the line without leakage or strain, and at the same time provide connections of such flexibility as to be unaffected by the uneven settling and jars and vibration commonly experienced. Also, this pipe can be swung through considerable curves without producing leakage at the joints, an instance being a 5-in. compressed air line carrying 75 to 90 lbs. pressure, where the bend amounts at some points to over 6 in. in 6 ft., and the line remains tight.

It is further claimed that practically no trouble from electrolysis is experienced with this pipe, as it forms a continuous conductor for the current, while the packed joints of the ordinary pipe cause the current to divert around them through the ground, producing deterioration. A suitable wire connection should, of course, be made at the point nearest the generators to prevent electrolytic action at that point.

The pipe is made in 6 ft. lengths, with shorter lengths varying from 6 to 60 in. Use of these lengths and the nipples furnished enables any desired length of pipe or distance between fittings to be obtained. This also makes the pipe easy to handle and cheapens the cost of laying. The pipe is made by the Central Foundry Co., New York. Julian L. Yale & Co. are Chicago agents for it.

The Bangs Automatic Oil Cup.

A design of oil cup for locomotive use for which considerable economy is claimed is shown herewith. It is the Bangs automatic, being arranged to feed only when the engine is in motion, and ceasing when the engine stops. Steady and uniform lubrication is obtained, it is claimed, with a minimum of attention. The cup is made of aluminum, brass or iron, and is of simple, durable construction, there being no springs or glass in its make-up. It can be placed in any position on the eccentrics, cross-heads, crank arms or reciprocating bearings, the motion of the engine causing the oil to be dashed over the feed-pipe aperture and equal amounts to pass through each time. The sediment remains at the lower part of the cup where it cannot enter and clog the feed.



Bangs Automatic Oil Cup.

Besides the locomotive type, Type A, it is made for various other applications, such as stationary and marine engines, automobiles and bicycles. The Bangs Automatic Oil Cup Co., Milwaukee, Wis., is the maker.

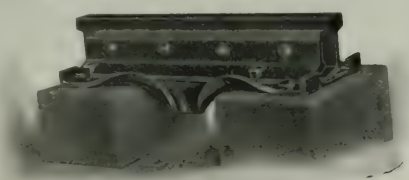
The Abbott Rail Joint Plate.

The ordinary angle bar or fish plate rail joint is in many respects the most satisfactory joint that has yet been produced, but it has an inherent defect of lack of strength due to its limited section when used under the heavy wheel loads of present practice.



Abbott Rail Joint Plate.

The Abbott rail joint plate, shown in the accompanying illustrations, was designed to provide the necessary strength and stiffness for the angle bar splice while still retaining its essential features of simplicity, low cost and ease of application. The construction is simple, consisting of one piece made from a flat plate $^{7}/_{16}$ in.



Angle Bar Joint With Abbott Joint Plate.

thick and of a length and width to correspond with the angle bar with which it is used. The downturned flanges at the center have a depth of 3 in. and a straight lower edge 1½ in. long. The upturned flanges extend from each end of the lower edge towards the ends of the plate 9½ in. each way from the center, making a

total length of flanging of 19 in. The greatest depth is at the center at the point of maximum stress. This combination of reversed top and bottom flanging makes proper provision for all stresses in the plate between the joint ties. The plate is given a slight camber in the center to insure that the ends of the rails first take a bearing, thus bringing the support of the plate into action before any deflection takes place in the splice bars. The upturned end or corner lugs act as "anti-creepers" by preventing the splice bars from moving relatively to the ties and also as guides for the rails to hold them in line in case the splice bars break or become loose.

The material from which the plate is made is a higher carbon steel than is used for the splice bars and has greater elasticity. With an 80-lb. rail section it is claimed that the vertical resistance is increased nearly 100 per cent. over the resistance of an ordinary angle bar joint. In lighter sections the increase is still greater. The plates may be applied to existing track which is breaking down at the joints under heavy loads and greatly prolong the life of the track. There is practically no wear on the plate and it may be used over and over again in renewals on curves where the wear on the angle bars is as rapid as the wear on the rails.

Many patent rail joints necessitate a special arrangement of joint ties before they can be put in place. The Abbott rail joint plate can be installed after track laying is completed and is applicable to any two-tie joint in either old or new track. In putting in switches or crossings where it is not practicable to use anything but angle bars, the plates can be left out and again continued beyond.

For step joints the usual form of compromise angle bar can be used and a simple flat plate of thickness equal to the difference in height of the two rail sections can be laid on the joint plate under the low rail. This gives a connection which can be made to hold surface as well as line. With this joint plate an ordinary angle bar joint can be insulated by using a continuous sheet of pressed fiber to fit around the rail section covering all the surface below the top and sides of the rail head. Angle bars of reduced size must be used to make a good fit but the joint plate supplies all the necessary vertical stiffness.

The Lackawanna Steel Co., 100 Broadway, New York, makes and sells these joint plates.

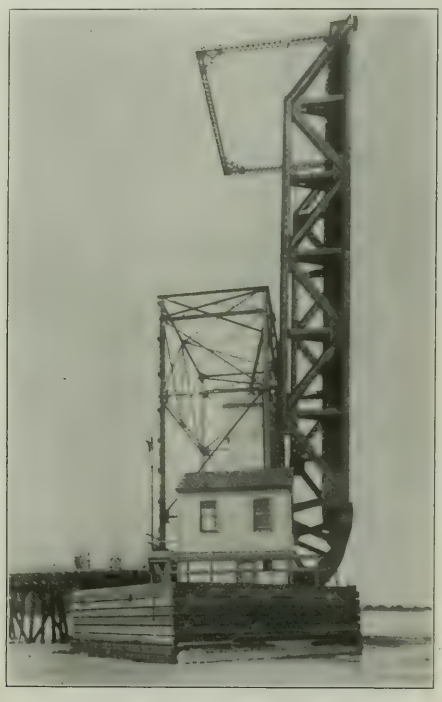
Prussian Hours of Labor.

In the State Railroad shops in Prussia the hours of work were reduced from 9½ to 9 on January 1, 1906. Inquiries among the authorities indicate that the result has been satisfactory all around. Most of the men are paid by the piece, and, as a rule, these have done as much and therefore earned as much in 9 hours as previously in 9½ and have been much more contented.

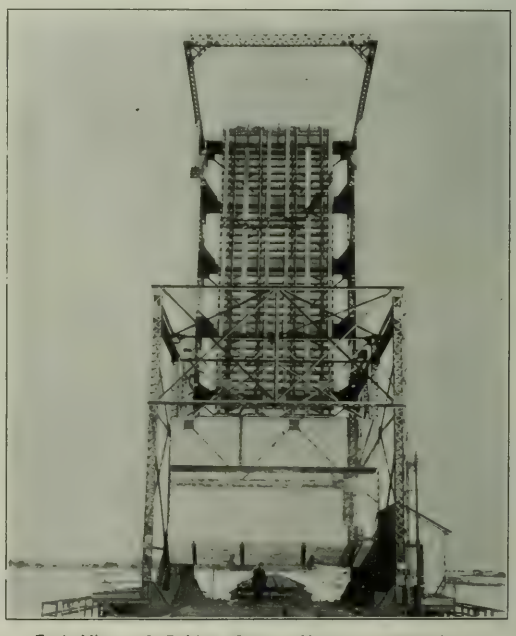
Strauss Trunnion Bascule Bridge; New Jersey Short Line.

The New Jersey Short Line, a double-track interurban line now building between Philadelphia and New York, crosses the Rahway river about four miles below Rahway, N. J. This river is navigable, requiring a drawbridge and a 150-ft. double arm plate girder draw span was originally designed for the crossing. It was later abandoned, however, and a Strauss design of trunnion bascule substituted. Views of the finished span are shown herewith.

The moving leaf has two riveted pony trusses with box-girder sections. The fore part is a Warren truss and the tail end is polygonal. The trunnion is located in the top chord at the junction point of the two parts mentioned, and is the center from which the truss members radiate, as well as the point to which the entire dead and half of the live load of the moving leaf is transmitted. The moving leaf comprises, in addition to the two trusses, all that part of the floor system beyond the break in the floor ahead of the trunnions. This part of the trusses is held laterally by deep knee braces at each floor-beam and by angle laterals. The tail ends are unsupported laterally beyond the trunnion, but the width of chord is exceptionally great in proportion to their unsupported length, and the tail ends are fully as stiff as the remainder of the trusses. The function of the tail end is to transmit the effect of the counterweight, which is pin-connected to it at the intersection of the two end members.



Side View of Bridge Open. Note Counterweight.

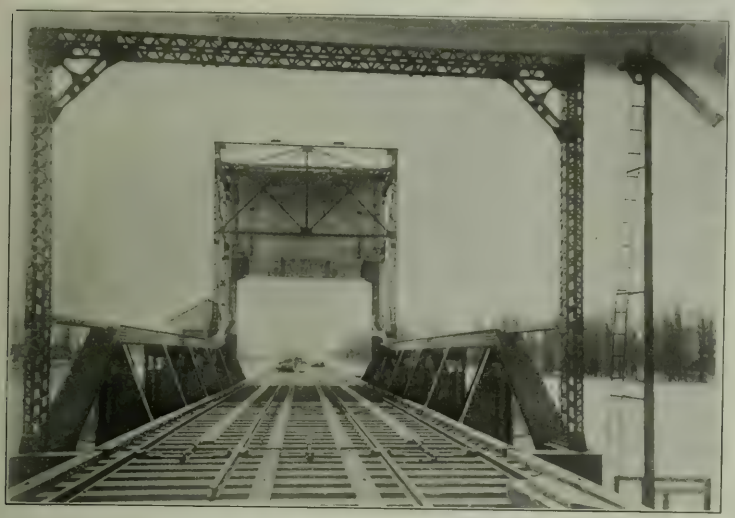


End View of Bridge Open. Note Counterweight.

The trunnion supports are two cast-steel journals riveted to a pair of short vertical posts, one on each side of each truss. The outer posts form part of two latticed frames, which are connected transversely by latticed struts above the clearance line and by top laterals, forming an enclosing tower for the counterweight as well as a support for the counterweight link. Heavy knee braces hold the outside posts laterally. The inside trunnion posts are riveted to the front floor-beam of the fixed approach, while the rear tower posts are riveted to the rear floor-beam of the fixed approach. The longitudinal bracing of the inside trunnion post is by means of a batter post and a horizontal strut to the rear floor-beam, acting in connection with a bottom lateral system of angle bracing. The fixed floor is supported on stringers spanning the space between the fixed floor-beam and by brackets to the break in the floor. This form of tower construction is to give solidity and stiffness.

The counterweight is concrete carried by a steel counterweight frame, which consists of two central vertical legs riveted to a main cross girder just above the traffic clearance line. At the top the posts are held by a cross strut, which with some diagonal shear bars is embedded in a concrete block 31 ft. 8 in. wide by 8 ft. thick by 22 ft. 9 in. high, built upon the cross girders as a base and embedding also the upper part of the steel legs, the whole forming the counterweight proper. The upper end of the counterweight frame is pin connected to a pair of braced links, which in turn are pin connected to the fore end of the tower. The relation of the link and the counterweight frame to the tail end of the truss

and the tower is such that the link is equal to and parallel with a line passing through the trunnion and the counterweight pin, while the leg of the counterweight frame is equal to and parallel with a line through the trunnion and the front link pin. The counterweight frame, therefore, as a member of a flexible parallelogram, can alter its relative position to the trunnion without changing from the vertical, thus maintaining an exact balance as the bridge opens and closes. The counterweight itself is high enough to permit such dimensions as are required for the use of concrete instead of cast-iron. Its point of application, however, is low and the center of gravity remains in the center of the trunnion close to the base of the rails. In other words, a high counterweight is obtained without a high center of gravity and the consequent low factor of stability.



Portal View, Strauss Bascule Bridge, Rahway, N. J.

The machinery is located on top of the pier on each side of the tower. It comprises two separate trains of gears and two driving pinions, meshing with cast-steel racks fitted to the tail ends of the trusses of the moving leaf. There are two 15 h.p. direct-current railway type driving motors, which, with the machinery, are enclosed in timber housings, the roofs of which are flush with the base of rails. On one side this roof forms the floor of the operator's house, which contains the controller, switchboards and the hand levers for the brakes, truss and rail lock and the semaphores. A winch for hand operators is also contained in the operator's house, as well as an indicator, showing the position of the leaf, and an air whistle instead of the old-fashioned bell. Walks and stairways lead to all the machinery parts and the tower is fitted with a ladder on the rear post, which gives access to the link pins.

The bridge has end shoes designed to act as buffers and absorb the impact of the leaf as it descends. For the upward movement an automatic motor cut-out is provided as well as bumping blocks of white oak on the trunnion post and a corresponding engaging shoe on the tail end. Two one-arm semaphores were furnished as a part of the bridge equipment; also two automatic signal lights, showing red when the bridge is closed and green when it is open; also four fixed lights on the piers.

The road being an interurban line, it was necessary to provide for trolley wires. At the end of the leaf this was done by riveting a structural steel trolley arch to the end floor-beam and bracing it back to the truss in the line of the top chord. At the tower end T-iron brackets were built into the counterweight for the attachment of insulated brass pans to guide the trolley. The trolley wire of the leaf passes over a sheave in the front pan and thence to a compensator on the front face of the counterweight, the device being such that the wire is always kept taut whether the bridge is open or closed. In the open position the trolley wires ride on iron rollers at the top of the tower. The wire being dead when the bridge opens, there is no transmission of current to the bridge metal. The approach wires are supported on the end frame of the tower at one end and to a trolley arch on the fixed approach at the other end.

The bridge floor has 8-in. x 9-in. x 22-ft. ties continuous over both tracks, secured to the stringers by 4¾-in. bolts for each tie. There are the usual timber guard rails, and also two lines of walking planks. The rail latches have a toggle action and act sidewise. The truss lock is a longitudinally moving tongue engaging a slot on the end shoes. No tail lock is provided, there being no live load on the tail end and no tendency therefore for the bridge to open under load.

The substructure of the bridge comprises a concrete pivot pier and a pile rest pier. The former is U-shaped to suit the tower and rests on short piles driven to a stratum of shale. Its construction was carried on by means of a puddled cofferdam, which was designed to remain in place and serve as a fender. For this purpose the puddle was removed after the pier was finished and replaced by broken stone. Ample end protections are provided by this fender as the views show. The rest pier is similarly protected by a fender. The footing of the trunnion post consists of I-beam bolsters suitably anchored in the concrete. The rear posts have heavier anchorage to provide for the wind stresses.

The contract requirement for speed of operation calls for a leaf movement of one minute, and a quarter of a minute for the operation of the locks. The motion is smooth and regular and there is no tendency to race. The power required is about 20 amperes at 450 volts. The hand-operating mechanism raises the bridge in 30 minutes on the high-speed gear and in 60 minutes on the low-speed, with one man at the winch. This mechanism is an emergency device and ordinarily disconnected.

The bridge crosses the river at right angles, the clear span being 65 ft. The distance from the center of the trunnion to the rest pier shoe is 83 ft. The length of the tail end or counterweight arm is 13 ft. The tower is 17 ft. c. to c. of posts parallel to the bridge and 33 ft. 6 in. across. Its height from top of masonry is 53 ft. 3 in. and from base of rails 43 ft. 4 in. The distance center to center of trusses is 30 ft. and the total weight of metal in the bridge is 391,000 lbs.



Strauss Bascule Bridge at Rahway, N. J.

The notable features of the bridge are its straight line construction, the absence of counterweight pits, and the concrete counterweight. The distance from base of rail to mean high water is only 10 ft. 6 in. and the cost of counterweight pits would have been prohibitive. All the main pins have been provided with double-lock keys to prevent their accidental dislodgement. The bridge was designed and built by the Strauss Bascule & Concrete Bridge Co., Chicago. It is now completed and ready for use as soon as the road is finished.

Reinforced Concrete Roofing Tile.

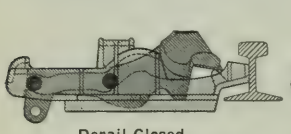
The roofing tile illustrated herewith is made of concrete reinforced with 18-gage expanded metal. It is very large, each tile having 8 sq. ft. exposed to the weather, with 4-in. laps and ¼-in. play at the sides. It is ⅞ in. thick and weighs 13 lbs. per sq. ft. Its strength is sufficient to bear any weight to which a pitch roof is subjected, it is claimed. It is laid directly on the purlins, no sheathing being interposed. It is neither nailed nor wired, being held in place by its own weight and the interlocking feature provided. It is claimed to be waterproof, never scales, cracks or blisters, requires no painting or repairing, and no storm short of that which can wreck the whole building will dislodge it. Its first cost is about the same as for other substantial roofs. It has already been applied to the roofs of many big buildings all over the United States, and is being used on the buildings being erected at Gary, Ind., for the United States Steel Corporation, and on the big plant of the Pittsburg Plate Glass Co. at Crystal City, Mo. It is called the "Bonanza" tile. The Hunkins-Willis Lime & Cement Co., St. Louis, Mo., is general agent for it.



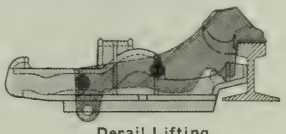
"Bonanza" Roofing Tiles.

Hayes Lifting Derail.

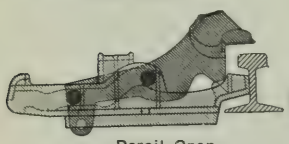
There are now in use on 220 railroads over 14,000 of the Hayes lifting derails shown in the accompanying illustrations. The new model A derail recently put out embodies a number of improvements. In the older styles the derail block was held on the rail by the pins in the cam slot. This is accomplished in the new model by forming a seat at the front end of the guide box which gives a bearing for a lug found on the under side of the derail block, which drops in front of the seat when the block comes down on top of the rail. The block cannot move sideways on the rail without lifting clear of the seat. The top and back cross braces of the guide block have been made heavier to add to the rigidity of the block. The Hayes Track Appliance Co., Geneva, N. Y., is the maker.



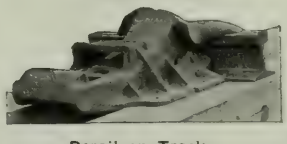
Derail Closed



Derail Lifting.



Derail Open.



Derail on Track.

Manufacturing and Business.

W. A. Hughes, Purchasing Agent of the Pullman Company, died at his home in Chicago on March 8th.

The American Car & Equipment Co., Chicago, has sold a number of tank cars to E. H. Young, Galveston, Tex.

The Chicago Railway Equipment Co., Chicago, has moved from the Great Northern Building to the Fisher Building.

Clive Runnells, Manager of Sales for the Western Steel Car & Foundry Co., has resigned to go to McCord & Company, Chicago.

The Draper Manufacturing Co., Port Huron, Mich., has sold to the Union Pacific R. R. a McGrath pneumatic turntable motor for use at Sidney, Neb.

The Lock Joint Pipe Co., 346 Broadway, New York City, has received a contract from the Charlotte Harbor & Northern to protect all the piling of its bridges and wharves in the state of Florida with lock joint pipe.

The Friestedt Interlocking Channel Bar Co., Chicago, has been bought by the Carnegie Steel Company. Arthur A. Friestedt, hitherto with the former company, will be Sales Manager of the steel piling department of the Carnegie company, with office at Pittsburg.

The name of The Lantry-Sharp Contracting Co., Kansas City, Mo., has been changed to The C. H. Sharp Contracting Co. C. H. Sharp continues as President and General Manager. The offices have been moved from the Gumbel Building to 708-9-10 Long Building.

The Pilling Air Engine Company, Detroit, Mich., is getting out plans and specifications for a new factory building, which will more than double its present capacity. It has bought two acres of land to allow for future expansion in making hoisting machinery and railroad equipment. J. C. Fleming is President and Manager.

The Hicks Locomotive & Car Works, Chicago, has established a southern office at Hattiesburg, Miss., primarily to make the lumber purchases for the company. It is in charge of J. F. Johnston, with the title of Southern Lumber Agent. He has been connected with southern lumber interests for 15 years, and will have charge of the purchasing, inspection and shipping departments of the Hicks works in the South, and will attend to sales of its products when opportunities present.

Robert E. Garrick, formerly General Superintendent of the Unit Concrete-Steel Frame Co., Philadelphia, Pa., and later general engineer with Tucker & Vinton, New York, is now with the General Fireproofing Co., Youngstown, Ohio. Mr. Garrick's experience has been extensive in planning and superintending the construction of reinforced concrete work, and in his present position his attention will be given to the sale and installation of the company's pin-connected girder frame. This type of girder reinforcement is claimed to possess an exclusive feature in that it provides a complete mechanical tie by a link and pin connection over each column or beam intersection which does not in any way depend upon the adhesion of the concrete to the steel.

J. R. Lovejoy has been appointed General Manager of the Sales Department of the General Electric Company. Mr. Lovejoy was born at Columbus, Ohio, in 1863. After a post-graduate course at the Ohio State University, from which he received the degree B. Sc., he entered the service of the Thomson-Houston Electric Co. at Lynn, Mass., August, 1886. He graduated from what was then known as the "expert course" to take up engineering work in the Boston office of the company. Later he was employed at headquarters, and when the Thomson-Houston Company was merged in the General Electric Co. in 1892, he became General Manager of the Supply Department. In 1900 he was made also Manager of the Railway and Lighting Departments. He is an officer and a director in several subsidiary companies; a director and member of the executive committee of the Schenectady Trust Company; a member of the American Institute of Electrical Engineers, the Franklin Institute and the American Society for the Advancement of Science, as well as several organizations pertaining to electrical science; president of the Mohawk Golf Club of Schenectady; a member of the Mohawk Club of Schenectady and the University Club of New York.

OBITUARY NOTICES.

Arthur V. Lomlin, Treasurer of the Missouri, Kansas & Texas of Texas, died in Dallas, Tex., on March 12 of malarial fever. Mr. Lomlin was 36 years old.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Canadian Society of Civil Engineers.

At a meeting of the Electrical Section held March 14, a paper by B. T. McCormick on "Effect of Armature Reaction in Synchronous Motors and Rotary Converters" was presented.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Bennettsville & Cheraw.—The following new officers have been elected: J. J. Heckart, President, succeeding J. A. Drake; George Burchill, Sumter, S. C., Secretary and Treasurer; H. A. Page, General Manager.

Delaware & Hudson.—Alexander E. Orr, Vice-President, has resigned. He remains a member of the Board of Managers and of the Executive Committee.

Missouri Pacific.—Stuyvesant Fish, formerly President of the Illinois Central, has been elected a Director of the Missouri Pacific, succeeding James H. Hyde. J. J. Slocum has been elected a Director, succeeding Russell Sage, deceased.

Santa Fe, Prescott & Phoenix.—George C. West has been appointed Auditor, succeeding Paul P. Hastings, appointed General Freight and Passenger Agent.

Operating Officers.

Bennettsville & Cheraw.—H. A. Page has been appointed General Manager, with headquarters at Bennettsville, S. C., succeeding

A. J. Matheson, Vice-President and General Manager. See same road under Executive, Financial and Legal Officers.

Chesapeake & Ohio.—J. A. Fox, Trainmaster at Covington, Ky., has been appointed Assistant Superintendent of the Kentucky division. G. H. Funk succeeds Mr. Fox.

Detroit, Toledo & Ironton.—H. A. Hardy has been appointed Trainmaster of the Northern division, with office at Napoleon, Ohio, succeeding W. H. Romoser.

Kansas City Southern.—A. G. Eggleston has been appointed Trainmaster at Shreveport, La., succeeding R. R. Sutherland, resigned.

Missouri, Kansas & Texas.—J. W. Walton, Superintendent at Parsons, Kan., has resigned to go to the St. Louis & San Francisco.

Pullman Company.—J. L. Woods, Assistant Superintendent at Cincinnati, Ohio, has been appointed District Superintendent at Detroit, Mich. J. P. McPhillips succeeds Mr. Woods.

Seaboard Air Line.—H. M. Waite, who has been appointed Superintendent of the Seaboard Air Line, with office at Birmingham, Ala., was born on May 15, 1869, at Toledo, Ohio. He graduated from the Massachusetts Institute of Technology in 1890, and began railroad work in that year on the Big Four as rodman; within a year he was appointed Engineer in charge of new lines and Engineer of Maintenance of Way of the St. Louis division. In 1893 he went to the Cincinnati, New Orleans & Texas Pacific as Division Engineer. For a year he was roadmaster of the Louisville & Southern, now part of the Southern Railway, but returned to the Queen & Crescent in 1895 as Superintendent of Bridges. Four years later he was appointed Superintendent of the Cincinnati division, and in 1906 Superintendent of the Chattanooga division, with headquarters at Somerset, Ky. Soon after Mr. Garrett's election as First Vice-President of the Seaboard Air Line, Mr. Waite followed him to that road.

Traffic Officers.

Cumberland Valley.—The office of the General Freight Agent has been moved from Harrisburg, Pa., to Chambersburg.

Midland Valley.—C. B. Hart, General Agent at Fort Smith, Ark., has been appointed to the new office of General Freight and Passenger Agent, with office at Muskogee, Ind. T.

Missouri Pacific.—W. D. Hurlbut, General Freight Agent in charge of Tariffs, Rates and Revisions, has resigned to go into other business.

New York, Chicago & St. Louis.—B. E. Morgan, Commercial Agent at Chicago, has been appointed Assistant General Freight Agent, with office at that city. J. H. Grant, Commercial Agent at Buffalo, has been appointed Assistant General Freight Agent at Cleveland, Ohio.

Santa Fe, Prescott & Phoenix.—Paul P. Hastings, Auditor, has been appointed General Freight and Passenger Agent, succeeding F. A. Jones, resigned to go into other business. See Santa Fe, Prescott & Phoenix under Executive, Financial and Legal Officers.

Engineering and Rolling Stock Officers.

Canadian Pacific.—J. E. Schwitzer, Principal Assistant Engineer, has been appointed Assistant Chief Engineer, with headquarters at Winnipeg.

Houston & Texas Central.—F. T. Jeans has been appointed Superintendent of Bridges, with office at Houston, Tex.

Northern Pacific.—W. C. Smith, Division Engineer at St. Paul, Minn., has been appointed Engineer of Maintenance of Way, with headquarters at St. Paul.

Purchasing Agents.

Chicago, Rock Island & Pacific.—W. K. Allen, Assistant to the General Purchasing Agent, has resigned.

LOCOMOTIVE BUILDING.

The Egyptian State Railways administration is inquiring for 70 American locomotives.

The Dry Fork Railroad, it is reported, has ordered one locomotive from the Baldwin Locomotive Works.

The Costa Rica Government Railways have ordered two locomotives from the Baldwin Locomotive Works.

The Pennsylvania, according to press despatches, has ordered 20 passenger locomotives from its Juniata shops.

The Central of Georgia, it is reported, has ordered 15 simple locomotives from the Baldwin Locomotive Works.

The Missouri, Kansas & Texas, it is reported, has ordered seven locomotives from the American Locomotive Company.

The Yuet Han (China) has ordered from the American Locomotive Company two prairie type (2-6-2) tank locomotives.

The Yokohama, of Japan, has ordered five prairie type (2-6-2) tank locomotives from the American Locomotive Company.

The National Railway of Nicaragua is understood to have ordered one locomotive from the Baldwin Locomotive Works.

The Canton-Hankow (China) has ordered two eight-wheel passenger locomotives from the American Locomotive Company.

The Guanica Central, Porto Rico, has ordered one six-wheel (0-6-0) switch engine from the American Locomotive Company.

The Central of Brazil has ordered three Mallet compound locomotives, each to weigh 208,000 lbs., from the American Locomotive Company.

The Northern Pacific Terminal Co., Portland, Ore., is reported to have ordered two locomotives from the American Locomotive Company.

The Guatemala Government Railways (Central America) have ordered from the American Locomotive Company two four-wheel type (0-4-0) saddle tank locomotives.

The La Dicha & Pacific, which is being built on the west coast of Mexico by the Mitchell Mining Co., is in the market for second-hand 36-in. gage locomotives. The contract will be placed through the New York purchasing office, room 1220, Broad Exchange Building.

The South Manchuria Railway has ordered 20 consolidation and two inspection locomotives from the Baldwin Locomotive Works. The same road recently ordered 183 engines of different types from the American Locomotive Company, four of which have been shipped.

The Mexican National Sugar Refining Company, which is to build a railroad on its plantation near Cordoba, state of Vera Cruz, will shortly be in the market for two locomotives. The contract will be placed through the Eastwick Engineering Company, Limited, 32 Broadway.

The Vandalia, as reported in the *Railroad Gazette* of December 21 last, has ordered 11 simple freight mogul (2-6-0), two simple Atlantic (4-4-2), and six simple six-wheel switching (0-6-0) locomotives from the Schenectady works of the American Locomotive Co., for June delivery. The general dimensions for these locomotives were published in our issue of December 21, and the special equipment is as follows:

Air brakes	Westinghouse
Axles	Cambria
Bell ringer (for mogul)	Simplicity
Boiler lagging	Franklin Mfg. Co.
Brake-beams	Creco or Davis
Couplers	Tower
Headlights	Vandalia standard
Injector (for mogul and Atlantic)	Simplex
Injector (for switching)	Nathan Simplex
Journal bearings	Pennsylvania R. R. specifications
Piston rod packings	U. S. metallic
Valve rod packings	U. S. metallic
Safety valve	Coale
Sanding devices	Leach
Sight feed lubricators	Nathan bull's-eye
Springs	Union Spring & Mfg. Co.
Steam gages	Ashcroft
Steam heat equipment (for Atlantic)	Penn. R. R. specifications
Tires—Driving wheel	Open hearth steel
Tires—Truck wheel (for mogul and Atlantic)	Paige steel
Tires—Tender wheel (mogul and Atlantic)	Schoen rolled steel
Other specialties (for mogul)	Walschaert valve gear

CAR BUILDING.

The Bristol (Tenn.) Street Railway will shortly buy some cars.

The Tuscaloosa (Ala.) Belt Railway is about to buy a gasoline motor car.

The Texas & Pacific is reported in the market for passenger equipment.

The Missouri, Kansas & Texas is about to let contracts for 2,500 freight cars.

The Meridian (Miss.) Light & Railway Company is about to buy some cars.

The Louisville (Ky.) Traction Company is reported to have ordered 50 cars.

The Nashville (Tenn.) Railway & Light Co. is reported to have ordered 30 cars.

The Missouri, Kansas & Texas has ordered 2,500 freight cars from the American Car & Foundry Company.

The Northern Electric Co., Chico, Cal., is said to have ordered 50 box cars from the American Car & Foundry Company.

The Louisiana & Arkansas, as reported in the *Railroad Gazette* of February 1, has ordered 300 box cars from Barney & Smith.

The Morrisey, Fernie & Michel, it is reported, has ordered 15 coal cars of 60,000 lbs. capacity from the Youngstown Car & Mfg. Co.

The Costa Rica Government Railways have ordered about 200 flat, box and stock cars from the American Car & Foundry Company.

The Colorado Midland is working on plans for 100 coal cars instead of 100 box cars, as reported in our advance sheet of February 27.

Brooke Smith, of Houston, Tex., is about to buy a gasoline motor car for use on the branch line of the Houston Electric Railway to Brooke Smith.

The Colorado & Southern, as reported in the *Railroad Gazette* of March 8, has ordered 100 Hart convertible cars from the Rodger Ballast Car Company.

The South Manchuria Railway has ordered a large number of box, gondola and flat cars. It is understood that most of these were ordered from the American Car & Foundry Co.

The Chicago, Milwaukee & St. Paul, according to press despatches, is about to build 3,000 steel underframe box cars at its West Milwaukee shops. A similar report several weeks ago was denied.

The Mexican National Sugar Refining Company, which is to build a railroad on its plantation near Cordoba, state of Vera Cruz, will shortly be in the market for from 50 to 60 cane cars. The contract will be placed through the Eastwick Engineering Company, Limited, 32 Broadway.

The Brooklyn Rapid Transit has ordered 50 elevated railroad motor cars from the Jewett Car Co., 50 elevated railroad motor cars from the Laconia Car Co., and 100 surface railway cars from the J. G. Brill Co. The elevated railroad cars will have steel frames and storm-proof vestibules.

The La Dicha & Pacific, which is being built on the west coast of Mexico by the Mitchell Mining Co., is in the market for 15 flat and six box cars of from 30,000 to 40,000 lbs. capacity. The contract will be placed through the New York purchasing office, room 1220, Broad Exchange Building.

The Kansas City, Mexico & Orient, as reported in the *Railroad Gazette* of February 15, has ordered 400 standard box cars and 200 36-ft. stock cars, both of 60,000 lbs. capacity, from the American Car & Foundry Co., for September delivery. The special equipment for both is as follows:

Bolsters	Bettendorf
Brake-beams	Chicago Railway Equipment Co.
Brake-shoes	Spear & Miller Co.
Brakes	Westinghouse
Brasses	Hewitt
Couplers	Climax
Door fastenings (for box)	Positive
Doors (for box)	Dunham
Dust guards	Ryan
Paint	American Car & Foundry Co.
Roofs (for box)	Chicago-Cleveland
Springs	Railway Steel Spring Co.
Trucks	Arch bar
Wheels	American Car & Foundry Co. (cast iron)

The Washington, Baltimore & Annapolis Electric, as reported in the *Railroad Gazette* of February 15, has ordered 19 passenger cars, four combination cars and two freight cars from the Niles Car & Mfg. Co., for July 15 to September 15 delivery. The passenger cars will be 51 ft. long, the combination cars will be 43 ft. long, and the freight cars will be 54 ft. long; all cars will be 8 ft. ¼ in. wide, and 9 ft. 6 in. high, inside measurements. The special equipment includes:

Axles	Standard Steel Co.
Brakes	Westinghouse
Brake-shoes	American Brake-Shoe & Foundry Co.
Couplers	Gould
Curtain fixtures	Curtain Supply Co.
Curtain material	Pantasote
Draft rigging	Gould
Heating system	Consolidated Car Heating Co.
Journal boxes	Symington
Paint	Sherwin-Williams
Springs	Baldwin
Trucks	Baldwin
Wheels	Standard Steel Co.

RAILROAD CORPORATION NEWS.

Catskill Electric Railway.—Capt. Arthur M. Murphy, of Catskill, N. Y., has been appointed receiver of this company.

Chicago, Rock Island & Pacific.—See Rock Island-Frisco Terminal.

Cleveland, Southwestern & Columbus (Electric).—This company was incorporated on March 4 at Columbus, Ohio, to consolidate the Cleveland & Southwestern Traction Co., the Cleveland, Ashland & Mansfield Traction Co., and the Ohio Central Traction Co., together operating 170 miles of line. The new company is reported to have acquired the Mt. Vernon Electric Railway, owning five miles of line in Mt. Vernon, Ohio.

Great Northern.—Gross earnings for the month of February were $2,656,873, a decrease of $531,386, or 17 per cent. There were snow blockades during the greater part of the month. For the eight months ended February 28, 1907, gross earnings show an increase of a little over $800,000.

Havana Electric Railway.—At the recent annual meeting an entirely new board of directors was elected, which Cuban bankers, represented by Frank Steinhart, American Consul-General at Havana, control. The road was formerly controlled by William L. Bull, of New York, and Hanson Bros., of Montreal. Warren Bicknell has resigned as President of the Lake Shore Traction Co., of Cleveland, and has been elected President of the Havana Electric, succeeding Edwin Hanson.

Merchants & Miners Transportation Co.—See New York, New Haven & Hartford.

New York Central Lines.—Gross earnings for the month of February, 1907, were as follows:

New York Central & Hudson River	$6,562,113	Decrease	$20,011
Lake Shore & Michigan Southern	3,263,828	Increase	232,952
Lake Erie & Western	373,168	Decrease	40,536
Chicago, Indiana & Southern	217,072	Increase	29,773
New York, Chicago & St. Louis	808,315	"	56,783
Michigan Central	2,088,988	"	67,995
Cleveland, Cincinnati, Chicago & St. Louis	1,821,251	"	77,618
Peoria Eastern	225,342	Decrease	2,690
Cincinnati Northern	71,884	Increase	8,662
Pittsburgh & Lake Erie	1,022,316	"	57,563
Rutland	177,943	"	1,286

New York, New Haven & Hartford.—It is officially announced that the New York, New Haven & Hartford has sold the Boston & Philadelphia Steamship Co., recently bought, to the Merchants & Miners Transportation Co., in which company it has bought a half interest. The stock of the Merchants & Miners is to be trusteed, the New Haven road to nominate one-half the directors and the outside stockholders the other half, the odd director to be chosen by the trustees. The Merchants & Miners Transportation Co. owns 17 steamships which it operates from Boston and Providence to Baltimore and Norfolk, from Philadelphia to Savannah, and from Baltimore to Newport News, Norfolk and Savannah.

Pennsylvania.—At the sixtieth annual meeting of the Pennsylvania Railroad held in Philadelphia March 12, the company was authorized by the stockholders to increase the authorized capital stock from $400,000,000 to $500,000,000, and to issue $100,000,000 new bonds. Authority was also given to increase the yearly contribution by the company to the employees' pension fund from $300,000 to $500,000.

Pittsburg & Lake Erie.—See Wheeling & Lake Erie.

Rock Island Company.—The Rock Island-Frisco Terminal Railway has made a mortgage securing $5,000,000 first mortgage 5 per cent., 20-year, gold bonds jointly guaranteed by the Chicago, Rock Island & Pacific Railway and the St. Louis & San Francisco. Of these, $3,000,000 have been sold. The property consists of three tracts in St. Louis, one on the east side of Broadway, extending from Biddle to Collins street, on which the new freight depot is located; a second tract about 2½ blocks on the east side of Broadway, between Brooklyn street and the property of the American Brake Shoe & Foundry Co., and a third north of the Merchants' Bridge approach, with an area of about 100 acres, which will be used for a switching yard.

St. Louis & San Francisco.—See Rock Island-Frisco Terminal.

Southern Pacific.—This company and the Union Pacific are notable in their reports of January earnings, in that results were better than in the corresponding month of 1906, while most railroads are showing much poorer results; this is particularly noticeable in net earnings. Gross earnings of the Southern Pacific for January, 1907, were $10,695,975, an increase of $2,514,841, or 30 per cent.; net earnings were $3,344,690, a gain of $1,045,292. For the seven months ended January 31, gross earnings were larger by about $10,480,000, and net earnings were $5,929,000 more than in 1906.

Union Pacific.—Gross earnings for January, 1907, with 195 miles more operated than last year, were $5,949,772, an increase of $834,596 over 1906; net earnings, $2,704,768, a gain of $439,645. For the seven months ended January 31, 1907, gross earnings increased $4,000,000, and net earnings $2,000,000. See Southern Pacific.

Wheeling & Lake Erie.—This company has sold to the Pittsburg & Lake Erie the franchises and property of the Lake Erie, Youngstown & Southern, a projected line to give the Wheeling & Lake Erie a line to Youngstown, Ohio, where the L. E., Y. & S. owned terminal properties valued at about $500,000. The Pittsburg & Lake Erie will probably turn over the terminal properties and right-of-way where available to the Lake Erie & Pittsburg, which the Lake Shore & Michigan Southern is building from Lake Erie south to Youngstown to extend the Pittsburg & Lake Erie from that point, its present northern terminus, to Cleveland and Lorain.

ANNUAL CONSTRUCTION RECORD

The asterisk (*) denotes that contracts have been let or that work is under way. It is our policy to be as conservative as possible in using this designation and in the great majority of cases where the asterisk appears definite news has been received, usually direct from officers or incorporators, that contracts have been let or work has actually been begun. The date **(Mar. 16, 1906)** following an item indicates that nothing has been heard either officially or through press reports since last year's Construction Record was issued. New lines built during the past year are omitted, notice of their completion having been given in the regular weekly Railroad Construction column. The number of lines, extensions or improvements projected or under way in Canada and Mexico is presumably larger than those given, owing to the difficulty experienced in getting information from remote places.

A

ABILENE & NORTHERN.—See Colorado & Southern.

ALABAMA CENTRAL.—Projected from Tuscaloosa, Ala., north to Decatur, about 125 miles. O. C. Simmons, Chicago, is interested.

ALABAMA CITY, GADSDEN & ATTALA (Electric).—Proposed extension from Gadsden, Ala., to Noccalula Falls, five miles.

ALABAMA GREAT SOUTHERN.—Proposed branch from Waubatchie, Tenn., to a connection near Lookout tunnel with Southern Railway.

ALABAMA RAILWAY & POWER COMPANY.—Organized to build from Chattanooga, Tenn., to Birmingham, Ala., 175 miles. H. T. Henderson, of Durango, Colo.; J. P. Montgomery, of Ashville, Ala., and C. L. Young, Jr., of Fort Payne, Ala., incorporators.

ALABAMA, TENNESSEE & NORTHERN.—Proposed extension from Aliceville, Ala., south 29 miles.

ALABAMA WESTERN.—See Illinois Central.

*ALAFIA, MANATEE & GULF COAST. Building from Boca Grande on Charlotte Harbor, Fla., to Brownville, 60 miles. L. M. Fouts, 316 Duval Building, Jacksonville, Fla., General Manager.

*ALASKA CENTRAL.—Building from Seward, on Resurrection Bay, to the Tanana river, in the interior of Alaska, 500 miles; 70 miles completed.

ALASKA MIDLAND. Organized in the state of Washington to build from Valdez, Alaska, to Eagle City. W. D. Hofius, Seattle, Wash., President. (Mar. 16, 1906.)

ALASKA RAILROAD.—Proposed line from Cordova Bay, Alaska, via Copper river valley to Eagle, 525 miles. Andrew F. Burleigh, New York, interested.

ALBANY & NORTHERN.—Proposed extension from Cordele, Ga., southwest to Pensacola, Fla., 225 miles. (Mar. 16, 1906.)

ALBANY, CAIRO & GULF.—Projected from Albany, Ga., to St. Joseph's Bay, Fla., about 175 miles. W. B. Roddenberry, W. A. Walker, W. S. Wight, W. C. Jones, J. P. Malloy, O. T. Davis, M. L. Ledford, J. M. Sasser, S. W. Smith, L. E. Welch, S. Farkas, R. L. Hall and W. H. Hall, of Newton, incorporators; office at Cairo, Ga.

ALLENTOWN, TAMAQUA & ASHLAND.—See Keystone Air Line.

*ALTON, JACKSONVILLE & PEORIA (Electric).—Organized to build from Alton, Ill., to Jacksonville, with branch lines, 70 miles. Contract let to Melville Bros. to build from Alton to Godfrey, 60 miles; track laid for two miles. W. R. Heagler, Alton and Jerseyville, Ill., Chief Engineer.

ALTOONA & LOGAN VALLEY (Electric).—Projected extension from Hollidaysburg, Pa., to Frankstown; also a number of extensions in Altoona.

AMADOR RAILROAD.—To build from Martell, Cal., to Bartons, 21 miles. T. N. Harvey, Oakland; L. A. Berger and T. Hahns, San Francisco; C. B. Mills, J. L. Scotchler, J. C. Sullivan and J. B. Peck, Berkeley, incorporators.

AMARILLO & SOUTHERN.—Proposed line from Coleman, Tex., via Abilene, northeast 75 miles.

AMERICAN ASIATIC.—See Washington-Alaska Transportation Co.

AMERICAN ELECTRIC. — To be built from Davenport, Iowa, west across Iowa to Council Bluffs, 260 miles air line.

*AMERICAN-MEXICAN PACIFIC.—Contracts let to C. Bradbury & Co., of Denver, Colo., to build the first section of this proposed line from Phoenix, Ariz., southeast to Naco, 250 miles. Lyman Bridges, President and Chief Engineer, Tucson, Ariz.

*AMERICAN RAILROAD OF PORTO RICO.—Building an extension from Ponce to Coamo, 19 miles; also from Ponce to Barancas, four miles. Address George Servajeau, Isabela, Porto Rico.

ANDERSON & SALINE RIVER.—Surveys being made for an extension from Grant Spur, Ark., to Leola, seven miles. Robert York, Treasurer and General Manager, Pine Bluff, Ark.

*ANDERSON TRACTION.—Building from Anderson, S. C., to Belton, 10 miles. Projected to Greenville, S. C., 25 miles. J. A. Brock, of Anderson, President.

ANNISTON & COLUMBUS. Organized to build from Anniston, Ala., southeast to Columbus, Ga., 110 miles. W. H. Wetherlee, Anniston, President.

*APALACHICOLA NORTHERN.—Contracts let to the Morey Engineering & Construction Co., of St. Louis, for building 59 miles between River Junction, Fla., and Apalachicola. Grading completed from Apalachicola to St. Joseph's Bay, 19 miles. Wm. A. Hunick, Chief Engineer of the construction company.

APPOMATTOX & CHARLOTTE. Proposed line from Drake's Branch, Va., northwest to West Appomattox, 40 miles. E. B. Eggleston, Charlotte Court House, Va., is interested.

ARIZONA & CALIFORNIA.—See Atchison, Topeka & Santa Fe.

ARIZONA & MIDLAND.—The Lake Superior & Arizona Mining Co., of Arizona, has organized this company to build a railroad to connect mines at Superior, Ariz., with the Gila Valley, Globe & Northern, 28 miles. J. D. Cuddihy and A. W. Kerr, of Calumet, Mich., and H. L. Baer, of Hancock, Mich., are interested.

ARKANSAS, ANTHRACITE & WESTERN.—Organized to build from Fort Smith, Ark., east to Prairie View, 65 miles. The Arkansas-Anthracite Co. is interested. R. M. Rommel, C. McKee, G. Heim, directors.

*ARKANSAS CENTRAL.—Work to be begun soon by C. C. Godman on an extension from Paris, Ark., to Dardanelle, 48½ miles.

ARKANSAS, LOUISIANA & GULF.—Permanent location made from Pine Bluff, Ark., south to Monroe, La., 150 miles. E. G. Hammock, Monticello, Ark.

*ARKANSAS, OKLAHOMA & WESTERN (Formerly Rogers Southwestern).—Contracts let to the W. R. Felker Construction Co., Rogers, Ark., for extension from Springtown, Ark., to Siloam Springs, 10 miles.

ARKANSAS PACIFIC.—Proposed line from Mangum, Okla., to Memphis, Tenn., 635 miles. Surveys partly completed. Some contracts to be let about May 1. The South Side Coal & Railway Co.'s line, projected from Paris, Ark., east to Dardanelle, 38 miles, to form part of the main line. George D. Locke, President, Missouri Trust Building, St. Louis, Mo.

ARKANSAS VALLEY.—See Atchison, Topeka & Santa Fe.

ARKANSAS VALLEY & WESTERN. See St. Louis & San Francisco.

ASHLAND & WESTERN.—Proposed extension from Ashland, Ohio, north to Vermilion, 50 miles, and south from Custaloga to Marietta, 100 miles.

*ASHEVILLE & CRAGGY MOUNTAIN.—Building from Craggy Mountain, N. C., to Democrat, 17 miles; three miles completed. The R. J. Tingley Co., New York, are the engineers. (Mar. 16, 1906.)

ASHEVILLE SOUTHERN.—See Southern.

ASTORIA & COLUMBIA RIVER.—Surveys made for an extension from Cartwright, Ore., south to Tillamook, 45 miles.

*ATCHISON, TOPEKA & SANTA FE.—The Eastern Railway of Oklahoma, the cut-off from Belen, N. Mex., east to Texico, 250 miles, is all built except 30 miles, which is nearly completed. The Lantry-Sharpe Contracting Co., of Kansas City, has the contract.

——*Contracts let to Thomas Mishon & Co., of Pueblo, Colo., and to William C. Whitecarver, of Trinidad, Colo., for extending the Arkansas Valley from Bristol, Colo., to Lays Junction, 17½ miles, and from Bent to Columbine, 41 miles.

——*Contracts let to the Brant Brothers Construction Company, Los Angeles, Cal., for a 27-mile extension of the Arizona & California in Arizona from mile post 80 to mile post 107.

——*The Denver, Kansas & Gulf, a part of the Denver, Enid & Gulf, is being extended from Sun City, Kan., to Belvidere, 10 miles. Kansas Construction Company of Medicine Lodge, Kan., contractors.

——A connecting line is to be built between Texico, N. Mex. (the eastern end of the Belen cut-off connecting with the Pacific lines), and Brownwood, Tex., about 300 miles, to connect with the Texas lines.

——*Contracts reported let to A. H. Moore, of Newton, Kan., for work on the Western Oklahoma from the main line at Alston, Okla., southeast to Seiling, 32 miles; grading under way. The company has also projected two other lines in Oklahoma.

——Proposed new double-track tunnel through Raton Mountain, near Raton, N. Mex. To be 5,000 ft. long, through solid rock, 144 ft. below the existing tunnel. (Mar. 16, 1906.)

——See Northwestern Pacific under Southern Pacific.

ATHENS, FLORAL PARK & NEWNAN AIR LINE.—Organized to build from Athens, Ga., southwest to Newnan, 70 miles. Ranson Rogers, 828 Empire building, Atlanta, Ga. (Mar. 16, 1906.)

ATHENS TERMINAL.—Organized to build a two-mile spur track from Athens, Ga., to the Seaboard Air Line. W. W. Mackall, T. M. Cunningham, C. B. Epps and W. B. Davis, incorporators.

ATLANTA & NEW ORLEANS.—Organized to build from Atlanta, Ga., to Baton Rouge and New Orleans, La. Office at Atlanta. Ronald Ranson, H. S. Collinsworth, F. M. Merkell, W. N. Hawkes, F. M. Butt and J. S. Middletown are interested.

*ATLANTA & ST. ANDREWS BAY.—Extension from Cottondale, Fla., south to Panama City, 54 miles, under construction; five miles built.

——Extension from Dothan, Ala., north to Opelika, 90 miles, and eventually to Atlanta, Ga.; projected.

ATLANTA & CAROLINA (Electric).—Organized to build from Atlanta, Ga., northeast to Commerce, and from Atlanta southwest to West Point, in all 170 miles. L. F. Sell, of Jackson; T. J. Clarke, W. E. Woods and R. W. Tucker, incorporators.

*ATLANTA, BIRMINGHAM & ATLANTIC.—Contracts let for building from La Grange, Ga., west to Birmingham, Ala., 165 miles, also from Chalybeate, Ala., northwest to Atlanta, 77 miles, to C. D. Smith & Co., of Memphis, Tenn.; the Callahan Construction Co., of Knoxville, Tenn., and Wright, Williams & Wadley, of Roanoke, Ala.

——Gates City Terminal, incorporated to build terminals in Atlanta, Ga.

ATLANTA, GRIFFIN & MACON.—Surveys made for proposed line from Atlanta, Ga., to Macon, 90 miles. Surveys under way from Macon south to Albany, 100 miles. This part of the work is to be carried out by the Interurban Construction Co. W. J. Kincaid, of Griffin, Ga., is President.

ATLANTIC & NORTH CAROLINA.—See Norfolk & Southern.

ATLANTIC COAST LINE.—Extension from Newberry, Fla., northwest about 75 miles to Perry; 20 miles built.

——*Building new freight yards at Waycross, Ga., to extend about a mile beyond the present yards, and to contain 15 miles of track.

——Branch from Washington, N. C., south to Newbern, 40 miles. Proposed. (Mar. 16, 1906.)

ATLANTIC & WESTERN.—Projected line from Broadway, N. C., east to Lillington, 15 miles. H. F. Edwards, Superintendent, Sanford, N. C.

ATLANTIC, NORTHERN & SOUTHERN.—Incorporated to build railroads in Iowa. J. H. Simmons, President; F. M. Nebe, Vice-President; Joseph Stier, Secretary, and E. Marquis, Treasurer, Atlantic, Iowa.

ARKANSAS, RED RIVER & PARIS.—Organized to build from Morris Ferry, Ark., east to Harris Ferry, on the Red river, 38 miles. T. S. Brown and W. S. Pryor, of Kansas City; F. A. Locke, W. C. Martin and W. E. Kinsworthy, of Ashdown, Ark., incorporators.

AUGUSTA & ELBERTON.—Projected from Augusta, Ga., to Elberton, 60 miles. F. E. Verdery, of Augusta, Ga., President. (Mar. 16, 1906.)

AUGUSTA & FLORIDA.—See Georgia & Florida.

AUGUSTA & LOUISVILLE.—Incorporated to build from Louisville, Ga., east to a point on the Augusta & Florida, about eight miles. J. C. Stone, R. M. Murphee, M. D. Jones and A. W. Jones, of Midville, Ga., and R. J. Piele, of Vidette, Ga., incorporators.

AUGUSTA & NORTHWESTERN.—Organized to build from Augusta, Ga., northwest to Athens, 100 miles. W. W. Ramsey, T. Fargo, B. Law

rence and R. D. Langdon, of Augusta, incorporators.

AUSTIN & GOLDFIELD.—Proposed line from Austin, Nev., to Tonopah and Goldfield, via Manhattan, promoted by Philadelphia capitalists who backed the Tonopah & Goldfield.

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BALTIMORE & OHIO.—Plans for a freight line to be built under the charter of the Patapsco & Susquehanna, around Baltimore, are held in abeyance awaiting a court decision. Route is from Gopsach station in Carroll County, through Carroll and Baltimore Counties, to the Western Maryland, east of Pikesville; thence under the Reisterstown turnpike by means of a tunnel; thence crossing the Northern Central near Rider station, passing north of Towsontown to a crossing of the Maryland & Pennsylvania near Oakleigh; thence to a connection with the Philadelphia division east of Baltimore at or near Sewall. The line will be about 40 miles long. Most of the grades will be 2 per cent. and the maximum 3 per cent.

——*Building classification yard at Brunswick, Md.

——*Laying third and fourth tracks between McKeesport, Pa., and Wheeling Junction.

——*Laying double track from Sterling, Ohio, to Nova, 25½ miles.

Preliminary survey for new line from Johnstown, Pa., to Somerset.

*BALTIMORE, FREDERICK & HAGERSTOWN (Electric).—Organized to build from Baltimore, Md., to Hagerstown, 78 miles. Contracts let to Westinghouse, Church, Kerr & Co., of New York, for building 26 miles. J. E. Ingram, Jr., Baltimore, President; J. R. McSherry, Vice-President; T. R. Howard, Treasurer, and H. Coblentz, Secretary, all of Frederick, Md.

BALTIMORE TERMINAL CO.—See Washington, Baltimore & Annapolis.

*BANGOR & AROOSTOOK.—Contract let to A. E. Trites to lay second track on Seaport division, between Northern Maine Junction and Legrange, 30 miles.

——*Contract let to A. E. Trites to build a cut-off between Legrange and a point four miles south of West Sebois, on the main line, about 28 miles.

BATON ROUGE, HAMMOND & EASTERN.—Organized to build from Baton Rouge, La., east to Nicholson, thence northeast to Merrill, Miss. S. O. L. Wexler, President. Office at Baton Rouge.

BATTLE CREEK & SOUTHEASTERN.—Incorporated to build from Battle Creek, Mich., south to Coldwater, 30 miles. Address Scott Webb, Columbus, Ohio.

BAY CITY & PORT HURON.—Proposed line from Bay City, Mich., to Port Huron, 105 miles; 20 miles of grade completed from Port Huron to Lexington. W. C. Penoyar, Bay City, President. (Mar. 16, 1906.)

*BAYFIELD, LAKE SHORE & WESTERN.—Contract let to W. H. Johnson, of Superior, Wis., to build from Bayfield, Wis., to Cornucopia, seven miles. The road is projected to Superior, 75 miles from Bayfield. (Mar. 16, 1906.)

BAY MINETTE & FORT MORGAN.—See Louisville & Nashville.

BAY POINT & CLAYTON.—Incorporated in California, with office at San Francisco, to build railroads. H. E. Cowell, S. P. Cowell and W. H. George, Directors.

BAY SHORE & PACIFIC.—Incorporated in California, to build from the southern boundary of San Diego to Pacific Beach and La Jolla; to be the first portion of a proposed railroad to Imperial (about 60 miles east of San Diego). H. T. Richards, C. R. Hammond, William Crouse, S. Connell, I. D. Stewart and H. C. Oatman, of San Diego, and N. H. Rodgers, of Denver, Directors. (Mar. 16, 1906.)

BAY SHORE.—See Southern Pacific.

*BEAUMONT & GREAT NORTHERN.—Under construction from Onalaska, Tex., southeast to Livingston, 15 miles.

*BEAUMONT & SARATOGA TRANSPORTATION.—Building with its own forces a three-mile extension from Sour Lake Junction, Tex., to Pelt; also a branch from Sour Lake Junction to a connection with the Beaumont, Sour Lake & Western, three miles; a further extension projected from Pelt to Saratoga, 11 miles. J. H. Broome, Voth, Tex.

BEAUMONT, SOUR LAKE & WESTERN.—See Colorado Southern, New Orleans & Pacific.

BEAVER CREEK.—Organized to build up Beaver Creek in Floyd County, Ky., 33 miles. Surveys completed. Office at Pikeville, Ky.

BEAVERTON & WILLSBURG.—See Southern Pacific.

BERING, KIAM & SOUTHERN.—Incorporated to build from Bering, Tex., southeast to Kiam, 15 miles. Conrad Bering, of Houston, and J. E. Hill, of Lexington, are incorporators.

BESSEMER & LAKE ERIE.—Double tracking to be finished at a cost of $1,000,000 between Conneaut and Bessemer.

BIG CREEK & TRINITY VALLEY.—Organized to build from Big Creek, Tex., to Elgin 10 miles. H. Steele, Galveston; S. T. Swinford and B. D. Brown, of Houston, incorporators.

BIG STONY.—See Norfolk & Western.

BILLINGS & NORTHERN.—See Great Northern.

*BIRMINGHAM & LINEVILLE.—Six miles of grading completed between Lineville, Ala., and Pattison 10 miles. Contracts for the remaining four miles let. (Mar. 16, 1906.)

BIRMINGHAM & MISSISSIPPI SOUTHERN.—Incorporated to build from Baton Rouge, La., northeast to Birmingham, Ala., about 250 miles, and a branch from Waynesboro, Miss., south to Scranton, 100 miles. Preliminary surveys made. William A. Aaron, of Hattiesburg, Miss., interested.

BIRMINGHAM & SOUTHWESTERN.—Organized in Mississippi to build from Birmingham, Ala., via Hattiesburg, Miss., to Baton Rouge, La. Incorporators include former Governor A. H. Longino, former Secretary of State J. J. Coleman, A. J. Hackett, of Jackson, Miss.; G. G. Gibson, of Birmingham; J. C. Dunlap, of Chicago; R. C. Oliver, of Hattiesburg, and E. F. Ballard, of Waynesboro, Miss. (Mar. 16, 1906.)

*BIRMINGHAM, COLUMBUS & ST. ANDREWS BAY.—Contracts let to Lemuel E. Miller, Philadelphia, for building from Warsaw, Fla., to St. Andrews Bay, 28 miles.

——Surveys for an extension from northern terminus at Chipley, Fla., to Columbus, Ga., 150 miles. W. M. Gordon, President, Columbus, Ga.

*BIRMINGHAM SOUTHERN.—The Tennessee Coal, Iron & Railway Company is reported to have given a contract for building a five-mile extension of this road to reach new mines near Pratt City, Ala.

*BLACK LICK & YELLOW CREEK.—Building from Rexis, Pa., to Burns Summit, 10 miles. A. W. Lee, Clairville, Pa., President.

*BLACK MOUNTAIN.—Contracts let to Callahan Construction Company, of Knoxville, Tenn., for building from Pennington Junction, Va., to Imboden, 17½ miles; also for spurs to coal mines, 5½ miles. E. S. Fraser, Chief Engineer, Bristol, Tenn.

BLOOMINGTON BELT TRACTION (Electric).—Incorporated with office at Bloomington, Ill., to build from Bloomington to Champaign, to form part of the McKinley-Syndicate lines. W. B. McKinley, Champaign, Ill.; Peter W. Moore, L. B. Thomas, E. D. Riddle and H. C. Larch, Directors.

BLUE RIDGE & ATLANTIC.—See Tallulah Falls.

BONNERVILLE & SOUTHWESTERN.—See St. Louis & San Francisco.

BOSTON & ALBANY.—See New York Central & Hudson River.

BOSTON & MAINE.—The line from Johnsonville, N. Y., southwest to Troy, 16 miles, is to be double tracked.

BOSTON & NEW YORK (Electric).—Organized to build from Forest Hills, Mass., to the Rhode Island state line, 30 miles. A. B. Leach & Co., New York, are said to be interested.

*BOSTON ELEVATED.—The work on the Washington street tunnel, Boston, now under construction, will be completed in about one year. On the completion of this tunnel it is to be operated by the Boston Elevated.

——Two subways to be built into Cambridge, one through Massachusetts avenue to Harvard Square, and the other through Cambridge street and East Cambridge, to Harvard Square, each connecting with subway into Boston.

BOSTON, LOWELL & LAWRENCE (Electric).—Organized to build from Boston, Mass., northwest to Lowell, 28 miles. Butler Ames, Paul Butler, Spencer Borden, Jr., Oakes Ames and Charles F. Remington, of Boston, Directors.

BOSTON TRANSPORTATION COMPANY.—Organized to build 10 miles of deep freight tunnels under the city of Boston, Mass. These tunnels would run to the North and the South stations, the docks, and the wholesale districts.

BOWLING GREEN & WESTERN.—Incorporated to build from Bowling Green, Ky., to Horsebranch. Surveys. M. T. Sweney, A. H. Taylor, of Bowling Green; W. A. Helm and J. M. Carson, of Morgantown, Ky., Directors.

BOYNE CITY, GAYLORD & ALPENA.—Incorporated to build from Boyne City, Mich., east to Alpena, 100 miles; 27 miles in operation.

BRANDON & LAUREL.—Preliminary surveys from Brandon, Miss., southeast to Laurel, 65 miles. Office at Brandon.

BRINSON RAILWAY.—Incorporated to build from Savannah, Ga., northwest to Athens, 180 miles. Office at Savannah. George M. Brinson, Charles Neville, Y. E. Bergeron, W. A. Beale, W. C. Myers, C. H. Mason, J. H. Dazemore, H. W. DeLoach, E. F. Rogers, and W. L. Clarke, incorporators.

*BROOKLYN RAPID TRANSIT.—Work under way changing the tracks of the Long Island Railroad and of the Brighton Beach branch of the Brooklyn Rapid Transit Co., in the Borough of Brooklyn, N. Y. The Brooklyn Grade Crossing Commission has the improvements in charge, under a special law. To be completed by May, 1907. The plans call for a cut from 18 ft. to 20 ft. deep on the Manhattan division of the Long Island from Manhattan Junction to Bay Ridge, where there will be a large depressed freight terminal.

——The Suffolk Traction Co., incorporated last July to build from Brookhaven, Long Island, to Babylon, 28 miles.

BROOKVILLE & MAHONING.—See Pittsburg, Shawmut & Northern.

BROWNSVILLE, HIDALGO & NORTHERN.—Contracts soon to be let for building from Brazos Island, Tex., west via Brownsville to Hidalgo, 84 miles, and Corpus Christi. Surveys completed and nearly all the right of way secured. Urian Lott is President; James A. Browne, Vice-President, and John D. Hill, Secretary, Brownsville.

BROWNSVILLE, MASONTOWN & SMITHFIELD (Electric).—Surveyed from Masontown, Pa., west to Riverview; also from Masontown north to Brownsville, and from Masontown to New Geneva, a total of 15 miles. W. J. Sheldon, of McKeesport, Pa., President.

BROWNWOOD, WACO & NORTHERN.—Proposed line from Rising Star, Eastland County, Tex., south to Brownwood, 30 miles, thence east to Waco, 125 miles. Address Brooke, Smith & Co., of Brownwood. (Mar. 16, 1906.)

BROXTON AIR LINE.—Organized to build from Broxton, Ga., to Helena, 30 miles. Contracts soon to be let. W. R. Frier, Broxton, Ga., President.

BROXTON, HAZELHURST & SAVANNAH.—Organized to build from Osierfield, Ga., east to Savannah, 130 miles. J. A. J. Henderson, W. N. Smith, J. A. Pruitt and J. D. Paulk, of Ocilla, Ga., incorporators. (Mar. 16, 1906.)

BRUSH CREEK & CROW'S RUN.—See Keystone Air Line.

BUCK CREEK & CATAWBA RIVER.—Chartered to build from a point in McDowell County, N. C., near the mouth of Buck Creek, down the valley of the Catawba river to the North Toe river at a point where it crosses the Tennessee state line, about 100 miles. C. Boice, of Abingdon, Va.; G. W. Edwards, of Winston-Salem; J. Crawford Biggs, of Durham; L. D. Heart, W. B. Jones and S. J. Hinsdale, of Raleigh, are interested. (Mar. 16, 1906.)

BUCKHANNON & NORTHERN.—Projected line from Bellington, W. Va., north to New Brownsville, Monongahela County, 60 miles. About 30 miles graded, but work suspended. S. D. Brady, Parkersburg, W. Va., Chief Engineer. (Mar. 16, 1906.)

BUFFALO & SUSQUEHANNA.—Plans for rebuilding the road from Juneau, south toward Pittsburg and for building new yards made. Bids may shortly be asked for.

——Reported that the right of way and surveys of the proposed Pittsburg & Northeastern, projected from Pittsburg, Pa., northeast to South Bend, in Armstrong County, 40 miles, are to be acquired for a Pittsburg entrance.

——*Building large yards near South Bend, Pa.

——Surveys made from Sagamore to South Bend.

——Will build a tunnel one mile long between Corbett, Pa., and Hull, and one near Newfield. Work to begin March, 1907.

*BUFFALO CREEK & GAULEY.—Contracts let to J. B. Tully, Sutton, W. Va., for building from Gulf, W. Va., to Rockcamp, two miles. Additional contracts soon to be let for building from Rockcamp to Camden, 29 miles. N. D. Janney, Chief Engineer, Clay Courthouse, W. Va.

BUFFALO CREEK EXTENSION.—Incorporated to build from Buffalo, N. Y., to Gardenville, Erie County, with a branch to the Lehigh Valley in Buffalo, eight miles. F. D. Underwood, President, and George F. Brownell, Vice-President.

BUFFALO, LAKE ERIE & NIAGARA.—Organized to build a connecting railroad around the city of Buffalo, N. Y., to Tonawanda, 37½ miles. Edward Michael, 618 Mooney Building, Buffalo, President, and C. C. Conkling, 798 Ellicott avenue, Chief Engineer.

*BUFFALO, LOCKPORT & ROCHESTER (Electric.)—Work under way on 54 miles of road from Rochester west to Lockport. Contract let to J. G. White & Co., New York. From Lockport the company expects to use the tracks of the International Traction Company into Buffalo. The project is financed by the Transit Finance Co., of New York, and the Mackenzie & Mann syndicate, of Toronto.

BUFFALO, ROCHESTER & PITTSBURG.—Surveys reported for an extension from Iselin, Pa., southwest to Pittsburg.

——Plans reported under way to complete the double track from Punxsutawney, Pa., to Rochester, N. Y. There remain about 11 miles to be done from Brockwayville, Pa., north to Carmen.

——Branch projected from near Juneau, Pa., to Rossiter, to develop new coal mines; also several spur mines in South Indiana County.

BUFFALO UNION TERMINAL.—Incorporated to build a steam railroad seven miles long in Buffalo, N. Y. F. C. Mosedale, C. A. Collins and Bernard Marron, all of Buffalo, Directors. (Mar. 16, 1906.)

*BURRS FERRY, BROWNDEL & CHESTER.—Contract let to Womack Construction Co. for extension from two miles east of Aldridge, Tex., east to Browndel, 25 miles.

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*CACHE VALLEY.—Contracts let to the Culver Construction Company of Sedgwick, Ark., for extension from Walnut Ridge, Ark., east to Paragould, 28 miles.

——Projected line from Newport, Ark., southeast to the state line, 80 miles.

CAIRO & KANAWHA VALLEY.—Proposed extension from Macfarlane, W. Va., south, 10 miles, to the Little Kanawha river.

CAIRO & TENNESSEE.—See Powell's Montana Mineral.

*CAIRO & THEBES.—Incorporated to build from Cairo northwest to Thebes, 25 miles. Surveys completed for nine miles from Cairo. Part of the work let to the Cairo Construction & Dredging Co. J. B. Magee, President; E. A. Smith and J. H. Galligan, of Cairo, incorporators.

CAIRO, MAYFIELD & NASHVILLE.—See Nashville, Chattanooga & St. Louis.

CALIENTE & PIOCHE.—See San Pedro, Los Angeles & Salt Lake.

CALIFORNIA & OREGON COAST.—Proposed

line from Grant's Pass, Ore., southwest to Takima, 45 miles. J. O. Gunn, Mechanics Savings Bank, President, and J. W. M. Draper, Chief Engineer, San Francisco, Cal.

CALIFORNIA NORTHEASTERN.—See Southern Pacific.

CALIFORNIA ROADS.—Reported that the Great Western Gold Co. plans to build from Red dinig, Cal., to the Ingot Smelter, 26 miles.

CALUMET, HAMMOND & SOUTHEASTERN.—Incorporated to build from Chicago, Ill., east of Lake Calumet to the Illinois-Indiana state line, with a branch to Lake Michigan. Talbot E. Pierce, Chicago, incorporator.

CAMDEN SOUTHERN.—Proposed line from Hillsdale County, Mich., to Coldwater, 32 miles. John Reck, Hillsdale, Mich., President. (Mar. 16, 1906.)

CANADIAN MIDLAND.—Incorporated to build from Kansas City, Mo., to El Paso, Tex. Office at Lawton, Okla. G. R. Robertson, C. F. H. Barber, G. McPaschal, Lawton; Milfred Steele, Chicago; I. B. Hampton, Hampton, Ind.; A. S. McKennon, Wekota, Ind. T., and E. A. Hill, Muskogee, incorporators. (Mar. 16, 1906.)

CANADIAN NORTHERN.—See under Canada.

CANADIAN RIVER.—See Santa Fe, Liberal & Englewood.

*CANTON & YOUNGSTOWN (Electric).—Contract let to Collins Construction Co., Chicago, for line from the cities of Canton, Ohio, to Youngstown, with branch from point north of Congress Lake to Akron, in all 65 miles.

CANYON CITY & ROYAL GORGE (Electric).—To build from Canyon City, Colo., through Royal Gorge, 11 miles. Successor of Canyon City, Florence & Royal Gorge Interurban. F. D. Heath, D. E. Gibson, James H. Peabody, W. H. Peabody and E. M. Smith, of Canyon City; W. W. Umberhauer and T. J. Budd, Philadelphia; W. Wood and W. Hutty, of Kansas City, Directors.

CAPE CHARLES.—Incorporated in Virginia to build a line 15 miles long. William A. Patton, Radnor, Pa., President.

CARLINVILLE, ALTON & ST. LOUIS.—Organized to build from Carlinville, Ill., southwest to Jerseyville, thence south to Alton, 50 miles. Headquarters in Jerseyville. Andrew J. Gross, J. M. Page, J. W. Becker, J. C. McGrath, Jerseyville; A. L. Austen, Chicago; Robert Curdie, Alton, Directors. J. M. Rhoades, Sec'y, Jerseyville. (Mar. 16, 1906.)

CAROLINA, GLEN ANNA & PEE DEE.—Proposed line from Winston-Salem, N. C., to Rockingham, 110 miles; 21 miles built. L. V. Edwards, Chief Engineer, Highpoint, N. C.

*CAROLINA MINERAL. — Incorporated by the Colosses Gold Mining & Milling Co., of Waxhaw, N. C., to build from the Colosses Mine north to Charlotte, N. C.; also south to Lancaster, S. C. Track-laying under way. J. F. Keller, Lancaster, Pa., President; A. J. Moore, Waxhaw, N. C., Chief Engineer.

CARO NORTHERN.—To build from Caro, Tex., north to Mount Enterprise, a new town in Rusk County. M. W. Jones and C. H. Morris, Winnesboro; W. T. March and W. G. Ross, Mount Enterprise, and W. W. Whiteman, Ardmore, Ind. Ter., incorporators.

CARROLLTON SHORT LINE.—See Alabama, Tennessee & Northern.

CEDAR CREEK.—Chartered to build six miles in Fayette and Westmoreland Counties, Pennsylvania. Charles Marshall Johnston, Pittsburg, President. (Mar. 16, 1906.)

CENTRAL & SOUTHEASTERN.—Projected line from Chanute, Kan., to Memphis, Tenn., 425 miles, and from the smelters at Chanute to zinc mines in southwest Missouri. Surveys made from Chanute to the Missouri-Arkansas state line. Rights of way secured in Kansas. Ten miles graded. A. N. Hoxie, President, Joplin, Mo.; F. S. Hoxie, Secretary, 273 Fifth Avenue, New York.

CENTRAL CALIFORNIA.—See Southern Pacific.

*CENTRAL CALIFORNIA TRACTION.—Building from Stockton, Cal., north to Sacramento, 50 miles. Contract let to Moring Bros., of Stockton, to build from Stockton to Lodi, 16 miles. Four miles of track laid. Extension projected from Stockton southeast to Modesto, 45 miles. R. S. Masson, Stockton, Chief Engineer.

CENTRAL ILLINOIS.—Chartered to build from Roodhouse, Ill., east to Paris, 145 miles. A. S. Somerville and J. Devine, Chicago, incorporators. (Mar. 16, 1906.)

CENTRAL OF LOUISIANA.—See Kansas City Southern.

*CENTRAL OF OREGON.—Contracts let for an extension from Union, Ore., northwest to La Grande, 45 miles. A. B. Brown, Union, Ore., Chief Engineer.

CHANDLER & OKMULGEE.—Organized to build from Chandler, Okla. Ter., east to Okmulgee, Ind. T., 60 miles. Office at Chandler. Lee Patterson, Strand; H. B. Gilstrap, G. B. Rittenhouse and M. D. Owen, Chandler, incorporators. Surveys made.

*CHARLESTON & SUMMERVILLE (Electric).—Contract let to D. E. Baxter & Co., New York, to build from Charleston, S. C., northwest to Summerville, 27 miles. Ogden Edwards, President, Troy, Ohio.

CHARLESTON, PARKERSBURG & WESTERN.—Chartered to build from Charleston, W. Va., to Parkersburg, 60 miles. Located for eight miles. A. S. Alexander, President, and C. P. Peyton, Chief Engineer, Charleston, W. Va. (Mar. 16, 1906.)

CHARLESTON, VIRGINIA & OHIO RIVER.—Chartered to build from Charleston, S. C., to Norton, Va., 350 miles. Headquarters at Morgantown, N. C. W. C. Irvin, H. L. Mallmer, E. F. Tate, of Morganton, and W. T. Hunter, Joseph F. Gowan and Robert N. Regney, of New York, incorporators.

*CHARLOTTE HARBOR & NORTHERN.—Building extension from Gasparilla, Fla., to Peace River, 29 miles. Surveys from Arcadia to Plant City, 65 miles. Address L. Fouts, 316 Duval Building, Jacksonville, Fla.

CHARTIERS SOUTHERN.—See Pennsylvania Lines West.

CHATTAHOOCHEE VALLEY.—Projected line from West Point, Ga., to a point in Carroll County, 30 miles; 17 miles in operation.

*CHATTANOOGA & MONTLAKE.—Building in Tennessee from the mines of the Montlake Coal Co., near Daisy, to Chattanooga, 20 miles; also branch to the Tennessee river, 7 miles. G. W. Nixon is President of the Montlake Coal Co. (Mar. 16, 1906.)

CHATTANOOGA NORTHERN.—Incorporated to build from Chattanooga, Tenn., to Walden's Ridge, 20 miles. The Chattanooga Company, Ltd., of which W. G. M. Thomas, of Chattanooga, is General Manager, said to be interested.

*CHERRYVALE, OKLAHOMA & TEXAS.—Contracts let to the Stubbs Construction Co., Kansas City, to build 215 miles from Caney, Kan., southwest to Kingfisher, Okla. Projected from Caney, Kan., to El Paso, Tex., 900 miles. S. M. Porter, Caney, Kan., President.

CHESAPEAKE & OHIO.—Extension of the Potts Creek branch, 25 miles, authorized.

*CHESTERFIELD & LANCASTER.—Contracts let to E. H. Page & Son for extension from Pageland, S. C., to Lynches River, three miles. A. H. Page, Cheraw, S. C., Secretary and Treasurer.

CHEWAHWAH VALLEY.—Incorporated to build 30 miles in Chelan County, Wash. Will let contracts about April 1. H. F. Albers, 82 Beaver street, New York, is interested.

*CHICAGO & EASTERN ILLINOIS.—Double-tracking 52 miles from Tuscola, Ill., southwest to Pana under way.

——Surveys reported from Joppa, Ill., south to Jackson, Tenn.

——Surveys made for proposed extension from Salem, Ill., northwest to Springfield, about 90 miles. (Mar. 16, 1906.)

CHICAGO & ILLINOIS WESTERN.—Surveys made and rights of way secured for an extension from Willow Springs, Ill., southwest to Joliet, 37 miles.

CHICAGO & NORTHERN INDIANA. (Electric).—Proposed line from Logansport, Ind., to Russiaville. Grading contracts to be let this month. Lester Soule, Indianapolis, Ind., President.

CHICAGO & NORTH-WESTERN.—The Lee County Railway has been incorporated to build a low grade cut-off on the main line to Omaha from Nachusa, Ill., west to Nelson, 12 miles.

——*Contract let to M. J. Peppard, of Minneapolis, for a ten-mile extension east from the end of the Antigo (Wis.) branch; also for a 30-mile line north and a 30-mile line south from the end of the new extension.

——*Winston Bros. Co., of Minneapolis, has the general contract for the Pierre, Rapid City & North-Western from Pierre, S. Dak., west to Rapid City, 155 miles. Some of the work sublet to the Calhoun Construction Co., of Spearfish, S. Dak. The line has been completed from Fort Pierre west to Midland, 49 miles, and from Rapid City east to Owanka, 44 miles, both of which are now in operation.

——*The Pierre & Fort Pierre Bridge & Railway is building from the western terminus of the lines of the C. & N.-W. in Pierre over the Missouri river to the eastern terminus of the Rapid City & North-Western in Fort Pierre, three miles.

——*Contract let to Kilpatrick Bros. & Collins, of Omaha, for building 26 miles of an extension from Bonesteel, S. Dak., northwest to Burke; 12 miles built last year. The line is to be extended northwest from Burke, crossing the Pierre-Rapid City line at Midland.

——See Sioux City, Pierre & North-Western.

*CHICAGO & WABASH VALLEY.—Building an extension from Dunwiddie, Ind., to Gary, 20 miles. Surveys under way from Dunwiddie to Crown Point.

*CHICAGO, ANAMOSA & NORTHERN.—Building from Anamosa, Iowa, to Waterloo, 73 miles; 20 miles completed. Henry Kiene, Dubuque, Iowa, President, and J. F. Lacord, Anamosa, Iowa, Chief Engineer.

CHICAGO, BLOOMINGTON & DECATUR.—Organized to build through Will, Grundy, Livingston, McLean, Dewitt and Macon Counties, Ill., 120 miles. (Mar. 16, 1906.)

CHICAGO, BURLINGTON & QUINCY.—Maps filed for an extension of the Big Horn from Worland, Wyo., south to Thermopolis, 40 miles, thence along the Big Horn river.

*Contracts let to the Kilpatrick Bros. & Collins Construction Co., of Beatrice, Neb., for new line to reduce grades from Lincoln, Neb., to Milford, 20 miles.

——Improvements to be made in freight facilities at St. Joseph, Mo.

Surveys reported for extension of Sargent branch from Sargent, Neb., west to Anselmo, 30 miles.

*CHICAGO, INDIANAPOLIS & LOUISVILLE.—Connecting line being built under charter of the Indianapolis & Louisville, from Wallace Junction, on the main line one mile north of Quincy, Ind., southwest through Cataract, Jorden, Patricksburg, Clay City, Howesville and Midland to Victoria, on the Illinois Central just west of Linton, the terminus of a C. I. & L. line. 17 miles. The Dickason Construction Company, contractors; 20 miles of track laid.

CHICAGO, IOWA & NORTHWESTERN.—Proposed line from Anamosa, Iowa, northwest to Austin, Minn., 160 miles. The Empire Railway Construction Co., incorporated with office at Waterloo, Iowa, to carry out this work. George E. Armstrong, Jr., William Bristol and G. H. Myers, of New York, interested in the construction company.

CHICAGO, JOLIET & KANSAS CITY.—Incorporated to build from Chicago, Ill., to Kansas City, 450 miles. Surveys reported made via Joliet, Peoria and Beardstown, crossing the Mississippi river at Quincy. J. C. Eden, President; B. F. Hardesty, Chief Engineer, and C. A. Denham, Construction Engineer, 608 Rector Building, Chicago.

*CHICAGO, LAKE SHORE & SOUTH BEND (Electric).—Contracts let to the South Bend Construction Co. for construction and equipment of this line from South Bend, Ind., to Kensington, within the city limits of Chicago. Track laid for 10 miles. J. B. Hanna, President, South Bend, Ind.

*CHICAGO, MILWAUKEE & ST. PAUL.—Rebuilding at various points its road between St. Paul and the Missouri river, and double-tracking the remaining 115 miles of the Chicago-St. Paul line.

——*Extension from Glenham, S. Dak., west via Butte, Mont., to Seattle, Wash., 1,500 miles, with a connecting line from the main line at Black River Junction south to Tacoma, 20 miles. There will be seven steel bridges aggregating 5,725 ft., with steel approaches 3,425 ft. long; 1,500 ft. of steel trestles over deep ravines; four tunnels with a total length of 15,630 ft., and later at Snoqualmie Pass a tunnel about two miles long. The line from Glenham to Butte is under contract to McIntosh Bros. of Milwaukee. The Bitter Root tunnel in Montana, and approaches for 2½ miles on each side, are being built by Nelson Bennett, of Tacoma, Wash. The line between the Bitter Root mountains and the coast is under contract to H. C. Henry, of Seattle. All steel bridges and trestles will be erected by the company's men. Grading is completed and track laid from Glenham to a point about 20 miles west of the Missouri river. Much grading has been done in the Yellowstone and Musselshell valleys, and sub-contracts have been let. It is expected that construction will be completed to Butte by January 1, 1908, and to the coast a year later.

——*The White River Valley building from Chamberlain, S. Dak., west to Rapid City, 219 miles; track laid for 136 miles; 75 miles in operation to Murdo Mackenzie.

——*Branch from Greene, Mich., southwest 12½ miles. Grading about half finished.

——See North Coast.

CHICAGO, NEW WASHINGTON & BUCYRUS (Electric).—Proposed electric line from Chicago, Ohio, through New Washington to Bucyrus. E. Z. Williams, Chicago, Ohio, President, and R. B. Seers, Bucyrus, Secretary and Treasurer.

*CHICAGO, ROCK ISLAND & PACIFIC.—The Rock Island, Arkansas & Louisiana is to be extended from the southern boundary of Winn Parish, La., to Eunice, on the projected Colorado Southern, New Orleans & Pacific, 90 miles. Contracts from Alexandria to Eunice, 56 miles, let to the Dalhoff Construction Company, of Little Rock, Ark.

——Surveys reported from a point near Watonga, Okla., northwest about 60 miles into Dewey County, north of the Canadian river.

——Plans reported for 39 miles of new yard tracks in the Kansas City terminals.

——Plans reported for an independent entrance into Denver, Colo., over a new 60-mile line to be built from Limon via Colorado Springs, and Resolis, thence northwest to Melvin, 10 miles southeast of Denver, from which point Colorado & Southern tracks are to be used into the city.

——The Roswell Construction Company has been organized to build from Roswell, N. Mex., to Tularosa, reported in the Rock Island interest. U. S. Bateman, J. A. Cottingham, G. T. Veal and H. W. Stevens, of Roswell, interested.

——See Colorado Southern, New Orleans & Pacific.

*CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA.—Contract reported let to Winston Bros., Minneapolis, Minn., for extension from Newcastle, Neb., to Wynot, 18 miles. Grading under way.

*CHICAGO, WEATHERFORD & BRAZOS VALLEY.—Contract let to the McCarthy-Miller Construction Co., of Lufkin, Tex., to build from Weatherford, Tex., to Bridgeport, 35 miles. Probable further extension south to Granbury or Glen Rose. (Mar. 16, 1906.)

CHOCTAW, NEWCASTLE & WESTERN.—Incorporated by J. R. Lebosquet, of Little Rock, Ark.; S. T. Pierson and W. P. Dix, of Shawnee, Ind. T. L. C. Rose and A. W. Underwood, of Chicago, to build from McAlester, Ind. T., west to Lawton, Okla., about 200 miles.

CIMARRON & NORTH WESTERN.—Incorporated with office at Raton, N. Mex., to build from Cimarron northwest to Van Bremmer Park, 36 miles. C. N. Blackwell, W. H. Decker and Albert A. Miller, incorporators.

CINCINNATI & BIRMINGHAM AIR LINE.—Surveys being made from Paintsville, Ky., south through Tennessee to Birmingham, Ala., 400 miles. J. H. Connor, President, Nashville, Tenn.

CINCINNATI & COLUMBUS TRACTION.—Proposed extension from Hillsboro, Ohio, north to Washington C. H., 30 miles.

CINCINNATI BELT (Electric).—Organized to build a double track belt line around Cincinnati, Ohio, to have 24 miles of track. J. G. Jacobs and O. C. Evans, Cincinnati, interested.

*CINCINNATI, BLUFFTON & CHICAGO.—Contracts let to the Ireland Construction Co. for an extension from Bluffton, Ind., northwest to Huntington, 23 miles.

CINCINNATI, COLUMBUS & TOLEDO.—Incorporated to build from Cincinnati, Ohio, to Toledo. H. H. Hoffman, Norwood, O., President.

*CINCINNATI, GEORGETOWN & PORTSMOUTH (Electric).—Contract let to Thomas Daulton, of West Union, Ohio, for extension from Russellville, Ohio, to West Union, 14 miles.

CINCINNATI, NEW ORLEANS & TEXAS PACIFIC.—The Kentucky & Southeastern is projected southeast through Breathitt, Perry, Knott and Letcher Counties, Ky., 70 miles.
——Surveys from Kismet, Morgan County, Tenn., southwest to South Pittsburg, 133 miles.

*CINCINNATI, TOLEDO & DETROIT SHORT LINE.—Has bought right of way for line from Toledo to Cincinnati. Contracts reported let.

CITIZENS' RAILWAY & LIGHT CO.—Incorporated by W. Bickwell, J. B. Nutt, of Cleveland, Ohio; W. O. Allen, of Fostoria, Ohio, and others, to build interurban lines radiating from Fort Worth, Tex.

CLAREMONT RAILROAD (Electric).—Incorporated to build from Jackson, Miss., west to Clinton, thence to Cooper's Well, 16 miles, and eventually to the Mississippi river, a total of 43 miles. R. K. Jayne and M. Culberson, of Jackson, and M. Walker, of Brandon, incorporators.

CLEAR LAKE & SOUTHERN.—Proposed line from San Francisco, Cal., north to Lakeport, 130 miles. Surveys. Address Le Grand Brown, 745 Monadnock Bldg., San Francisco.

CLEVELAND & SHARON TRACTION (Electric).—Organized at Sharon, Pa., to build from Sharon to Middlefield, Ohio. Francis B. Morgan, President, Cleveland, Ohio.

CLEVELAND, ALLIANCE & MAHONING VALLEY (Electric).—Organized to build from Cleveland, Ohio, through Ravenna to Alliance, with branch from Ravenna to Newton Falls. David Morrison, President; F. H. Townsend, Treasurer, and C. R. Morley, Secretary, Cleveland.

*CLEVELAND, ASHLAND & MANSFIELD.—Incorporated to build from Ashland, Ohio, southwest to Mansfield, 14 miles. Contract for grading is let to L. B. Stanley & Co., Collinwood, Ohio. Work under way. Office, Williamson Building, Cleveland, Ohio.

CLEVELAND, BROOKLYN & ELYRIA (Electric.)—Rights of way secured from Cleveland, Ohio, southwest to Elyria, 25 miles. J. J. Breitenger, President; B. E. Ottman, Treasurer, and J. H. Knieseley, Jr., Secretary, Cleveland.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—Surveys under the charter of the Evansville, Mt. Carmel & Northern from Mt. Carmel, Ill., south to Evansville, Ind., 34½ miles.

*CLEVELAND SHORT LINE.—Building around Cleveland, Ohio, from Collinwood to Rocky River, 18 miles. Three miles of track laid; five miles of grading completed. Contracts let to John Marsch, of Cleveland, and Dunn & Keith, for masonry work. Additional contracts soon to be let. M. A. Fanning, President, Cleveland, Ohio.

CLEVELAND, YOUNGSTOWN & EASTERN.—Incorporated as successor of the Eastern Ohio Trion Co. and to build from Chagrin Falls, Ohio, southeast to Garretsville, 20 miles. Robert D. Beatty, General Manager, Schofield Building, Cleveland.

CLINTON, CHEYENNE & CANADIAN.—Incorporated to build from Clinton, Okla., west to Canadian, Hemphill County, Texas, 100 miles.

COAL & COKE.—Proposed extension from Gassaway, east up the Elk river beyond Sutton.
———Also a line from Gilmer, east of Gassaway, up the Little Kanawha, to Glenville, 11 miles.

*COAL RIVER.—Contracts let to Carpenter Bros., of Clifton Forge, Va., for extension from Lick Creek, Va., to Racine, seven miles, and from Cobbs to Seng Camp, 36 miles.

COAST LINE RAILWAY.—See Southern Pacific.

COFFEYVILLE & MEMPHIS.—Incorporated to build from Coffeyville, Kan., southeast through Oklahoma to a point in Crittenden County, Ark., on the Mississippi river, about 375 miles, with a 15-mile branch southwest to Shawnee, Okla. J. O. Hall, W. P. Brown, E. A. Rosser, P. H. Grahon, E. C. Kiddoo, George A. Gabbler, J. E. McClunry, A. J. Yoke and W. C. Hall, of Coffeyville; J. I. Lehman, of Centralia, Kan., and O. N. Selby, of Oklahoma City, incorporators.

COLLEGE CITY & SOUTHERN.—Incorporated to build from Kiowa, Kan., to Alva., Okla. Ter., 35 miles. Office at Alva. E. T. McKnight is President and General Manager, Alva. T. G. Woodward is First Vice-President, J. B. Kent, Second Vice-President; W. B. Taylor, Secretary, and J. B. Dullin, Treasurer.

COLORADO & NORTHERN.—Incorporated to build from a point near Hayden, Colo., north 20 miles, with a branch eventually to Hahns Peak, Colo., and to Encampment, Wyo.; also from Hayden southwest to Patlos. B. L. Dorsey, President; A. A. Johnson, Vice-President and General Manager, and M. E. Johnson, Secretary and Treasurer.

*COLORADO & SOUTHERN.—The Trinity & Brazos Valley is being extended from a point 32 miles north of Teague, Tex., north to Waxahachie, 35 miles.
———*The Abilene & Northern is being extended from Abilene one mile south. M. T. Reed, contractor. It is projected from Abilene, Tex., south to Brady, 85 miles.
——Galveston, Terminal Co. will soon start work on extensive terminals in Galveston.
——Proposed line from Trinidad, Col., north to Florence, 120 miles.
——Surveys made to extend the Catskill branch from Martensen, Colo., west 50 miles.
——Proposed northern extension to the Yellowstone river in Montana.

COLORADO & SOUTHWESTERN.— Incorporated to build from Grand Junction, Colo., south through Unaweep canyon to La Sal mountain, thence through the Sinbad and Paradox valleys. D. C. Willerby, of London, England; A. E. Guy and John Nix, of Norwood, Colo., and J. H. Hinkin, of Chicago, promoters.

COLORADO, COLUMBUS & MEXICAN.—Projected from Columbus, N. Mex., to Salt Lake City, Utah, about 500 miles. Preliminary surveys made. Address A. O. Bailey, Columbus, N. Mex.

*COLORADO SOUTHERN, NEW ORLEANS & PACIFIC.—This company, controlled by the Rock Island-Frisco interests, is to operate a line from New Orleans west to Houston, 360 miles. Construction is now under way from Baton Rouge, La., west via Eunice, to which the Rock Island, Arkansas & Louisiana is being built from the north, and De Quincy, La., and Beaumont and Liberty, Tex., to Houston, 265 miles. A number of branches are also projected. The Beaumont, Sour Lake & Western, which runs from Beaumont to Sour Lake, 22 miles, is to be used and extended from Sour Lake west to Houston, 65 miles. Contracts for first 55 miles of this line from Sour Lake to Humble let to Kehefick, Hammond & Quigley, Beaumont, Tex. Sub-contracts let to King & Galvin, of Houston, for grading 12 miles from Houston east, and to Sunderman & Dolson, from Sour Lake west; 25 miles from Sour Lake west to Trinity river built last year.

*COLORADO, TEXAS & MEXICO.—Contracts let to the Colorado Construction Co., of Mangum, Okla., for first 46 miles to Chilicothe, Tex., of this proposed line from Mangum, Okla., south to Abilene, Tex., 269 miles; 14 miles completed. Morris R. Locke, President, Mangum, Okla.

COLUMBIA RIVER, OUTLOOK & NORTHWESTERN.—Organized to build from Spokane, Wash., over the Cascade mountains, through Yakima Indian Reservation to Vancouver, Wash. Office at Outlook, Wash. William Stewart and M. C. Stewart interested.

COLUMBIA SOUTHERN.—See Oregon Railroad & Navigation Co.

COLUMBUS & ANNISTON.—Organized to build from Columbus, Ga., to Attalla, Ala. Frank G. Lumpkin, E. H. Hardaway, Howell Hollis and E. K. Cargill, Columbus, Ga., incorporators. (Mar. 16, 1906.)

COLUMBUS & ERIE.—See Erie.

COLUMBUS & SOUTHERN.—Proposed extension from Wyandotte, Ohio, northeast to Lancaster, 15 miles. E. B. Bingham, Toledo, Ohio, interested.

COLUMBUS, MAGNETIC SPRINGS & DELAWARE INTERURBAN.—Incorporated to build electric railroads in Ohio. W. M. Galbraith, Pittsburg, President; Chris McGee, Jr., Pittsburg, Pa., Vice-President and Treasurer; W. N. Embert, Secretary.

COLUMBUS, NEW ALBANY & JOHNSTOWN TRACTION.—Proposed extension from Gahanna, Ohio, northeast to New Albany and Johnstown, 17½ miles. W. D. Brickell, Despatch Building, Columbus, Ohio, President.

COLUMBUS NORTHERN.—Chartered to build from Columbus, Ga., to Lagrange, 60 miles. Charles L. Davis, of Warm Springs, Meriwether County; O. C. Bullock, T. W. Bates and R. O. Howard, of Columbus, incorporators.

COLVILLE & COLUMBIA RIVER.—Incorporated to build a 19-mile road between Colville, Wash., and Myers Falls, with steamship connections on the Columbia river. A. Wilkes, W. B. Aris, Ellen C. Gilluly, G. K. Gilluly and H. C. Rice, of Spokane, Wash., incorporators.

CONEMAUGH & BLACKLICK.—Organized to build from Josephine, Pa., to the mouth of Tom's Run in Indiana County, five miles. Walter F. Arma, Punxsutawney, Pa., President.

CONEMAUGH VALLEY STREET RAILWAY.—Bond issue of $1,000,000 authorized to build from Johnstown, Pa., to Ebensburg. Headquarters at Johnstown.

CONNECTICUT ROADS (Electric).—Organized to build from East Windsor Hill to Broad Brook and Hazardville, 11 miles. W. D. Burr, F. S. Carey, C. S. Hills, G. A. Gray, C. C. Cook and D. W. Hewes, of Hartford, incorporators.

CONSOLIDATED RAILWAY.—See New York, New Haven & Hartford.

COOK COUNTY & SOUTHERN.—Incorporated to build from Franklin Park, Ill., south to Gary, in Cook County, 12 miles. Office at Chicago. James S. Hopkins, of Chicago, and George W. Child, of Hinsdale, Ill., incorporators. (Mar. 16, 1906.)

*COPPER RIVER.—Proposed line from Cordova, Alaska, north along Copper river to Tanana Junction, with branches from north of Tural east along the Chitana river to Bonanza Mine, and from near the mouth of the Copper river east to east of Bering Lake. Work now under way by M. J. Heney, contractor for the White Pass & Yukon; some grading finished. Permanent organization will not be completed until the line is in operation. Close Brothers, of Chicago and London, are financing the road.

COPPER RIVER & NORTHWESTERN.—Surveys from Valdez, Alaska, northeast to the Copper river, 40 miles, thence to Eagle City, about 270 miles additional. John Rosene, J. D. Trenholme, of Seattle, Wash., and William T. Perkins, of Nome, are interested. Headquarters of the company at Carson City, Nev. (Mar. 16, 1906.)

CORDELE, HAWKINSVILLE & NORTHEASTERN.—Organized in Georgia to build from Cordele northeast to Hawkinsville, 35 miles. J. Polk Brown, P. H. Lovejoy, H. N. Parsons, J. J. Harvard, C. W. Jordan, Jr., and E. J. Henry, of Gainesville, interested. (Mar. 16, 1906.)

CORINTH & SHILOH (Electric).—Incorporated to build from Corinth, Miss., to the National Park at Shiloh, Tenn., 22 miles. W. W. Williams & Co., of Nashville, Tenn., are financing the project.

CORTLAND & AUBURN.—Organized to build from Binghamton, N. Y., northeast to Auburn, 75 miles. Right of way secured; construction work to begin this spring. E. L. Stone, of Homer, N. Y., Secretary.

CORVALLIS & EASTERN.—Surveys made for an extension from Yaquina, Ore., west to Newport, five miles.

COUNCIL BLUFFS, TABER & SOUTHERN (Electric).—Proposed line from Omaha, Neb., to Tarkio, Mo., 70 miles. W. J. Dobbs, of Taber, Iowa, President.

*COUNCIL CITY & SOLOMON RIVER.—In operation from Dickson (Spiomon) Alaska, to north of Penelope creek, 32 miles. Extension to Council City, 21 miles, surveyed and to be built this year. Address A. D. Keep, 5 Nassau street, New York.

*COVINGTON & SOUTHWESTERN.—Organized to build from Covington, Ind., southeast to Kingman, thence east to Crawfordsville, 40 miles. Grading completed from Covington to Coal Creek, eight miles. W. G. Ruhl, President, Chicago.

CRESTON & WESTERN.—Organized to build from near Carroll, Iowa, south to Creston, 50 miles. T. Dufer, President, Des Moines; Thomas A. Way and Irving W. Keerl, Vice-President and Treasurer, Mason City, and E. E. Sampson, Treasurer, Des Moines. (Mar. 16, 1906.)

CROSS ISLAND TRACTION.—Incorporated to build an electric line from Brookhaven, Long Island, to West Sayville, 42 miles. L. Baldwin and Paul T. Brady, 11 Pine street, New York, Directors.

CRYSTAL RIVER AND SAN JUAN.—Proposed extension from Marble, Colo., to marble quarries, three miles. C. A. Meek, of Marble, Colo., President.

*CULLMAN & SOUTHWESTERN. Incorporated to build from Cullman, Ala., south to Bryan, 40 miles. Contract let for 20 miles from Cullman to Bremen. William N. Cooke, G. H. Ten Broeck and A. W. Lilliendahl, Cullman, incorporators.

CULVER & PORT CLINTON.—Projected from Gypsum, Ohio, to East Toledo, and a branch from Harris Township, Wood County, to Bowling Green. G. A. Esch, M. Brennan, J. McNaught, O. M. Knode and O. B. English, Toledo, incorporators. (Mar. 16, 1906.)

CUMBERLAND & NORTHERN.—See Louisville & Nashville.

CUMBERLAND RAILROAD.—Survey being made for extension from the Bush Creek coal fields of Knox County, Ky., to Jellico, Tenn., 17 miles. (Mar. 16, 1906.)

CUMBERLAND RIVER & NASHVILLE. — Surveys being made for a line from Corbin, Ky., to the Tennessee state line, 95 miles. S. Woodward, Carlisle Building, Cincinnati, Ohio, President.

CYNTHIANA & CLAYSVILLE.—Incorporated to build from Claysville, Ky., southwest to Cynthiana, 12 miles.

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DAKOTA & GREAT NORTHERN.—See Great Northern.

DAKOTA MIDLAND.—Incorporated in South Dakota to build from Sioux City, Iowa, northwest to a point in Campbell County, S. Dak., 385 miles. L. R. Giddings, President, and J. A. Frederickson, Chief Engineer, both of 1341 Vine place, Minneapolis, Minn.

DANBURY & PORTCHESTER.—See New York, New Haven & Hartford.

DANVILLE & MT. MORRIS.—Surveys being made from Danville, N. Y., south to Hornell, 16 miles. William Humphrey, General Manager, Danville, N. Y.

DANVILLE & SCOTTSVILLE.—Incorporated in Kentucky to build from Danville southwest to Scottsville, Allen County, 100 miles. J. G. Taylor, of Chicago; G. B. Cooper, Stanford; J. S. Murphy, McKinney; J. Brown, Liberty; J. B. Coffey, Columbus; J. H. Allen, Somerset, and J. Follette, M. M. Perkins, Ralph Leach and J. F. Allen, of Cincinnati, incorporators.

DARIEN & WESTERN.—See Georgia Coast & Piedmont.

DAVIS & TURNER FALLS.—Incorporated with headquarters at Oklahoma City, Okla., to build from Davis, Ind. T., to Turner Falls, 10 miles. A. L. Welch, Robert Chowning, J. W. Grant, R. H. Wilkins and W. M. Demeryx, of Oklahoma City, and John Watts, of Newton, Kan., incorporators.

DAWSON, EL PASO & SOUTHWESTERN.—Incorporated by the Phelps-Dodge interests to build from Dawson, N. Mex., south to Corona, on the El Paso & Southwestern. Surveyed to Las Vegas; work to begin this spring.

DEEPWATER.—See Tidewater.
——See Virginia Railway.

DEERING SOUTHWESTERN.—Proposed extension from Camp, Mo., west to the Missouri-Arkansas state line, 11½ miles, to be done by the company's forces. (Mar. 16, 1906.)

DEKALB, SYCAMORE & INTERURBAN TRACTION.—To build an electric line from Belvidere, Ill., south via Dekalb to Yorkville; also from Sycamore east to Elgin, with branches.

DELAWARE & EASTERN.—New road in operation from East Branch, N. Y., on the New York, Ontario & Western northeast to Arkville, 37 miles. Proposed northern extension to be built by the Schenectady & Margaretsville to Schenectady, 70 miles.
——Proposed southern extension to be built by the Hancock & East Branch southwest to Wilkesbarre, Pa., 100 miles.

*DELAWARE & HUDSON.—The Napierville Junction, from Rouse's Point, N. Y., to St. Constant, Que., on the Canadian Pacific, is approaching completion. The Pacific Construction Co., of Ottawa, is doing the track-laying and ballasting.
——*Contracts let to O'Brien & Mullarkey, of Montreal, for extending the Quebec, Montreal & Southern toward Quebec, from Pierreville, Que., to St. Jean des Chaillons, on the Lotbiniere & Megantic, 48½ miles.
——*Contracts for double-tracking from Schenectady, N. Y., southwest to Delanson, 13 miles, let to Elmore & Hamilton.
——New interchange yard to be built at South Wilkesbarre, Pa. Right of way being obtained.

DELAWARE & SOUTHERN.—Incorporated to build from Deposit, N. Y., northeast to Trout Creek, 17 miles. Charles P. Knapp, of Deposit; W. O. Dennis, of Trout Creek, and G. H. Perigo, of Scranton, Pa., incorporators. (Mar. 16, 1906.)

DELAWARE, LACKAWANNA & WESTERN.—Surveys made for a cut-off from Port Morris, N. J., to Slateford, Pa., 28.7 miles.
——*Work under way on the double-track tunnel through Bergen Hill, N. J., to parallel the present tunnel at 51½ ft. between centers.

DELAWARE SUBWAY.—Organized in Pennsylvania to build from Front and Market streets, Philadelphia, along the Delaware river, one mile. W. P. Brockermann, 620 Fairmont avenue, Philadelphia, President.

DEMOPOLIS & LINDEN.—Incorporated in Alabama by F. M. Abbott, of Selma, and H. McDaniel and B. G. Wilson, of Demopolis, to build 16 miles of railroad.

DENISON & NORTHERN.—Surveys reported from Coalgate and Lehigh, Ind. T., via Davis to Lawton, Okla. T., 125 miles, with east and west lines through the coal fields of the Chickasaw Nation, Ind. T., and in Comanche County, Okla. T. (Mar. 16, 1906.)

DENVER & KANSAS NORTHERN.—See Missouri Pacific.

DENVER & OMAHA SHORT LINE.—Proposed new line between Omaha and Denver. Russell Harding and H. B. Hollins & Co., New York, reported interested.

DENVER & RIO GRANDE—Proposed line from Dotsero, Colo., north to a connection with the Denver, Northwestern & Pacific at Kremmling, about 50 miles.
—Proposed broad gaging of the line from Montrose, Colo., east to Salida, 136 miles.
——Proposed double-tracking from Adobe, Colo., west to Canyon City, 12 miles; also from Adobe east to Swallows, 13 miles.
——*The Rio Grande Western is building an extension from Revere, Utah, to Bingham Mines, 15 miles.
——Cut-off in Utah from Salina, on the Sevier branch of the Rio Grande Western east to Green River, on the main line west of Grand River, 115 miles; 20 miles cut of Salina built, but work stopped. The Utah Construction Co., contractors. (Mar. 16, 1906.)
——Cut-off to be built from Westwater, Utah, west to Thompsons, about 30 miles. (Mar. 16, 1906.)
——Surveys reported for a cut-off from Fort Garland, Colo., south to Embudo, N. Mex., 95 miles. (Mar. 16, 1906.)
——Projected branch from Sargents, Colo., north to Tomichi, 12 miles. Preliminary work begun. (Mar. 16, 1906.)

DENVER, ENID & GULF.—See Atchison, Topeka & Santa Fe.

DENVER, KANSAS & GULF.—See Atchison, Topeka & Santa Fe.

DENVER, LARAMIE & NORTHWESTERN.—Organized at Laramie, Wyo., to build from Denver, Colo., to the northern boundary of Wyoming, 450 miles. S. Johnson, President; W. R. West, Vice-President; R. H. Dwyer, Second Vice-President and General Manager; S. Kent, Third Vice-President; J. O. Curry, Treasurer, and J. T. West, Secretary.

DENVER NORTHERN (Electric).—Organized to build from Denver north to Cheyenne, Wyo. W. C. Brown, Senior Vice-President of the New York Central; M. J. Jones, of Boulder; R. S. Law and C. W. Waterman, of Denver, reported interested.

*DENVER, NORTH-WESTERN & PACIFIC.—Building from Denver, Colo., to Salt Lake City, Utah, 500 miles. In operation to Kremmling, 126 miles. Contract let to Dunphey & Nelson, from Kremmling to Azieve, five miles, and to Orman & Crook, from Azieve to Steamboat Springs, 85 miles.

DENVER SOUTHEASTERN.—Organized to build from Denver, Colo., south to Raton, N. Mex., 225 miles, with a branch from Pueblo east via Las Animas to Amity, about 150 miles additional. Walter H. Tunis, L. W. Herney, W. O. Temple, H. O. Tunis, W. C. K. Dunn and T. B. Doan, of Denver; L. Cockey, of Washington; F. A. Sherwood, of Philadelphia, and R. D. Whiting, of New York, interested.

DENVER TRANSCONTINENTAL.—Incorporated to build from Denver, Colo., southwest to San Diego, Cal., 850 miles. Wm. A. L. Cooper, of Denver; R. E. Vidler, of Georgetown, and C. A. Baldwin, of Colorado Springs, incorporators.

*DENVER, YELLOWSTONE & PACIFIC.—Proposed line from Denver, Colo., to Walcott, Wyo., 250 miles. Contracts let from Denver to Collins, 65 miles, and from Walcott, Wyo., to Encampment, 45 miles. Grading under way. W. R. West, of Laramie, Wyo., and John D. Milliken, McPherson, interested. (Mar. 16, 1906.)

DES MOINES & MISSOURI.—Rights of way secured for proposed line from Des Moines, Iowa, south to Seymour, 80 miles. G. Wright and Clark M. Garver, of Des Moines, interested. (Mar. 16, 1906.)

*DES MOINES, IOWA FALLS AND NORTHERN.—Building the St. Paul & Des Moines from Iowa Falls, Iowa, north to Mason City, 45 miles. R. A. Elzy, of Marshalltown, Iowa, contractor; 10 miles built; 6 miles more of grading completed.

DES MOINES, WINTERSET & CRESTON (Electric).—To build from Des Moines, Iowa, southwest to Creston, 65 miles. A. E. Park, General Manager, Des Moines.

DETROIT & GRAND RAPIDS.—Organized to build from Farmington, Mich., northwest to Corunna, thence north to Saginaw, 100 miles. E. P. Sherman, Bancroft, Mich., President.

DETROIT & MACKINAC. Proposed branch from Alpena, Mich., west towards Boyne City.

*DETROIT RIVER TUNNEL CO.—See Michigan Central.

DETROIT, TOLEDO & IRONTON.—Surveys made for building from Ashland, Ky., up Hoods creek, East fork and down Bear creek to the Big Sandy river, thence up that river to the mouth of Shelby creek, 118 miles. From this point a branch to be built up Long Fork creek, 23 miles, to coal properties. The Ashland & Ironton Bridge Co. is now building a bridge over the Ohio river at Ashland. Another branch is to be built up Shelby creek, 20 miles, and a third branch will be built up Beaver creek to the Beaver creek coal fields, 36 miles. J. F. Prindivle, Paintsville, Ky., is Engineer in charge.
——Proposed extension of Kingman branch from Kingman, Ohio, to Harveyburg, five miles.

DONIPHAN, KENSETT & SEARCY.—Extension from Kensett west to Searcy, Ark., 4½ miles, to be built. H. R. Kilpatrick, Kensett, is General Manager.

DOUGLAS, AUGUSTA & GULF.—See Georgia & Florida.

DOVER & SOUTH BOUND.—Proposed extension from Richlands, N. C., southeast to Swansboro, 30 miles. (Mar. 16, 1906.)

DUBLIN & SOUTHWESTERN.—Proposed extension from Eastman, Ga., southwest to Cordele, 35 miles.

DUBUQUE, IOWA & WISCONSIN.—Organized to build from Dubuque, Iowa, through Illinois and Wisconsin. J. M. Meradden, Dubuque, A. W. Tredway, F. J. Piekenbrock, H. H. Blish and J. E. Hedley, Directors.

*DULUTH & NORTHERN MINNESOTA.—Building with its own forces a 4-mile extension.

*DULUTH, MISSABE & NORTHERN.—Building with its own forces a branch to the Wacootah mine, 1.74 miles; and one from Myer's mine to Hartley mine, one mile; also one from Glen mine to Pillsbury mines, 0.9 mile.

*DULUTH, RAINY LAKE & WINNIPEG.—Contracts let to the Minnesota Land & Construction Co. for an extension from milepost 50 north to Rainer, Minn., 35 miles.
——Proposed extension from Rainy Junction, Minn., south to Duluth, 70 miles.

DULUTH, VIRGINIA & RAINY LAKE.—See Duluth, Rainy Lake & Winnipeg.

DUQUOIN RAPID TRANSIT.—Proposed interurban line from Benton, Ill., northwest to Belleville, 75 miles. Office at Duquoin, Ill.

DURHAM & SOUTHERN.—Proposed extension from Dunn, N. C., southeast to Southport, at the mouth of Cape Fear river, 100 miles.

*DYERSVILLE & NORTHERN.—Building from Dyersville, O., to New Vienna, five miles. Contract let to E. L. Tobie, of St. Paul, Minn. Grading completed. E. C. Peaslee, of Dubuque, Iowa, is interested. (Mar. 16, 1906.)

E

EAGLE VALLEY.—Projected from Baker City, Ore., east to the Snake river, 75 miles. David Eccles, Ogden, Utah, and W. L. Vinson, of Baker City, reported interested.

EAST CENTRAL.—Incorporated to build from Ormond, Fla., south to Daytona, thence west to De Land, thence south to Sanford and Orlando, 70 miles. E. L. Potter, Seabreeze, Fla., President.

EAST SIDE VIADUCT.—Incorporated to build an elevated railroad from the terminus of the Harlem river branch of the New York, New Haven & Hartford at Willis avenue in the Borough of the Bronx, New York City, southward across the Harlem river and thence between First avenue and Avenue A to East 34th street, Manhattan. Proposed to build a six-track stone viaduct between Avenue A and First avenue and across Jefferson Park. O. W. Barnes, Fishkill, N. Y.; C. H. Cook, O. B. Nairs and L. C. Twombley, of New York, and F. H. Loomis, of Steubenville, Ohio, Directors.

EASTERN OF OKLAHOMA.—See Atchison, Topeka & Santa Fe.

EASTERN SIERRA & PACIFIC.—Incorporated as the Sierra Pacific and consolidated with two other companies. Construction work to begin near Walker Pass, Cal., on line to San Luis Obispo. Work will be let in 40-mile sections. Otto Bashore, President, Porterville, Cal.; C. B. Reas, Second Vice-President of Success, Cal.; George D. Avery, Secretary; J. W. Davis, Treasurer, and G. B. Mitchell, General Manager, all of Porterville.

*EASTERN TENNESSEE & WESTERN NORTH CAROLINA. Laying third track to make the road double gage from Elizabethton, Tenn., to Hampton, five miles.

EASTERN TEXAS. Proposed extension from Kennard, Tex., west to Crockett, 15 miles.

EASTERN WASHINGTON. Projected line from Fletcher, Adams County, Wash., southwest to Connell, 30 miles. E. W. Swanson, Spokane, Wash., is interested. Surveys completed. (Mar. 16, 1906.)

EAST ST. LOUIS, COLUMBIA & WATERLOO.—Proposed new line from East St. Louis, Ill., south to Waterloo, 25 miles. Surveys. E. F. Schoening, Columbia, Ill., President.

*EDDY LAKE & NORTHERN.—Contract let to R. E. Broty for extension from Brown Swamp, S. C., to Marion, 20 miles.

ELECTRIC TERMINAL OF KANSAS CITY.—Incorporated in Missouri, to build a line five miles long within Kansas City. John Mayer, Parsons, Kan.; G. H. Kahmann, B. Steele, W. E. Winner and H. G. Pert, all of Kansas City, incorporators.

*EL DORADO & WESSON.—Building from El Dorado, Ark., to Wesson, 10 miles. Contracts let to A. J. Seymour for seven miles, and to James Ulmer for three miles. Grading completed for seven miles, and track laying to be begun this month. James Harrington, Chief Engineer, El Dorado, Ark.

*ELDORADO, MARION & SOUTHWESTERN.—Work started on this line from Eldorado, Ill., through Marion, west to a point on the Mississippi river. Contract let for grading east of Marion to Charles E. Larue. S. T. Brush, Carbondale, Ill., President, and F. Hutchinson, Chief Engineer.

ELK, BIRCH & GAULEY.—Incorporated to build from the Birch river, in Braxton County, W. Va., southeast to Camden-on-Gauley, 30 miles. P. T. West, Grafton; G. S. Bennett, Amos; C. A. Shaw, Shinnston, and E. T. Tetrick, Clarksburg, W. Va., incorporators.

ELKHORN SOUTHERN.—Incorporated with office at Bristol, Va., to build from the Virginia-Kentucky state line near the Big Sandy river into Dickenson or Buchanan Counties, Va., 40 miles, with branches. Geo. L. Carter, President, Bristol, Va.

ELK SHORT LINE.—Incorporated to build near the village of Elk Rapids, Mich. Homer Siy and Milton B. Lang, of Elk Rapids, Directors.

ELMIRA, CORNING & WAVERLY (Electric).—See Erie.

*ERIE.—Proposed improvement of Jersey City terminal approved by city officials. The plans provide for an open cut 70 ft. deep and 4,500 ft. long through Bergen Hill for passenger trains. There will be four passenger tracks. The tracks will run on a curve in the city east of the tunnel to a new station. The present tunnel will be used for freight trains. The company has bought a large tract of land at the western end of the tunnel, and the city has vacated five blocks on the meadows; also tracks at Barnum street and at Ninth street. There will be about 120,000 cu. yds. of earth and 480,000 cu. yds. of rock to be excavated, 15,000 cu. yds. of concrete masonry to be built. The Penhorn Creek Railroad has been incorporated to build this short line. Contract let to the Millard Construction Co., Philadelphia, Pa.
——*Contract let for the electrification of 34 miles from Rochester to Avon and Avon to Mount Morris, to Westinghouse, Church, Kerr & Co., of New York. Work about finished. Estimates made for electrifying the rest of the Rochester division from Avon to Corning, 76 miles.
——*Contract let to Bennett & Talbot, of Greensburg, Pa., for building the first section of 12 miles of the Guymard cut-off (Erie & Jersey) from Blowells, N. Y., to Guymard, 42 miles. This includes a 5,300-ft. double-track tunnel through the Shawangunk mountains. Additional contracts let between Highland Mills and Guymard as follows: Newburg Junction to Woodbury, Sundstrum & Stratton, New York; Woodbury to Moodna Creek, John F. Shields, Richmond Hill, Long Island; Moodna Creek viaduct, steel work to be done by the company's forces, masonry work by Smith-McCormick Co., Belfast, N. Y.; Moodna Creek to Otterkill, Ferguson Contracting Company, New York City; Otterkill to Stony Ford, Lathrop, Shea & Henwood Co., Scranton, Pa.; Stony Ford to Howells, F. M. Clement & Co., Philadelphia, Pa.
——*Building under the name of the Columbus & Erie, a new double-track main line from Lakewood, N. Y., southwest to Columbus, Pa., 23 miles. Contracts from Lakewood to Grant, N. Y., let to Burke Bros., of Scranton, Pa., and from Grant to Columbus, Pa., to J. G. White & Co., of New York; 2½ miles built.
——*Contracts let for work on the Genesee River Railroad from Hunts, N.Y., south to Cuba, as follows: Hunts to Rossburg, Millard Construction Co., Philadelphia, Pa.; Rossburg to Black Creek, W. H. Coverdale & Co., New York; Black Creek to Cuba, Bennett & Smith, Wilkinsburg, Pa.

——Double tracking from Carrollton, N. Y., to Cuba, 25 miles. To be done in connection with the low-grade line being built from Cuba to Hunts, N. Y.

——*Contract let to the McGinty Contracting Co., of Minerva, Ohio, to build a concrete subway at the eastern end of its yards at Randall, Ohio.

——*Erie reported to be financing the Elmira, Corning & Waverly (electric), building from Waverly, N. Y., to Elmira, on the right of way of the Erie, and to buy the Waverly, Sayre & Athens Traction Co. and extend it to Binghamton.

ERIE & JERSEY.—See Erie.

*ERIE, CAMBRIDGE SPRINGS, UNION & CORRY (Electric).—Contract reported let to Charles Van Bibber, of Boston, for building from Erie, Pa., to Corry, with branch to Cambridge Springs, in all 40 miles.

ESSEX COUNTY TRACTION.—Incorporated to build from Westport, N. Y., on Lake Champlain west to Newman, Essex County, 49 miles. A. S. Washburn and N. C. Speer, of Hartford, Conn.; W. L. Kiley and George S. Raley, of Glens Falls, and R. L. Trumbull, of Ausable, N. Y., Directors.

EVANSVILLE, MT. CARMEL & NORTHERN.—See Cleveland, Cincinnati, Chicago & St. Louis.

F

FALLON RAILWAY.—See Southern Pacific.

FALLS CITY, SYCAMORE SPRINGS, SABETHA & SOUTHWESTERN.—Incorporated to build from Falls City, Neb., south to Topeka, Kan., 100 miles, with a western line from a point near Sabetha, in Nemaha County, Kan., west 320 miles. Samuel Kimmel, of Falls City, Neb.; E. V. Kauffman and H. Reding, of Sabetha, and W. A. S. Bird, of Topeka, Directors. (Mar. 16, 1906.)

FALMOUTH RAILROAD.—Incorporated in Virginia to build from a point in Stafford County west of Falmouth east to tidewater on the Rappahannock or Potomac rivers, 25 miles. W. E. Grant, President, Richmond, Va.

*FLORIDA EAST COAST.—Extension from Homestead, Fla., southwest along Florida Keys to Key West, 126 miles; 37 miles built to southern end of Key Largo.

FLORIDA RAILWAY.—Proposed extension from Liveoak, Fla., northeast to Fernandina, 150 miles.

FLORIDA ROADS (Electric).—Franchise granted to William H. Evers Engineering Co. to build from Tampa, Fla., east to Bartow, 45 miles.

FORT SMITH, INDIAN TERRITORY & TEXAS. Projected line from Panama, Ind. Ter., southwest to Wilburton, Ind. Ter., 50 miles. Western Land & Construction Co., of Memphis, promoters.

*FORT WAYNE & SPRINGFIELD.—Projected from Fort Wayne, Ind., south to Portland, 48 miles. Graded from Fort Wayne to Decatur, 21 miles; track laid for two miles. (Mar. 16, 1906.)

*FOURCHE RIVER VALLEY & INDIAN TERRITORY.—Contract let to Robert G. Jenkins, of Fourche, Ark., for extension from Camp D, in Arkansas, to the west line of Perry County, 38 miles.

*FOX RIVER (Electric).—Eight miles of track laid and all grading completed on this projected line from Manitowoc, Wis., south to Sheboygan, 30 miles. O. C. Beahnke, Manager, Manitowoc.

FRANKLIN & CLEARFIELD.—See Lake Shore & Michigan Southern.

FRANKLIN SOUTHEASTERN.—Incorporated in Georgia to build from Franklin to either Hogansville or LaGrange. W. Nussbaum, N. W. Wick, A. J. Crovatt, J. S. Wright and J. Y. Brame, of Brunswick, Ga.; C. W. Demming, of LaGrange, Ga., and E. Broyston, of Jacksonville, Fla., incorporators.

*FREEO VALLEY.—Contracts let to S. R. Neu, of Princeton, Ark., for extension in Arkansas from mile post 22 to mile post 26.

FRISCO, OKLAHOMA & TEXAS.—See St. Louis & San Francisco.

FRONT ROYAL, RAPPAHANNOCK & TIDEWATER.—Preliminary surveys from Front Royal, Va., to Griglersville, 50 miles. Hugh E. Naylor, Secretary, Front Royal.

G

*GAINESVILLE & GULF.—Building under the name of the Tampa & Jacksonville extension from Sampson, Fla., northeast to Jacksonville, 50 miles, and from Fairfield south to Tampa, 150 miles. Contracts let to the American Construction Co., Gainesville; sub-contract let to W. H. Jones for grading 53 miles.

*GAINESVILLE, WHITESBORO & SHERMAN.—Chartered to build from Sherman, Tex., east to Gainesville, 32 miles. G. A. Hassinger, H. H. Lazarus, of New Orleans; H. G. Stinnett, of Sherman; S. B. Cowell, of Whitesboro, and John King of Gainesville, incorporators. Office at Gainesville.

GALVESTON HOUSTON INTERURBAN.—Organized to build from Galveston, Tex., north to Houston, with branch lines east to Laporte and Seabrook. J. O. Ross, President; Henry House, Vice-President, and F. L. Dana, of Colorado Springs, Secretary.

GALVESTON TERMINAL.—See Colorado & Southern.

GASSAWAY, ELK RIVER & HUTTONSVILLE.—Chartered to build from Gassaway, W. Va., southeast to Webster Springs, 25 miles; also an extension from Webster Springs northeast to Huttonsville, 35 miles. J. M. Hoover, Webster Springs, incorporator.

GATES CITY TERMINAL.—See Atlanta, Birmingham & Atlantic.

GENESEE RIVER.—See Erie.

GENEVA, PHELPS & NEWARK (Electric).—Authorized to build from Geneva, N. Y., north to Newark, 15 miles.

*GEORGIA & FLORIDA.—This system is building an extension of the Augusta & Florida from Keysville, Ga., north to Augusta, 26 miles, and proposes to extend the Douglas, Augusta & Gulf from Barrows Bluff, Ga., north to Rockledge, 50 miles. Two pieces of road aggregating 50 miles must be built to give a through line from Augusta south to Madison, Fla. A line is also projected to Savannah, Ga., which involves building from Summit to Statesboro, 26 miles.

GEORGIA & FLORIDA PINE BELT.—Incorporated to build from Waycross, Ga., southwest to Statenville, Ga., 60 miles. W. B. Ellington, W. W. Sharp, G. R. Yeoman, J. S. Bailey, of Ware County; W. C. Dodson, C. J. Haden and B. W. Blackstock, of Atlanta, incorporators.

GEORGIA COAST & PIEDMONT.—Surveys being made for an extension from Darien, Ga., south to Brunswick, 17 miles.

GEORGIA EASTERN.—Incorporated to build from Americus, Ga., east to Eastman, 80 miles. J. P. Heard, Vienna, Ga., incorporator.

*GEORGIA, FLORIDA & ALABAMA.—Work under way on an extension from Cuthbert, Ga., north to Columbus, 63 miles.

GEORGIA NORTHERN.—Proposed extension from Boston, Ga., southwest to Monticello, Fla., 19 miles.

GEORGIA, SOUTHWESTERN & GULF.—Chartered to build from Dawson, Ga., via Albany to point in Washington County, Fla., 175 miles. W. M. Legg, H. J. Brewton, A. H. Russell, M. D. Fowers, W. M. Gordon, Jr., of Dawson; W. H. Milton, Miami, Fla.; E. V. Babcock and F. R. Babcock, of Pittsburg; E. S. Peter and J. H. Pope, of Chicago, incorporators.

GEORGIA ROADS.—Proposed line from Social Circle, Ga., south to Mansfield, 10 miles. Colonel J. N. Preston and Captain A. W. Roberts, of Atlanta, and T. A. Perry, of Decatur, are interested.

GILA VALLEY, GLOBE & NORTHERN.—See Southern Pacific.

GILPIN & CLEAR CREEK DISTRICT.—Proposed line 17 miles long to mines in Gilpin County, Colorado. John C. McShane, President, and R. H. Carpenter, Central City, Colo., Chief Engineer. (Mar. 16, 1906.)

GLEN MARY.—Incorporated to build from Glen Mary, Tenn., southeast to Oliver Springs, 28 miles. J. N. Scott and Robert Walton, of Roane County, incorporators.

GLENVILLE & KANAWHA.—Surveys being made for proposed line from Glenville, W. Va., northeast to Weston, 30 miles. R. L. Ruddell, General Manager, Glenville, W. Va.

GOSHEN, SOUTH BEND & CHICAGO (Electric).—Incorporated to build from the northern end of the Ohio-Indiana state line to Hammond, Ind., 140 miles. Part of the proposed Chicago-New York Electric Air Line.

GRAND RAPIDS TERMINAL BELT.—Incorporated to build a belt line around the city of Grand Rapids, Mich. Grading work will begin this spring. E. H. Christ, Chief Engineer, Grand Rapids, Mich.

GRANITE CITY & EAST ST. LOUIS TERMINAL.—Incorporated with office in Chicago to build from Granite City, Ill., to East St. Louis. Charles G. Lucas, F. A. Nueffer, H. H. Phillips, H. B. Herd and R. M. Cole, Directors.

*GRAY'S HARBOR & PUGET SOUND.—Incorporated to build from Aberdeen and Hoquiam, Wash., west to Centralia, 75 miles. Construction under way. J. J. West, President; J. B. Bridges, Counsel; W. J. Patterson, Treasurer and General Manager; J. F. Richards, Purchasing Agent and Assistant Auditor, all of Aberdeen, and J. M. Clapp, Chief Engineer and Auditor, of Seattle. Office at Aberdeen.

GREAT BEND & GULF.—Chartered to build from Great Bend, Kan., south to Medicine Lodge, 80 miles. R. C. Otis, B. C. Sammons, H. S. Duncome, R. Pringle, of Chicago; F. V. Russell and G. L. Chapman, of Great Bend, Kan., incorporators. (Mar. 16, 1906.)

*GREAT NORTHERN.—The Billings & Northern is building a connecting line between the Great Northern and Montana Central on the north and the Northern Pacific and Burlington on the south. Grading under way from Armington, Mont., to Laurel, 199 miles.

——*New line to be built in Canada from Vancouver to Winnipeg. The Vancouver, Victoria & Eastern is building the western end. Tracks laid from the international boundary at Midway, B. C., west to crossing of the Similkameen river, eight miles beyond Oroville, 64 miles. Work under way to Keremeos, 32 miles further. Contracts let soon, Keremeos to Princeton, 45 miles. Eastern part of through line probably via Fernie, B. C., Medicine Hat and Regina, Sask., and Portage la Prairie, Man., to Winnipeg.

——*Minneapolis & Great Northern extension from Greenbush, Minn., to Warroad, 44 miles, is graded but no track laid.

——*Projected branch from Wenatchee, Wash., northeast to Oroville, 140 miles. Three contracts let between Orondo and Wenatchee; also from Oroville south.

——Proposed change of over 100 miles of main line from Cut Bank, Mont., to Belton; new line to be 17 miles shorter; track laid.

——Surveys between Spokane and Newport, Wash., 70 miles, to secure a more direct route and lighter grades.

——Proposed branch from Grand Forks, N. Dak., north on the east side of the Red River to Drayton, passing between Olson and Alvarado, Minn. (Mar. 16, 1906.)

——Maps filed showing location of proposed extension from Summers, Flathead County, Mont., east to Holt, thence along the east side of Flathead lake to the northern side of Flathead reservation, 60 miles. (Mar. 16, 1906.)

——Surveys from Rugby, N. Dak., southwest to Balfour, thence southwesterly to coal lands. (Mar. 16, 1906.)

——See Portland & Seattle.

GREAT SOUTHERN.—To build remaining 22 miles between The Dalles, Ore., and Tygh Valley with its own forces.

GREEN BAY, OHKOSH, MADISON & SOUTHWESTERN.—See Wisconsin & Northern.

GREENFIELD & SOUTHEASTERN.—Incorporated to build from Greenfield, Ark., southeast to Marked Tree, 20 miles. W. H. Howe, of Greenfield; S. E. Howe, of Logansport, Ind., and J. J. Mardic, of Harrisburg, Directors. (Mar. 16, 1906.)

GREENSBURG & WESTERN (Electric).—See West Penn Railway.

GREENVILLE & ROLLINGFORD (Electric).—Incorporated to build from Leland, Miss., through Greenville and Rollingford.

GREENVILLE, GREENWOOD & KNOXVILLE.—Projected line from Greenville, S. C., to Greenwood, 50 miles. H. H. Prince, Greenville, S. C., interested. (Mar. 16, 1906.)

*GREENWICH & JOHNSONVILLE.—Building extension from Greenwich, N. Y., to Salem, 12 miles. A. A. Parker, Superintendent of Construction.

GULF & NORTHWESTERN.—Surveys from Waco, Tex., northwest to Strawn, 120 miles. Projected an additional 250 miles from Strawn northwest to Plainview. P. A. McCarthy, Lufkin, Tex., Chief Engineer.

GULF & SABINE RIVER.—Incorporated to build from Leesville, La., southwest to Merryville, 35 miles. T. H. Fullerton, J. L. Reaves, G. W. Johnson, F. L. Feiben and C. S. Maillard, Directors. Office at Leesville.

GULF, BROWNWOOD & CISCO.—To build during 1907 from Brownwood, Tex., to Cisco, 50 miles. Address G. H. Connell, Fort Worth, Tex.

*GULF, COLORADO & SANTA FE.—Contracts let to the Grigsby Construction Company, of De Ridder, La., for extending the Jasper & Eastern from Cravens, La., to Oakdale, 25 miles.

——Proposed connecting line from Center, Tex., to Timpson, 15 miles.

——Projected line from the northern end of the Texas & Gulf at Longview, Tex., to a point on the Red river, 125 miles, to be eventually extended northwest to Indian Territory, 150 miles.

——Proposed line from Winnie, on Gulf & Interstate division to Houston, 60 miles.

*GULF, HUTCHINSON & NORTHWESTERN.—Building from La Crosse, Kan., north to Hays, 25 miles. Projected from Hays north to Phillipsburg, 75 miles, and from La Crosse southeast to Hutchinson, 100 miles. Address Eugene Tillen, Hutchinson, Kan.

GULF, PLAINVILLE & NORTHERN.—Chartered to build 60 miles from Plainville, Kan., north to the Nebraska state line. Office at Plainville.

GULFPORT & NORTHWESTERN.—Surveys for line from Gulfport, Miss., northwest to Poplarville, 45 miles. Edward Hines, Chicago, President; E. F. Barthe, First Vice-President; A. McAlpin, Second Vice-President; F. A. Weyerhaeuser, St. Paul, Minn., Treasurer; C. F. Wiehe, Secretary; S. J. Cusson, General Manager.

GURDON & FORT SMITH NORTHERN.—See Missouri Pacific.

GURLEY & PAINTROCK VALLEY.—Organized by the Cleveland Coal & Iron Co. to build nine miles from Gurley, Ala. George E. McNeil, President, and J. D. Austin, Secretary, Treasurer and General Manager, both of Chicago.

H

HAMMOND & SOUTHERN.—Incorporated to build from Hammond, Ark., east to Hervey, 10 miles. L. Evers, of Hammond; J. W. Stayton and J. Volkner, of Newport, interested. (Mar. 16, 1906.)

HAMPSHIRE SOUTHERN.—Incorporated to build from Springrun, W. Va., southwest to Durbin. John T. McGraw, of Grafton; J. J. Cornwell, of Romney, and W. B. Cornwell, of Fairmont, incorporators.

HAMPTON & YORKTOWN (Electric).—Incorporated to build from Hampton, Va., to Yorktown, 19 miles. Surveys.

HANCOCK & EAST BRANCH.—See Delaware & Eastern.

HANNIBAL & KIRKVILLE.—Proposed line from Hannibal, Mo., northwest to Kirkville, 75 miles. (Mar. 16, 1906.)

HANOVER RAILWAY.—Incorporated to build from Hanover, Ill., to North Hanover. Office at Hanover. William Speer, John Eadie and Albert B. White, of Hanover, incorporators.

HARBOR SPRINGS.—Surveys for extension from Indian Garden, Mich., to Dutch Church, two miles

*HARRISBURG & OHIO RIVER.—D. E. Baxter & Co., Inc., New York, have contracts for building this line from Galatia, Ill., southeast to Harrisburg, nine miles. T. Edwin Bell, of Hammond, Ind., President.

HARTWELL & WASHINGTON.—To build from Washington, Ga., north to Hartwell, 60 miles. W. J. Anderson, Washington, Ga., incorporator.

HATTIESBURG & MAMMOTH SPRINGS (Electric).—Incorporated to build from Hattiesburg, Miss., south to Mammoth Springs, 12 miles. E. F. Ballard and J. Fitch interested.

HAYS CITY & GREAT NORTHERN. Organized to build from Great Bend, Kan., northwest to Hays, thence north to point in Rooks or Graham County, 90 miles. E. L. Peckham, of Blackwell, Okla. T., and H. T. Shaffer, of Hays City, interested.

HILLSBORO, KIMMSWICK & NORTHERN. Incorporated to build from Hillsboro, Mo., north east to St. Louis, 23 miles. H. W. Gulke, A. F. Furrer, Lee A. Hall, Charles A. Gulke and James J., Ring, St. Louis, interested.

HILLSBORO NORTHEASTERN. Proposed extension from Hillsboro, Wis., southwest to Richland Center, 28 miles.

HIWANEE & TOMBIGBEE.—Organized to build from Hiwanee, Miss., to the Tombigbee river in Alabama, 35 miles. Col. E. L. Russell, of Jackson, Miss., interested.

HOBOKEN & MANHATTAN.—See Hudson & Manhattan.

HOLLY RIVER & ...ODISON. See West Virginia Midland.

*HOLSTON RIVER.—Incorporated to build from Rogersville, Tenn., northeast to Bristol, 45 miles. Contract let to the Callahan Construction Co. Grading begun last summer. Sub-contract let to J. R. Oates, of Ashville, N. C., for 10 miles near Moccasin Gap. John B. Newton, Bristol, Tenn., interested.

HOMAN & SOUTHERN.—Incorporated to build from Homan, Miller County, Ark., northeast to Harney, 10 miles. C. B. Kelley and H. G. McBurney, of Homan, interested. (Mar. 16, 1906.)

*HOOD RIVER.—Contracts reported let to Archie Mason and Giebisch & Joplin; 16 miles of this projected road along the east bank of Hood river in Oregon. (Mar. 16, 1906.)

HORNELL, BATH & LAKE KEUKA (Electric).—Incorporated to build from Hornell, N. Y., northeast to Jerusalem, 46 miles. John F. Turk and Charles G. Wheeler, of Hammondsport; Fred W. Hastings, Wilson R. Campbell, Moses Davison, Dr. W. H. Phillips, G. H. Parkhurst and Frank N. DeCamp, of Bath, and L. D. Whiting, of Canisteo, N. Y., Directors.

HOT SPRINGS, OUACHITA & MENA.—See Kansas City Southern.

*HOUSTON, SABINE & RED RIVER.—Contract let in July, 1906, to C. Rice. Proposed route from Houston, Tex., north and northeast to Alexandria, La., about 200 miles. About 22 miles of grade completed. H. W. Cortes, President; Edwin Kennedy, Vice-President, and J. M. Cotton, Secretary, all of Houston.

*HUDSON & MANHATTAN.—Work includes twin tunnels from Jersey City under the North river to Cortlandt and Dey Streets, New York; also a twin tunnel from Hoboken under the North river to Christopher street, and a subway through Christopher street to Sixth avenue, and along Sixth avenue to 33d street. A connecting line will be built from the Lackawanna terminal in Hoboken on the north, south to the present Pennsylvania terminal in Jersey City. From here a line is projected to Newark to be used by fast electric trains. The tunnels to Hoboken are finished. At the Manhattan end they extend from the shaft near the foot of Christopher street to near Christopher street and Ninth avenue. Contract for subway up Sixth avenue to Sixth avenue and Thirty-third street, New York, about one mile, let to Degnon Contracting Company. The two tubes from Jersey City have been bored about three-fourths of the way, and work on the tunnels for the Jersey connections of the under river tubes is about half done.

HUDSON RIVER & EASTERN TRACTION.—Authorized to build from Ossining, N. Y., east through Briarcliff Manor and Pleasantville to Sherman Park, nine miles. F. E. Stratton, President of the Northern Westchester Traction Co., White Plains, N. Y., President.

HUNTINGTON RAILROAD (Electric). — This company has been authorized to build an electric line from Huntington, on the Long Island Railroad, southwest across Long Island to Amityville, 15 miles. Work to be begun by April 1, 1907, and completed by October, 1908.

HUNTSVILLE & BIRMINGHAM (Electric).—Incorporated to build from Huntsville, Ala., south to Birmingham, 80 miles. C. T. Briggs, of Joppa, President; L. J. Hanners, of Cullman, Vice-President; T. W. Riddle, of Holly Pond, Secretary, and F. T. Petty, of Huntsville, Treasurer and Attorney. Office at Huntsville.

I

IDAHO NORTHERN.—Proposed line from Kingston, Ida., northeast to Murray, 22 miles; also from Murray south to Wallace, 20 miles. B. F. O'Neill, President of the State Bank of Commerce, Wallace, President.

*ILLINOIS CENTRAL.—Building from Corinth, Miss., southeast to Haleyville, Ala., 80 miles, as part of its Birmingham extension. The line in Mississippi under the name of the Mississippi & Alabama, 42 miles, and the remainder in Alabama under the name of the Alabama Western, 38 miles. Contracts for the Mississippi & Alabama let to Smith & Scott, of Corinth. About 85 per cent. of the grading is completed and track laid for over three miles. On the Alabama Western, contracts let to the Talley-Bates Construction Co., Memphis, Tenn.; L. E. Myers Co., Chicago, Ill., and to Smith & Scott, of Corinth, Miss.; also to the Strobel Steel Construction Co., of Chicago, Ill., for the Brush Creek viaduct. Grading 44 per cent. completed, and track laid for two miles.

——*Yazoo & Mississippi Valley let contracts to N. J. Beard & Co. and P. H. Rogers of Memphis Tenn., and to J. D. Lyncn, of Monmouth, Ill., for work from Holly Bluff, Miss., to Kelso, 13.3 miles; Kelso, Tenn., to Lake View, Miss., 6.7 miles; Leland, Miss., southwest 10.8 miles, and Phillipp, Miss., to Charleston, 27.6 miles; a total of 58.4 miles.

ILLINOIS, INDIANA & GARY. With the Milwaukee, Rockford & Eastern, to build a double-track line from Gary, Ind., north to Milwaukee, Wis., 230 miles. H. H. Harris and E. Clark, Chicago; J. C. Dodin, DeKalb, Ill., and H. W. Seaman, Clinton, Ia., incorporators.

*ILLINOIS VALLEY (Electric). Incorporated to build from Joliet, Ill., southwest to Morris, thence west to Spring Valley. Grading under way. F. W. Bedard, La Salle, Ill., interested.

ILWACO RAILWAY & NAVIGATION.—See Oregon Railroad & Navigation Co.

INDIANA, CLEARFIELD & EASTERN (Electric). See Keystone Air Line.

INDIANA, COLUMBUS & EASTERN TRACTION. Organized in Ohio to build from Dayton, O., west to Richmond, Ind., 100 miles.

INDIANAPOLIS, CHICAGO & LOGANSPORT.—Surveys made and rights of way secured from Indianapolis, Ind., north to Logansport, 80 miles. Walter A. Osmer, Chief Engineer, Logansport, Ind.

INDIANAPOLIS & LOUISVILLE. See Chicago, Indianapolis & Louisville.

INDIANAPOLIS, COLUMBUS & SOUTHERN TRACTION.—Contract let to Howard Lee for grading 20 miles on an extension from Columbus, Ind., south to Seymour.

*INDIANAPOLIS, HUNTINGTON, COLUMBIA & NORTHWESTERN.—Grading begun in September, 1906, from Indianapolis, Ind., to Goshen, 155 miles. Contracts let to M. V. Ryan, of Syracuse, Ind., for building from Huntington to Goshen, 60 miles. Grading completed from Wawasee Lake to Benton, 11 miles, and tracklaying to be started this spring. Denver L. Horner, of Syracuse, Ind., Chief Engineer.

INDIANAPOLIS, NEW CASTLE & TOLEDO (Electric).—To be built by the Electrical Installation Company of Chicago. Main line will be from Indianapolis to New Castle, Ind., with branch lines as follows: Indianapolis to New Castle, 45 miles; Maxwell to Greenfield, five miles; Shirley to Anderson, 16 miles; New Castle to Muncie, 20 miles; New Castle to Winchester, 28 miles; New Castle to Richmond, 26 miles; total, 140 miles.

INDIANA UNION TRACTION.—Proposed extension from Anderson, Ind., southeast to New Castle, about 20 miles; also from Anderson northwest to Elwood, 15 miles.

INDIAN CENTRAL.—Incorporated to build from Ponca, Okla., southeast to Paris, Tex., with a branch from the Red River northwest to Oklahoma City, a total of 460 miles, 120 miles of which will be in Oklahoma. Pleasant Porter, of Muscogee; E. T. Hathaway, O. D. Halsell, Ed. Overholser and William C. Reeves, of Oklahoma City, and the Sequoyah Development Co. are interested. Office at Oklahoma City.

*INDIAN CREEK & POUND RIVER.—Five-mile extension up north fork of Pound river is well under way. Proposed seven-mile extension from Pound, Va., south to coal and timber fields.

INTER-CALIFORNIA.—See Southern Pacific.

INTERIOR & WEST VIRGINIA.—See Norfolk & Western.

INTERSTATE (Electric).—Incorporated in Missouri to build from Kansas City north to St. Joseph, 47 miles. George R. Collins, Kansas City, interested.

INTERURBAN.—Incorporated to build from South Lebanon, Ohio, east to Morrow, five miles

IOWA & NORTHWESTERN. — Incorporated to build 75 miles of railroad east from Waterloo, Iowa. Stephen B. Howard, President; E. M. Rice, Vice-President, and E. C. Luther, Secretary and Treasurer, all of New York.

IOWA CITY, MONTEZUMA & WESTERN (Electric).—Incorporated to build from Iowa City, Ia., west to Montezuma, 60 miles. E. B. Macey and L. H. Bufkin, of Lynnville; J. W. Carr, of Montezuma; F. O. Hardington, of York; P. S. Carson, of Iowa City, and M. C. Rohret, of Union, interested.

ITHACA & SENECA FALLS INTERURBAN.—Incorporated to build from Ithaca, N. Y., north to Seneca Falls, with branches from Willard to Ovid, and from Trumansburg to Mecklenburg, a total of 52½ miles. J. N. Hammond and T. J. Cary, Seneca Falls, and J. Rothschild, Ithaca, Directors.

J

JACKSON, PASCAGOULA & GULF.—Organized in Mississippi to build from Jackson southeast to Pascagoula, on the Gulf, 175 miles. F. A. Lewis, of Scranton, Miss.; Stone Deavours, of Laurel, and E. C. Jones, of Jackson, incorporators.

JACKSONVILLE, FERNANDINA & SOUTHERN. —Chartered to build from Jacksonville, Fla., northeast to Fernandina, 30 miles. Eugene E. West, President; John R. Young, Vice-President; Samuel A. Swan, Secretary, and Frank Adams, Treasurer. (Mar. 16, 1906.)

JACKSON, YAZOO CITY & MEMPHIS.—Organized to build from Vicksburg, Miss., to Memphis, 230 miles. I. N. Barnwell and E. S. Crane, of Yazoo City, incorporators. (Mar. 16, 1906.)

JAMESTOWN, DIAZ & CHERRY VALLEY.—Chartered to build from Jamestown, Ark., east to Cherry Valley, 65 miles. (Mar. 16, 1906.)

JASPER & EASTERN.—See Gulf, Colorado & Santa Fe.

JENNINGS & SOUTHWEST.—Organized to build from Lake Arthur, Calcasieu Parish, La. northwest to Jennings, thence north to point on the projected Colorado Southern, New Orleans & Pacific. S. L. Cary, Alba Heywood, O. W. Heywood, A. C. Wilkins, S. C. Morse, W. Kerlow, E. P. Fox, George Hathaway and L. E. Rouson, Directors.

JOHNSON CITY, BAKERSVILLE & SOUTHERN. —Proposed line from Johnson City, Tenn., to Bakersfield, N. C., 40 miles. 5½ miles from Unicol to Davisville, Tenn., was built four years ago. Surveys made from Davisville to Johnson City, 18½ miles. C. B. Allen, Johnson City, Vice-President. (March 16, 1906.)

JOHNSON CITY SOUTHERN. See Southern.

JOHNSTOWN, EBENSBURG & NORTHERN.—Incorporated in Pennsylvania to build 25 miles of road in Cambria County. G. E. Daniels, Johnstown, Pa., President.

JOLIET & SOUTHERN TRACTION.—Franchises secured in Joliet for 10 miles of track to be used as entrances for interurban lines from Morris, Dwight and Blue Island; also for independent entrance for the Joliet, Plainfield & Aurora, which has been absorbed by the Joliet & Southern. H. A. Fisher, President; John M. Raymond, Vice-President; J. K. Newhall, Secretary; L. D. Fisher, Treasurer and Chief Engineer, Joliet, Ill.

K

KALAMAZOO, GULL LAKE & NORTHERN.—Incorporated to build from Kalamazoo, Mich., to Richland and Prairieville, with branch to Gull Lake, in all 20 miles. J. T. Upjohn, Kalamazoo; H. K. Whitney, S. O. Howes and A. A. McKay, all of Battle Creek; M. P. Hinkle, A. H. Brown and E. B. Hosmer, of Chicago, interested.

KANAWHA & WEST VIRGINIA.—Surveys being made for extension from Pond Gap, W. Va., to Sweet Springs, 140 miles.

KANSAS CITY & BELTON. — Incorporated to build from Kansas City, Mo., south to Belton, 20 miles. W. J. Bales, D. W. Scott, T. A. Gill, W. Withers and E. S. Yoeman, all of Kansas City and Belton, incorporators.

KANSAS CITY & EXCELSIOR SPRINGS.—Chartered to build from Kansas City, Mo., northeast to Excelsior Springs. W. J. Thurman, McKinney, Tex.; A. F. Martin, C. D. Pratt, J. Williams and Eugene G. Jaccard, of Kansas City, interested.

KANSAS CITY & SPRINGFIELD SOUTHERN.—Surveys made from Springfield, Mo., to Richards, 93 miles, and from Sylvania to Stockton, 18 miles. Office at 2975 Michigan avenue, Chicago.

KANSAS CITY, GALVESTON & MEXICO.—Chartered to build from Kansas City, Mo., to Port Progresso, state of Yucatan, Mex.; also branches from Wagoner and Sapulpa, Ind. T., west to Guthrie; from Dallas west to Fort Worth, and from Austin to Houston and Galveston. G. V. Pattison, H. W. Pentecost and N. D. McGiney, of Guthrie, incorporators. (Mar. 16, 1906.)

*KANSAS CITY, LAWTON & PACIFIC.—Incorporated in Oklahoma to build from Kansas City to San Diego, Cal., 1,600 miles. Contracts let to R. F. King, of Ada, and to W. T. Sherwin, of Paul's Valley, Ind. T., for building from Wagoner, Ind. T., southwest to Lawton, Okla., 250 miles, and from Wewoka, Ind. T., east to Dustin, 30 miles. E. A. Hill, Assistant General Manager, 401 Odd Fellows' Building, St. Louis, Mo.

*KANSAS CITY, MEXICO & ORIENT.—Building from Kansas City, Mo., via Wichita, Kan.; Fairview, Okla. T.; Sweetwater and Presidio, Tex., and Chihuahua, Minaca and El Fuerte, Mex., to Topolobampo, on the Pacific coast, in the state of Sinaloa, 1,659 miles. In operation to 309 miles. Grading completed on 383 miles more. The Chihuahua & Pacific, 122 miles, will be part of the line, leaving 1,128 miles of track still to be laid. Branch projected from San Angelo, Tex., to Del Rio, 180 miles. Contract let to the Union Construction Co. and the International Construction Co., both of Kansas City, for building 344 miles.

*The Kansas City Outer Belt & Electric, which is to be the Kansas City (Mo.) terminal of the K. C., M. & O., has let contracts.

KANSAS CITY OUTER BELT & ELECTRIC.—See Kansas City, Mexico & Orient.

KANSAS CITY, NEVADA & SPRINGFIELD.—Proposed line from Kansas City, Mo., southeast to Springfield, 160 miles. Surveys. T. P. McDonough, President. (Mar. 16, 1906.)

*KANSAS CITY, OKLAHOMA & HOUSTON.—Grading in progress between Honey Grove, Tex., and the Red River, 22 miles. M. J. Smith, South McAlester, Ind. T., Chief Engineer. (Mar. 16, 1906.)

KANSAS CITY SOUTHERN. — Projected cut-off from Siloam Springs, Ark., along the Arkansas-Indian Territory boundary line, south to Cherokee Junction, Ind. T., thence paralleling the St. Louis, Iron Mountain & Southern to Fort Smith, and south through Sebastian and Scott counties, joining the old main line near Mena, Ark., in all 120 miles.

——The Hot Springs, Ouachita & Mena, chartered in Arkansas to build from Mena, Ark., east to Hot Springs, 70 miles.

KANSAS CITY TERMINAL CO.—Incorporated to build the new Union Passenger Station at Kansas City, Mo., and all the lines connected with it. John V. Hanna, Chief Engineer, Kansas City, Mo.

KANSAS CITY, TULSA & SOUTHWESTERN.—To build from Kansas City, Mo., to Wichita Falls, Tex. Surveys under way from Joplin, Mo., to Tulsa, Ind. T. W. H. Hendren, Tulsa, Ind. T., Chief Engineer. (Mar. 16, 1906.)

KANSAS CITY, TULSA, TEXAS & GULF.—Organized to build from Kansas City, Mo., to

Matagorda, Tex. D. B. Merry, Tulsa, Ind. T., Chief Engineer.

KANSAS SOUTHERN & GULF.—Proposed extension from Westmoreland, Kan., south to Alma, 35 miles. O. J. Collmann, Westmoreland, Kan., General Manager.

KENTUCKY & SOUTHEASTERN. — See Cincinnati, New Orleans & Texas Pacific.

*KENTUCKY & TENNESSEE.—Contracts let to C. B. Donaghy for extension from Yamacraw, Ky., six miles, toward Bellfam, 12 miles. Surveys to Bellfam.

*KENTUCKY MIDLAND.—Building from Central City, Ky., to Madisonville, 25 miles; five miles graded. M. M. Wheeler, Chief Engineer, Central City, Ky.

KENTUCKY NORTH & SOUTH.—Surveys under way from Fullerton, Ky., to Bristol, Tenn., 200 miles. R. G. Taylor, Fullerton, Ky.; L. E. Miles, Springfield, O.; A. T. Noe, Pittsburg, Pa.; J. P. Purdun, Portsmouth, Ohio, and C. H. Hoglen, Dayton, Ohio, incorporators.

KENTUCKY-VIRGINIA.—Proposed extension line to Clintwood, Va., 23 miles. Surveys made. Address J. A. Boyd, Wise, Va.

KEYSTONE AIR LINE (Electric).—Organized in Pennsylvania by Joseph Ramsey, Jr., and associates to build across the state of Pennsylvania as part of the New York, Pittsburg & Chicago Air Line, to be 810 miles long from New York via Pittsburg to Chicago. The projected Indiana, Clearfield & Eastern, to be 25 miles long in Indiana and Clearfield Counties; the Allentown, Tamaqua & Ashland, 50 miles, in Lehigh and Schuylkill Counties, and the Brush Creek & Crow's Run, 10 miles in Beaver County, have arranged to build extensions so that they will connect and form part of the through line.

KINGSPORT SOUTHERN.—Incorporated to build from Sinking Creek, Tenn., north to the Virginia state line, 20 miles. D. V. Mullens, A. P. Moore, A. B. Whitaker, J. A. Dickey and J. C. Anderson, of Bristol, Tenn., interested.

KNOXVILLE, SEVIERVILLE & NEWPORT.—Preliminary surveys on this line from Knoxville, Tenn., to Newport. J. Templeton, Knoxville, Tenn., President.

L

LAKE CHARLES NORTHERN.—Incorporated to build from Lake Charles, La., north to De Ridder, 50 miles. G. W. Nott, President.

LAKE ERIE & PITTSBURG.—See Lake Shore & Michigan Southern.

LAKE ERIE & SOUTHERN.—Incorporated to build from Cleveland, Ohio, south to Massillon, 60 miles. R. T. Wood, H. B. Camp, J. R. Zmunt, F. W. Green and H. McIntyre, Cleveland, incorporators.

*LAKE ERIE TERMINAL & SOUTHERN (Electric).—Contract let to the Terminal Traction Co., Cleveland, for building from Cleveland, Ohio, south to Akron, 35 miles; track laid for five miles. R. J. Wood, Cleveland, Chief Engineer.

*LAKE SHORE & MICHIGAN SOUTHERN. The Lake Erie & Pittsburg is building an extension of the Pittsburg & Lake Erie from Youngstown, Ohio, to Lake Erie. Contract let to Carter Construction Co. from Mill Creek Junction, near Cleveland, southeast to Kent, 26 miles.

——*Four-tracking to be finished between Toledo and Chicago.

——*Contracts let for building the Franklin & Clearfield from Franklin, Pa., southeast to Brookville, 56 miles, to the Crary Construction Co., McNally Co., Ferguson Contracting Co., Mills Construction Co., King Bridge Co., and American Bridge Co.

LAKE SUPERIOR & SOUTHEASTERN.—See Wisconsin Central.

*LAKE SUPERIOR SOUTHERN.—Contracts let to D. E. Baxter & Co., Inc., New York, for this line from Manson, Wis., north to Huron Bay, Mich., 290 miles. M. C. Phillips, President; W. K. Rideout, Secretary and Treasurer; E. B. Priest, Chief Engineer, Oshkosh, Wis.

LANCASTER & NORTHERN.—Chartered to build 10 miles from Lancaster, Pa., south to Millway. H. G. Seip, President, Easton, Pa.

*LAS VEGAS & TONOPAH.—Contracts let to Deal Bros. & Mendenhall for extension from Rhyolite, Nev., north to Goldfield, 76 miles. Projected to Tonopah, 16 miles further.

——Proposed branch into the Greenwater mining district of Inyo County, Cal.

LAUREL RAILWAY.—Incorporated to build from Damascus, Va., south to the Virginia-Tennessee state line, five miles. E. A. Mock, President, Damascus.

LEE COUNTY.—See Chicago & North-Western.

LEHIGH & LAKE ERIE.—See Lehigh Valley.

*LEHIGH VALLEY.—Construction of the Lehigh & Lake Erie, a 10-mile terminal railroad in Buffalo, N. Y., under way. To be finished this year. Contracts for grading, masonry and bridge superstructures let to F. D. Hyde, of New York.

LEROY & SOUTHWESTERN.—Incorporated to build from Leroy, Ill., southwest to Waynesville, 25 miles. A. H. Shelby, President, Bloomington, Ill.

*LEWISTON & SOUTHEASTERN (Electric).—Contracts let to Schofield & Co., Philadelphia, for building from Lewiston, Idaho, south to Grangeville, with branch from Westlake east to Ilo, and thence south to Nezperce, a total of 135 miles. Grading under way. W. P. Wood, Chief Engineer, Lewiston, Idaho.

LEXINGTON & EASTERN.—Surveys for extension from Jackson, Ky., southeast to Hazard, 33 miles.

LIBERTY-WHITE.—Surveys for extensions from Hahnesville, Miss., east to Columbia, and from Liberty west to Natchez.

*LIMA & TOLEDO TRACTION.—Building extension from Leipsic, Ohio, north to Toledo, 40 miles.

LINVILLE RIVER.—Proposed extension from Saginaw, N. C., to Mortimer, 15 miles.

LIVE OAK & GULF.—See Florida Railway.

*LIVE OAK, PERRY & GULF.—Extension being built from Rigler creek, Fla., west 30 miles.

*LONG ISLAND.—Second track from Roslyn to Glen Cove, from Flushing to Port Washington and from Flushing to Whitestone Landing; also from Oakdale to Patchogue. Third and fourth track from Winfield to Jamaica, and double-track connection from Glendale Junction on the Montauk division to White Pot on the main line, and third track from Hollis to Brushville; all to be built this year.

——*New cut-off between Jamaica and Far Rockaway, seven miles, under construction.

——Electrification of the North Shore branch to Whitestone Landing and to Port Washington from Long Island City, and the line from Long Island City to Manhattan Beach is planned.

LORAIN & ASHLAND.—Surveys being made for extension from Wellington, Ohio, south to Loudonville, 39 miles. Address August Mordecai, Wellington, Ohio.

LORAIN & WEST VIRGINIA.—See Wabash.

*LOUISIANA & ARKANSAS.—Contracts let to M. Tansey, of Tioga, La., for extension from Tioga south to Pineville, opposite Alexandria, five miles.

*LOUISIANA & PINE BLUFF.—Incorporated to build from Huttig, Ark., to Wellington, 20 miles. Track laid for three miles, and contract for balance let to S. R. Neal, of Huttig, Ark. It is to cross the Iron Mountain near Huttig. (Mar. 16, 1906.)

*LOUISIANA EAST & WEST.—Extension from Ville Platte, La., to Eunice, 16 miles, graded; track-laying under way. C. J. Carpenter, Superintendent, Bunkie, La.

LOUISIANA RAILWAY & NAVIGATION CO.—Proposed branch from Hessamer, La., north to Marksville, seven miles.

LOUISVILLE & ATLANTIC.—Surveys for extension from Beattyville, Ky., east 50 miles.

*LOUISVILLE & EASTERN (Electric).—Building extension from Lakeland, Ky., east to Frankford, 46 miles; also branch from Shelbyville north to Newcastle, 16 miles.

LOUISVILLE & GREAT WESTERN TRACTION. Surveyed from New Albany, Ind., to French Lick, 53 miles, and from New Albany to Corydon, 20 miles. J. C. Henderson, New Albany, Chief Engineer.

*LOUISVILLE & NASHVILLE.—Revision of line on the Henderson division between Greenbrier, Tenn., and Guthrie, Ky., 26 miles; 16 miles completed, the rest to be done this year.

——*On the Kentucky division the revision of line from Corbin, Ky., to Livingston, 41 miles, under way; 30 miles completed last year.

——*Work under way double-tracking and changing grades between Graces, Ala., and Hardy, 17 miles. Contract reported let to N. J. Oliver, Knoxville, Tenn.

——*Building branch from main line near Helena, Ala., into the Actin coal basin, six miles.

——The North Alabama extension of the Cane Creek branch from Vulcan, Ala., to Shelton Creek, 14 miles, will be built in 1907.

A short line to the mine of the Lacey-Buck Iron Co., 1½ miles, to be built this year.

——Revision and double-tracking of main line between Oxmoor, Ala., and Helena, 9 miles.

——*Contract let to the Walton, Wilson & Rodes Co., of Knoxville, Tenn., to build the Madisonville, Hartford & Eastern from Madisonville, Ky., east and then north to Mitchell, 60 miles. George W. Feagin, Hartford, Ky., Chief Engineer of the M., H. & E.

——The Cumberland & Northern projected from Scottsville, Ky., northeast to Lebanon, Ky., 110 miles.

——Pine Mountain Railroad reported building from Williamsburg, Ky., east to Pineville, 35 miles.

——Surveys near Pineville, Ky., for line up right fork of Straight creek to coal fields, seven miles.

——The Bay Minette & Fort Morgan to be eventually extended from Foley, Ala., to Fort Morgan, 45 miles from Bay Minette. W. W. Olney, Bay Minette, Ala., Chief Engineer. (Mar. 16, 1906.)

LOUISVILLE, NEW ALBANY & CORYDON.—Proposed extension from Corydon Junction, Ind., east to New Albany, 20 miles.

LOUISVILLE, SOUTH PITTSBURG & BIRMINGHAM.—Incorporated to build from Louisville, Tenn., to Birmingham, Ala., 225 miles. C. H. Glatzan and E. Ripley, of Pittsburg; J. W. Davis, of Falconer, N. Y., and J. A. Shillito, of Crossville, Tenn., incorporators.

*LUXORA, JONESBORO & WESTERN.—Incorporated to build from Luxora, Ark., to Jonesboro, 45 miles. Contract for grading first 10 miles reported let to H. P. Liston, of Luxora, Kan. J. B. Driver, Luxora, President. (Mar. 16, 1906.)

M

MADISONVILLE, HARTFORD & EASTERN.—See Louisville & Nashville.

MADRAS & EASTERN.—Incorporated to build from Madras, Ore., east to Hay Creek coal mines and thence toward Port Ontario. W. H. Huston, Prineville, Ore., President.

MAINE & NEW HAMPSHIRE (Electric).—Organized to build from Standish, Me., south to Hollis, 10 miles. G. B. James, of Boston, President; E. E. Hastings, of Fryeburg, Me., Clerk, and A. C. Kennett, of Conway, N. H., Treasurer.

MALONE, FORT COVINGTON & HOPKINS POINT.—Incorporated to build from Malone, N. Y., north to a point in Province of Quebec, 18 miles. J. M. Cantwell and Lewis Mitchell, of Malone, incorporators.

MANGHAM & NORTHEASTERN.—Building extension from Mangham, La., to Baskinton, three miles. Address O. A. Wright, Mangham, La.

MANILA & SOUTHWESTERN.—Building with its own force from Lunsford, Ark., to Hancock, 12½ miles. Surveys under way from Hancock to Manila, 6½ miles further.

*MANILA RAILWAY.—Work has begun on the 400-mile railroad system which the syndicate formed by Speyer & Co., of New York, plans to build in the island of Luzon in the Philippine Islands. The syndicate agrees to build 428 miles in Luzon, including 100 miles in the provinces of Albay and Ambos Camarines, the line from Manila to Batanzas and Lucena with branches, and several branches from the existing line of the Manila & Dagupan, branching to the east and to the west and including a line from Dagupan to San Fernando de la Union, and a branch to the foot of the mountains near Bagnio.

MARIANNA, BRINKLEY & WESTERN.—Contracts were to be let late last year to build from Marianna, Ark., northwest to Brinkley, 28 miles. G. W. L. Brown, of Marianna, is General Manager.

MARION RAILROAD.—Incorporated to build from Fairmont, W. Va., north to Fairview, 100 miles. J. N. Hamilton, J. Gregory and J. R. Thomas, Jr., of Fairview; James R. Lynn, F. H. Bailey and A. S. Fleming, of Fairmont, incorporators.

MARION & JOHNSTON CITY.—See Missouri Pacific.

MARIETTA & LAKE.—Projected from Jewett, Ohio, south to Marietta, 101 miles; surveys under way. Proposed extension from McCleary's southwest to Chillicothe, 100 miles. W. H. Young, Chicago, President, and R. S. Blinn, Mt. Vernon, Ohio, Chief Engineer.

MARLBORO & DEEPWATER.—Incorporated to build 12 miles in South Carolina. J. J. Matheson, President; G. D. Matheson, Vice-President, and C. R. May, Secretary and Treasurer.

MARLBOROUGH RAILROAD.—Incorporated in Michigan to build from the Pere Marquette to Marlborough, Lake County. C. B. Parsons, O. B. Taylor, W. S. Duncan, H. H. Parsons and Arthur Stansell, of Detroit, Directors.

MARSH FORK.—See Tidewater.

MASCOUTAH & BELLEVILLE (Electric).—Projected from Mascoutah, Ill., to Belleville, 11 miles. Peter W. Litt, Secretary, Mascoutah, Ill.

MASON & OCEANA.—Proposed change to standard gage of 27 miles, and extension from Walkerville, Mich., south to Grand Rapids.

MATTAWAMKEAG & NORTHERN.—Organized to build from Mattawamkeag, Me., northwest to Millinocket, 22 miles. F. A. Greenwood and A. Wetherby, of Lincoln, Me., interested.

*MAYFIELD & COLUMBUS.—Contracts reported let for this line from Mayfield, Ky., to Columbus, 20 miles. W. B. Sanfield, Chief Engineer, Mayfield, Ky.

*McCLOUD RIVER.—Building with its own forces a 25 mile extension.

MEMPHIS & NEW ORLEANS.—See St. Louis & San Francisco.

*MEMPHIS, PARIS & GULF.—Projected from Memphis, Tenn., via Little Rock, Ark., to Paris, Tex., 400 miles. Contract for grading two miles from Little Rock, Ark., let to J. F. Anders. J. W. Brown, Camden, Ark., President, and C. C. Henderson, Arkadelphia, General Manager.

MERIDIAN & TOMBIGBEE.—To build from Meridian, Miss., northwest to Philadelphia, 50 miles. Surveys. C. F. Woods, J. M. McBeath, A. D. McCraven, Frank Heiss, of Meridian, and D. P. Phillips interested.

*MICHIGAN CENTRAL. — Detroit River Tunnel Co. building the Michigan Central's new railroad tunnel under the Detroit river between Windsor, Ont., and Detroit, Mich. The length of the underground part of the tunnel will be 2.6 miles, and the distance from surface to surface about three miles. Contract let to the Butler Brothers-Hoff Co., of New York. Design "A" modified is being used. The contract calls for the completion of the work by June 1, 1909. See *Railroad Gazette* Feb. 16, 1906, p. 149, and Feb. 23, 1906, p. 184.

MIDDLESBORO MINERAL.—See Southern.

*MIDDLETOWN & CECILTON.—Building from Middletown, Del., via Warwick, Md., to Cecilton, Fredericktown and Georgetown, Md., 12 miles. Contracts let to W. R. Polk, Middletown, for nine miles; 7½ miles graded, but no track laid. Proposed branch from Cecilton to Bayview, seven miles. W. R. Polk, Wilmington, Del., General Manager.

MIDLAND VALLEY.—Proposed extension from Hoye, Tex., south to Texarkana, 150 miles.

MID-OREGON & EASTERN.—Incorporated to build from Portland, Ore., southeast through the Cascade mountains, then east to point on Snake river, 325 miles. C. H. Monroe, David Leppert and C. L. Tobias, incorporators.

MILLEN & SOUTHWESTERN.—See Georgia & Florida.

MILLTOWN AIR LINE.—Projected from Naylor, Ga., southwest to Valdosta, 15 miles.

MILWAUKEE & FOX RIVER (Electric).—Incorporated to build from Cedarburg, Wis., to Chilton; thence to Kaukauna and Appleton, 80 miles; also a branch southwest from Chilton to

Fond du Lac, 30 miles. J. M. Seaman, of Sheboygan; G. Bricknauer, J. B. Connell, H. W. Wilson, F. Phillips, A. J. Pullen, incorporators.

MILWAUKEE, PEORIA & ST. LOUIS. -Incorporated to build from Peoria, Ill., north to Rockford, 125 miles. (Mar. 16, 1906.)

MILWAUKEE, ROCKFORD & EASTERN.—See Illinois, Indiana & Gary.

MINERAL BELT. -Projected from Florence, Tenn., to Manning, 15 miles. T. H. Allen, Florence, Interested.

MINIDOKA & SOUTHWESTERN. See Oregon Short Line.

MINNEAPOLIS & GREAT NORTHERN.—See Great Northern.

•MINNEAPOLIS & RAINY RIVER.—Building an extension from Big Fork, Minn., 13 miles; further extension of 80 miles to International Falls projected.

•MINNEAPOLIS & ST. LOUIS. Contracts let to Winston Bros. Co., of Minneapolis, for extending the Minnesota, Dakota & Pacific from Chelsea, S. Dak., to Le Beau, 83.42 miles.

MINNEAPOLIS & ST. PAUL SUBURBAN. This subsidiary of the Twin City Rapid Transit Co. will extend several lines from Minneapolis, Minn., north and west.

•MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.- Building double-track line of its own into St. Paul from Soo Junction to Seventh and Kittson streets; includes 1,500-ft. tunnel under Great Northern and Northern Pacific tracks.

——•Contract reported let for preliminary work and grading on branch from Brooten, Minn., northeast to Duluth, 175 miles.

MINNESOTA & INTERNATIONAL.—See Northern Pacific.

MINNESOTA, DAKOTA & PACIFIC.—See Minneapolis & St. Louis.

MIONA SPRINGS.—To build from Fort Valley, Ga., west to Southland, 27 miles. J. R. Lane, C. B. Culpepper and A. O. Brewton, of Fort Valley, incorporators. J. R. Lane, General Manager.

MISSISSIPPI & ALABAMA.—See Illinois Central.

•MISSISSIPPI CENTRAL.—Building from Hattiesburg, Miss., southeast 18 miles; track laid for 10 miles, and eight miles is under construction. Bowles & Hemingway, contractors.

——•Contracts let to the Worthington Construction Co., of Brookhaven, Miss., and the O. A. Gibson Construction Co., of Natchez, Miss., to build the Natchez & Eastern from Brookhaven, Miss., west to Natchez, 66 miles.

•MISSISSIPPI EASTERN.—Building five-mile extension from Camp, Miss.

MISSISSIPPI GARDEN.—To build from Hattiesburg, Miss., north to Carthage. G. A. Flater, of Toledo, Ohio; S. P. Floeter, of New Albany, Miss., and W. F. Floeter, of Taylorsville, Miss., incorporators.

•MISSISSIPPI ROADS.—W. Denny & Co. are building from Moss Point, Miss., north to Donavan, 40 miles; 19 miles completed.

——Application made to incorporate company to build from Gulfport, Miss., north to West Point, 220 miles.

•MISSOURI & NORTH ARKANSAS.—Formerly St. Louis & North Arkansas. Projected extensions from Seligman, Mo., northwest to Joplin, 50 miles, and from Leslie, Ark., southeast to Helena, 100 miles. Contracts let to M. C. Burke and L. S. Joseph, of Cape Girardeau, Mo., and Leslie, Ark., from Seligman to Nesho, 41½ miles, and to Scott & Dalhoff, of Nesho, from Leslie to Searcy, 96 miles.

•MISSOURI, ARKANSAS & SOUTHWESTERN.—Building from Batesville, Ark., northeast to Black Rock, 52 miles; 30 miles surveyed. B. I. Brookfield, Jonesville, Ark., Chief Engineer.

MISSOURI, IOWA & NEBRASKA.—Incorporated to build from Millard, Mo., northwest to Sioux City, Ia., 300 miles.

MISSOURI, KANSAS & TEXAS. — Surveys reported for a line from Wichita Falls, Tex., north to Lawton, Okla.

——Surveys reported for branch from Mineral, Kan., to Pittsburg. (Mar. 16, 1906.)

•MISSOURI, OKLAHOMA & GULF.—Contracts let for grading and bridge work to J. W. Hoffman & Co., of Kansas City, Mo., on an extension from Wagoner, Ind. T., north to Afton, 70 miles. Projected north to Pittsburg, Kan., with branch east to Joplin, Mo., from Henryetta west to Shawnee, Okla. T., 50 miles, from Dustin south to Denison, Tex., 128 miles.

MISSOURI PACIFIC.—Contracts let as follows:

——•On the Gurdon & Fort Smith Northern, from point near Caddo Gap, Ark., to near Black Springs, 9.62 miles, to the Dalhoff Construction Co., Little Rock, Ark.

——•Wabash Southern from five miles northeast of Zeigler, Ill., to Benton, 4.37 miles, to the J. A. Ware Construction Co., of St. Louis, Mo.

——•Marion & Johnston City from Marion, Ill., to Johnston City, 9.44 miles, to T. E. Newell, of Marion, Ill.

——•Springfield Southwestern between Crane, Mo., to Springfield, 34.36 miles, to the Willier Construction Co., of Springfield, Mo. Sub-contracts let to R. M. Busbman and A. M. Hanson, of Springfield, Mo., for 20-mile extension into Springfield.

——Proposed extension from Atchison, Kan., to St. Joseph, Mo. Land bought for terminal facilities. Not yet authorized.

——Surveys for branch from Joplin, Mo., southwest to Muskogee, Ind. T., 120 miles.

——Proposed cut-off from Lamar, Mo., northeasterly to the St. Louis-Kansas City line. Not authorized.

•Contract let to Johnston & Grommet Bros. for new line of the St. Louis, Iron Mountain & Southern from Eudora, Ark., south to Gilbert, La., 78 miles; 37 miles built last year.

——Surveys reported by the St. Louis, Iron Mountain & Southern from Benson, Mo., south to the Mississippi River opposite Hickman, Ky., 25 miles.

——Surveys made by the Denver & Kansas Northern to build from Stockton, Kan., southwest to Scotts, 125 miles.

MISSOURI RIVER & GULF.—Incorporated at Topeka, Kan., to build from Kansas City to Denison, Tex., the northern terminus of the Houston & Texas Central, with branches to Shreveport, La., and Joplin, Mo. K. L. Browne, A. L. Berger, C. K. Wells, S. N. Prouty, B. R. Lane and W. Freeman, of Kansas City, Kan., directors. May be a Harriman project.

MOBILE & WEST ALABAMA.—Surveys made for a line from Mobile, Ala., to Florence, also a branch into Birmingham; 14 miles built last year.

MOBILE & WESTERN. Extension projected from Mission Church, Ala., west to the Mississippi River.

MOHAWK VALLEY CO. (Electric).—See New York Central & Hudson River.

MOLINE, ROCK ISLAND & EASTERN TRACTION.—Incorporated by J. F. Porter, F. G. Young, J. R. Lardner, K. Casteel and D. F. Peck, of Rock Island, to build from Rock Island Ill., to Carbon Cliff; also from Rock Island south to Galesburg.

MONONGAHELA RAILROAD.—See Pennsylvania.

•MONTANA NORTHERN (Electric). — Projected from Basin, Mont., to Kalispell, 216 miles. Work under way on first 10 miles.

•MOREHEAD & NORTH FORK.—Contract let to the Snyder Construction Co. for line from Morehead, Ky., to Paragon, 10 miles. Subcontracts let to the Rinehart-Dennis Co., for three miles, including a 1,400-foot tunnel. Grading completed and three miles of track laid. E. W. Hess, Chief Engineer, Clearfield, Pa.

MORGANFIELD & ATLANTA.—Projected from Morganfield, Ky., south to Providence, 28 miles. Surveys and rights. T. B. Young, President, and W. W. Olney, Chief Engineer, Morganfield, Ky. (March 16, 1906.)

MORGANTOWN & DUNKARD VALLEY.—Proposed line from Morgantown, W. Va., to Mannington, 42 miles. W. W. Smith, Secretary, Morgantown, W. Va.

MORGANTOWN & PITTSBURG.—Incorporated to build 12 miles in Green County, Pa. W. P. Rainbow, of Pittsburg, President. P. G. McClelland, J. S. Weller, J. B. Chalfant, R. W. Martin and J. E. Sampson, Pittsburg, Directors.

MORGANTOWN & SOUTHERN (Electric).—Incorporated to build from Morgantown, W. Va., southwest to Fairmont, 28 miles. J. W. Wiles, President, and J. R. Johnson, Chief Engineer, both of Morgantown.

MUHLENBERG & EASTERN.—Incorporated to build from Central City, Ky., east to Rochester, 20 miles. G. T. Westerfield and T. O. Jones, Central City; W. P. Ennis, S. Murray and J. R. Drake, Bowling Green, incorporators.

MUNCIE & PORTLAND TRACTION.—Work under way on an extension from Portland, Ind., to Celina, O.

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NACOGDOCHES & SOUTHEASTERN. Proposed extension from Hayward, Tex., to Nacogdoches.

NAPA & VACA VALLEY. — To build from Vallejo, Cal., to Vacaville, 30 miles. E. H. Winship, H. M. Meacham and D. A. Dunlap, of Napa, incorporators.

NAPIERVILLE JUNCTION.—See Delaware & Hudson.

NASHVILLE & HUNTSVILLE (Electric).—To build from Nashville, Tenn., via Birmingham and Montgomery, Ala., to Pensacola, Fla. J. H. Connor, President.

NASHVILLE & VALDOSTA.—Organized to build from Valdosta, Ga., north to Nashville, 35 miles.

•NASHVILLE, CHATTANOOGA & ST. LOUIS.—Track laying under way on new yards near Atlanta, Ga.

——Cairo, Mayfield & Nashville to build from Murray, Ky., to Cairo, Ill., 60 miles.

NATCHEZ & EASTERN.—See Mississippi Central.

•NATCHEZ, COLUMBIA & MOBILE. — Building with own forces extension from Loweton, Miss., to Pearl river, 3½ miles.

NEBRASKA, KANSAS & SOUTHWESTERN.—Incorporated to build from Superior, Neb., southwest to Morton County, Kan., 300 miles. A. W. Wilson, H. C. Floyd, J. C. Hopper, C. H. Rassfield and R. D. McKinley, incorporators.

NEVADA-CALIFORNIA-OREGON.—Surveys being made for an extension from nine miles north of Madeline, Cal., to Alturas, Cal., 30 miles.

NEWCASTLE & NEW WILMINGTON.—Incorporated to build a 10-mile line in Lawrence County, Pa. J. H. Venzey, President; J. J. Ashenhurst, C. Freeman, C. E. Trainor and G. N. Nealy, New Wilmington, Directors.

•NEW JERSEY SHORT LINE (Electric).—Building from Milltown, N. J., to Elizabeth, 19 miles. Contracts let to the Schuylkill Stone Co., of Philadelphia, Pa., from Metuchen to Elizabeth, 10 miles grading half finished, but no track laid. Additional contracts shortly to be let. Richard I. D. Ashbridge, Weagel Building, New Brunswick, N. J., Chief Engineer.

NEW LONDON & EAST LYME STREET RAILWAY.—Proposed extension from Niantic, Conn., west to the Connecticut river, about 8 miles.

NEW ORLEANS & BATON ROUGE Electric). — To build from New Orleans, La., northwest to Baton Rouge, 100 miles. W. O. Orton, C. S. Young, Edward Goodchaux, R. H. Hunel and F. E. Lowe, incorporators.

NEW ORLEANS & NORTHERN MIDLAND. — Incorporated in Louisiana to build north to the Ohio river. H. O. True, Memphis, Tenn., President.

NEW ORLEANS, CROWLEY & WESTERN.—Incorporated to build from New Orleans to the Missouri, Kansas & Texas in Texas. W. F. Owen, President.

•NEW ORLEANS GREAT NORTHERN. — Contracts let to W. J. Oliver, of Knoxville, Tenn.; Smith & Scott, Memphis, Tenn.; the Worthington Construction Co., of Alabama; E. W. Hanlon, of New Orleans, La., and to Shea & Ford, Buffalo, N. Y., for building various sections of its line as follows: May's Creek, Miss., to Jackson, 54 miles; Lawrence Creek, La., to Tylertown, Miss., 23 miles, and Slidell, La., via Mandeville to Abita Springs, 26 miles.

NEW ORLEANS, NATCHEZ & PACIFIC.—Organized to build from Natchez, Miss., south to New Orleans, 160 miles. A. B. Wheeler, New Orleans, President; W. J. Poitevant, New Orleans, First Vice-President; R. F. Larned, Natchez, Treasurer, and C. E. Moritz, Natchez, Secretary.

•NEW RIVER, HOLSTON & WESTERN.—Contracts let to the Sale Construction Co., of Narrows, Va., for extension from Boxley, Va., to Day, two miles.

•NEWTON & NORTHWESTERN.—Contract let to J. G. White & Co., of New York, for electrifying this road from Newton, Ia., northwest to Rockwell City, 102 miles.

NEW YORK & PORTCHESTER.—See New York, Westchester & Boston.

NEW YORK & QUEENS COUNTY (Electric).—Proposed extensions to Bayside and Whitestone, Long Island, and eventually to Douglaston and Little Neck.

•NEW YORK, AUBURN & LANSING (Electric).—Grading finished on this line from Auburn, N. Y., to Ithaca, 39 miles. Track laid from Auburn to Genoa, 19 miles. H. A. Clarke, Chief Engineer, Wright avenue, Auburn, N. Y.

•NEW YORK CENTRAL & HUDSON RIVER.—Work in progress widening the line for four tracks at various points on the Hudson division, 27 miles. Grade crossing elimination and improvement at Yonkers has been approved by the Railroad Commissioners and is under way.

——On Grand Central Station improvement the excavation of section No. 2 of the main yard west of the Lexington avenue yard begun.

——•Improvement work for large new Bronx station at 149th street, New York, in progress.

——Tracks in Tenth and Eleventh avenues, New York, to be removed from the surface of the streets. Not yet determined whether they will be elevated or depressed in a subway.

——Planning a two-track subway under West Fifty-third street, New York City, to connect the present Park avenue tunnel with the proposed subway under Eleventh avenue.

——•Large new yard at Gardenville, near Buffalo, N. Y. Work begun.

——•Electrification of 44 miles of the West Shore between Utica and Syracuse for joint interurban service by the Mohawk Valley Co. Nearly finished.

——Plans made for betterments on the Boston & Albany as follows: 14½ miles of third track between Pittsfield, Mass., and Albany, N. Y.; additional track at Charlton, Mass.; extension of third and fourth tracks from Lake Crossing, Mass., west to South Framingham, about five miles, and terminal improvements in Boston.

•NEW YORK, CHICAGO & ST. LOUIS.—Laying 50 miles of second track in Illinois, Indiana and Ohio.

NEW YORK CONNECTING.—See Pennsylvania.

•NEW YORK, NEW HAVEN & HARTFORD.—Harlem River branch from Harlem River to New Rochelle, N. Y., now double track, is being six-tracked. Contract let to Daly & Holbrook. Four tracks will be equipped electrically with the third-rail system. Estimated cost of the entire work on this branch, $7,701,881; $4,825,891 for the roadway and stations, and $2,285,000 for the electrical equipment and apparatus.

——•Electrification of line from Wakefield, N. Y., east to Stamford, Conn., nearly finished.

——•Further double-tracking of the Highland division from Danbury, Conn., east to Hawleyville 5.6 miles and from Waterbury, and rebuilding northeast to Bristol, 10 miles by the new line. Contract for first section let to Lathrop & Shea, of Brooklyn, N. Y. Waterbury to Bristol involves relocation of much of the line and a 3,500-foot tunnel at Pequabuck, Litchfield County. Work under way.

——•The Providence Terminal Co. is building a line from the main line station at Providence, R. I., under the river to East Providence, 2.70 miles. This includes a tunnel about two miles long and to cost $2,000,000, under the city.

——•Widening cut through the city of New Haven for four tracks, 1.65 miles. C. B. Rakeslee & Sons, of New Haven, have the contract.

——•New four-track bridge on the New York division at Naugatuck Junction. Nearly finished.

——Large improvements to be made to freight and steamship terminal facilities in Boston.

——The remaining 20 miles of the Providence division are to be four-tracked.

——The air line between New Haven and Willimantic, 34 miles, to be straightened and rebuilt.

——The Danbury & Portchester is to build a new double track cut-off from New York division near Greenwich, Conn., via Ridgefield, to

Highland division west of Danbury, 30 miles; will shorten distance between New York and Danbury 15 miles.

——Surveys made some time ago for cut-off from Plantsville, on the Northampton division, southeast to Yalesville on the Hartford division, eight miles.

——Authority asked for a line from present southern terminus of main line at Woodlawn, 12 miles north of New York, south along the east bank of the Bronx river, four miles, to connection with Harlem River & Portchester branch near West Farms, four miles north of Harlem River terminus.

——The Consolidated Railway, building an extension of the Springfield & Eastern (Electric) from Monson to Fiskdale, 12 miles; and to South Monson, one-half mile.

——*Contract let by Consolidated Ry. to C. W. Blakesley & Sons, New Haven, Conn., to build the Naugatuck Valley (Electric) from Naugatuck, Conn., to Seymour, 8 miles; track laid for 5 miles.

——*Consolidated Ry. building electric roads from Waterbury, Conn., to Woodbury, 13 miles, and from Waterbury to Thomaston, 6 miles.

——See East Side Viaduct.

NEW YORK NORTHERN (Electric).—Organized to build from Watertown, N. Y., south to Oswego, 70 miles. F. P. Shines, President.

NEW YORK, PITTSBURG & CHICAGO AIR LINE (Electric).—See Keystone Air Line.

*NEW YORK SUBWAYS.—Subway to Brooklyn from the Battery, Manhattan, under the East river, and Joralemon and Fulton streets to the Flatbush avenue station of the Long Island R. R., Brooklyn. Work under way.

——Bids to be asked shortly for a four-track subway loop to connect the Brooklyn and Williamsburg bridges. Work will cost $5,245,000 and take three years.

*NEW YORK, WESTCHESTER & BOSTON (Electric).—Work under way from 177th street, New York, north to the city boundary, 4¼ miles. Contract let to James P. McDonald, 42 Broadway, New York City. Proposed line is from Harlem river at 129th street, north through West Farms, Westchester, Bay Chester, Pelham Manor, Pelham, New Rochelle, Larchmont, Mamaroneck, Harrison and Rye to Port Chester to the Connecticut line, with branch from Pelham through Mount Vernon, Alameda Park, Fairview Park, Tuckahoe, Arthur Manor and Scarsdale to White Plains, N. Y., in all 38 miles. The New York & Portchester, which has franchises over nearly same route, now controlled by same interests. William L. Bull, President, and William A. Pratt, Chief Engineer, 30 Broad street, New York.

NIAGARA PENINSULA.—Projected from Port Colborne, Ont., west to Welland. Rowell, Reid Wilkie, Wood and Gibson, of Toronto, solicitors.

NITANNY RAILROAD.—Incorporated to build from Cedar Springs, Pa., north to Millhall, four miles. W. C. Lingle, of Patton, President.

NORFOLK & CAROLINA COAST.—A syndicate represented by Rudolph Kleybolte & Co., of New York, has organized this company to build from Norfolk, Va., to Beaufort, N. C., with branches 200 miles. (Mar. 16, 1906.)

*NORFOLK & SOUTHERN.—Contracts let to H. H. George, Richmond, Va., and J. G. White & Co., of Wilson, N. C., and New York, for work in North Carolina, on the Norfolk & Southern, the Raleigh & Pamlico Sound, the Virginia & Carolina Coast, and the Atlantic & North Carolina, as follows: From Raleigh to Zebulon, 25 miles; Zebulon to New Bern, 105 miles; Farmville to Snow Hill, 10 miles, and Bayboro to Oriental, 10 miles; 53 miles of grading finished and 45 miles of track laid. Other contracts to be let soon for work from Mackay's Ferry to Edenton, 10 miles.

——*Contract let to J. A. Wilkinson to build cut-off from Bishop Cross west to Pinetown, 10 miles.

*NORFOLK & WASHINGTON AIR LINE.—Contract for construction and equipment of this line from Washington, D. C., to Esperanza, Md., 64 miles, let to D. E. Baxter & Co., Inc., New York. A. B. Linderman, Philadelphia, Pa., President.

NORFOLK & WESTERN.—This company has work under way to be completed during 1907 as follows:

——*The Virginia & Potts Creek, to be built from the terminus of the Interior & West Virginia to Potts Creek, Va., 11 miles.

——*The Interior & West Virginia, to be built from the terminus of extension of Big Stony through Monroe County, W. Va., to Virginia State line, 17½ miles.

——*The Big Stony, to be extended from Interior, Va., to West Virginia state line, six miles.

——*The Pocahontas & Western, to be extended 4½ miles up Laurel Creek in Virginia.

——Also double-tracking and revision of line is proposed between Walton, Va., and Pearisburg, 19 miles, including new tunnels, and between Vivian, W. Va., and Thacker, 50½ miles.

——*Contracts reported let for six tunnels aggregating 6,100 feet on the West Virginia division, to cost about $3,000,000, and be completed within three years.

NORTH & SOUTH TEXAS.—Contracts to be let for 34 miles from two miles north of Groveton, Tex., to Lufkin; also from Groveton to Oakhurst, 25 miles. Surveys from Oakhurst to Houston, 70 miles. McCarthy, Starnes & Co., Lufkin, Tex., interested.

NORTH ALABAMA.—See Louisville & Nashville.

NORTH CAROLINA & OHIO.—Organized to build from Raleigh, N. C., east to Washington, 90 miles. C. O. Haines and Adam Tredwell, of Virginia; John S. Cunningham, Steven C. Bragaw, L. J. Moore, C. M. Brown and W. Bragaw, of North Carolina, Directors. (Mar. 16, 1906.)

NORTH CAROLINA CONNECTING. — Incorporated to build from Springhope, N. C., northwest to Roxboro, 60 miles. D. W. Gunn, of Roanoke, La.; D. J. Nysewander and S. P. Douglas, of Toledo, Ohio; T. F. Whittlesey, of Mobile, Ala.; W. H. Hood and H. H. Hood, of Henderson, N. C., incorporators. (Mar. 16, 1906.)

NORTH COAST.—Projected from North Yakima, Wash., on the route of the St. Paul's Pacific extension west through Tieton Pass to Kosmos. Surveyed and part of right of way secured. Reported to be a St. Paul project. R. E. Strahorn, Spokane, President.

NORTH MISSISSIPPI & BAY SPRINGS.—To build from Burnsville, Miss., south to Itawamba County line, 30 miles. F. J. Ozanne and E. B. Causey, all of Memphis, Tenn., incorporators. (Mar. 16, 1906.)

*NORTH NEW MEXICO & GULF.—Building from Espanola, N. Mex., to Abiquin, 25 miles. Surveys under way for 10 miles additional from Abiquin. William H. Coe, of New York; E. B. Miller, of El Rito, N. Mex.; G. H. Howard, of Santa Fe; G. V. Howard, of Boulder; F. E. Coe, of Denver, Colo., incorporators.

NORTH RIVER.—Chartered in Virginia to build railroads. R. M. Gillespie, New York, President, and C. B. Williamson, Harrisonburg, Va., Secretary and Treasurer.

NORTH SHORE (Cuba).—Incorporated to build from a point on Mayanabo Bay, north of Nuevitas, in province of Puerto Principe, Cuba, west through Cubitas Valley to Caibarien, a port in province of Santa Clara, 250 miles; also a 50-mile branch from Senada to iron mines south of the Cubitas mountains. C. D. Gibbons, 106 Wall street, President.

NORTH SHORE & WESTERN (Electric).—To build from Elgin, Ill., west to Evanston, 35 miles. George P. Merrick, 100 Washington street, Chicago, Attorney. William C. McHenry, E. R. Fifer, George P. Merrick and William A. Love, of Chicago, incorporators.

*NORTH YAKIMA & VALLEY.—Contract let to Allen & Mathieson for grading part of this road through Naches Pass, in the Yakima Valley, Wash. George Donald, of North Yakima, interested. (Mar. 16, 1906.)

*NORTHEASTERN TEXAS.—Work under way on the remaining 40 miles of this road between Red Water, Tex., and Texarkana; 14 miles built from Red Water south to Daingerfield. G. Munz, Red Water, Tex., President, and R. E. Gray, Chief Engineer. (Mar. 16, 1906.)

*NORTHERN ELECTRIC. — Building extension from Marysville, Cal., to Sacramento, 30 miles; nearly finished.

——Extension surveyed from Red Bluff, Cal., north to Redding, 40 miles.

NORTHERN MICHIGAN.—Projected from St. Ignace, Mich., northeast to Sault Ste Marie, 49½ miles. A. S. Robinson, Sault Ste. Marie, Chief Engineer.

NORTHERN MICHIGAN (Electric). — Incorporated to build from Manistee, Mich., northeast to Cheboygan, 220 miles. Surveys under way. F. O. Olsen, of Traverse City, interested.

NORTHERN OF MAINE.—Projected from a point near Fort Kent, Me., southwest to the St. Johns and the St. Francis rivers, 25 miles; also east to Frenchville, Madawaska and Grant Isle, thence southeast to Van Buren, 35 miles. Arthur H. Lewis, Chicago; V. N. Therriault, Fort Kent; E. E. Goodrich, Waterville, and E. R. Michand, Frenchville, interested.

*NORTHERN PACIFIC.—Contract reported let to Doherty & Dempsey, of Bemidji, Minn., to extend the Minnesota & International from Big Falls northeast to International Falls, 37 miles.

——*Extension from Culdesac, Idaho, southeast to Grangeville, 55 miles; grading completed for 15 miles. Porter Brothers & Walsh, Spokane, Wash., reported to have the contract. Will be finished this year.

——Surveys reported from De Smet, Mont., to St. Regis, in the Coeur d'Alene country, 72 miles, to relocate the Coeur d'Alene branch.

——Proposed cut-off around Valley City, N. Dak., from Alta west to Berea.

——Location maps filed for branches, one from Mandan, N. Dak., south to the Standing Rock Indian reservation, 40 miles, the other from Mandan north, to point on Missouri river in Mercer County, near Mannhaven, 60 miles.

——*Work begun on the Port Townsend Southern from Quilcene, Wash., south to the N. P. main line, probably at Olympia.

——Proposed cut-off from Lind, Wash., west 100 miles to Ellensburg. (Mar. 16, 1906.)

——Extension of McHenry branch from McHenry, N. Dak., through Fort Totten Indian reservation to Oberlin, 40 miles. (Mar. 16, 1906.)

——Proposed extension from Turtle Lake, N. Dak., west to Coalharbor, McLean County, 24 miles. (Mar. 16, 1906.)

——See Oregon, Washington & Idaho under Oregon Railroad & Navigation Co.

——See Portland & Seattle.

NORTHWESTERN PACIFIC.—See Southern Pacific.

NORTHWESTERN RAILROAD. See Oregon Short Line.

NORWAY & WESTERN. Incorporated to build from Norway, Me., to East Stoneham; also from Norway to South Waterford, total 21 miles. J. Bartlett, of Stoneham; L. S. Burnham, of Albany, Me.; W. G. Rand, of Boston, Me.; F. H. Noyes, of Norway, and W. H. Kilgore, of North Waterford, Directors. (Mar. 16, 1906.)

NORWOOD & ST. LAWRENCE.—The Raymondville & Waddington incorporated to build an extension from Raymondville, N. Y., to Waddington, 15 miles.

*NUECES VALLEY, RIO GRANDE & MEXICO.—Building from Carrizo Springs, Tex., to Del Rio, 123 miles. Contract let to Ward & Lee, of Palestine, for first 20 miles. W. A. Squires, Carrizo Springs, Tex., General Manager. (Mar. 16, 1906.)

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OAK POINT & ELYRIA.—Incorporated with office at Elyria, Ohio, to build railroads. A. R. Mannering, E. S. Cooke and F. S. McGowan, incorporators.

*OCEAN SHORE (Electric).—Building double-track line from San Francisco, Cal., south to Santa Cruz, 83 miles. Contracts let to the Rialto Construction Co. from San Francisco to Ocean View, eight miles; to Willitt & Burr, the Ransome Construction Co. and Mahoney Bros. from Ocean View to Mussel Rock, 4¾ miles; to the Ransome Construction Co., Lewis Moring and Antonelli & Bandman from Mussel Rock to San Cruz, 83 miles; to the Ransome Construction Co., from San Pedro Mountain to Wadse Beach, 41 miles, and to Shattuck & Desmond and Pratchner & Chadwick from Wadse Beach to Santa Cruz, 21 miles. Grading all finished. Track laid for 22 miles. Steam to be used for freight service. J. Downey Harvey, President; Burke Corbet, Secretary; J. B. Rogers, Chief Engineer, San Francisco.

——The San Joaquin Valley Western reported incorporated to build extension from Santa Cruz, Cal., east via Holester toward Fresno, 40 miles.

——The Ocean Shore & Eastern incorporated to build a branch from Santa Cruz, Cal., southeast to Watsonville, 20 miles.

——The Pascadero Railway & Improvement Co. is to build a branch from the Ocean Shore up Pascadero Creek, Cal., eight miles. John B. Rogers, Chief Engineer of the Ocean Grove, is an incorporator.

OCEAN SHORE & EASTERN.—See Ocean Shore.

*OCILLA & VALDOSTA.—Extension from Ocilla, Ga., south to Allapaha, 17 miles. Six miles graded.

OCONEE COUNTY.—Organized to build from Westminster, S. C., south to Fair Play, 12 miles. W. P. Anderson and William Bibb, of Westminster; A. W. Shelor, of Walhalla; J. J. Hailey and L. A. Edwards, of Oakway; J. K. Heller, of Fair Play, and J. W. Shirley, of Townville, incorporators. (Mar. 16, 1906.)

OHIO & LICKING VALLEY.—Surveyed from Cannel City, Ky., northwest to Hillsboro, Fleming County, 72 miles.

OHIO RIVER & COLUMBUS.—Proposed extension from Ripley, Ohio, to Maysville, Ky., 10 miles. (Mar. 16, 1906.)

OHIO RIVER & GULF.—Projected from Johnson Stand, Tenn., north to Jamestown, 34 miles; surveys made. William Cooper, Maryland, Tenn., President; J. E. Jones, Monterey, Tenn., Secretary and Treasurer; Major R. B. Moscrep, Maryland, Tenn., Engineer. (Mar. 16, 1906.)

OHIO RIVER NORTHERN.—Chartered to build from East Liverpool, Ohio, to Lisbon, 21 miles. P. F. Smith, Pittsburg; John C. Wallace, Alfred T. Kelley, J. N. Vodrey, G. W. Clark and D. M. McLane, incorporators. (Mar. 16, 1906.)

OKLAHOMA & CANADIAN RIVER.—To build from El Reno, Okla., northwest to Meade, Kan., 245 miles. E. E. Blake, H. B. Low and C. O. Blake, of El Reno, and P. E. Walker and M. A. Low, of Topeka, incorporators.

*OKLAHOMA & CHEROKEE CENTRAL. — Contract let to Maney Bros., Oklahoma City, for building first 14 miles from Chelsea, Okla., toward the Verdegris river. Eventually to be extended to Pryor Creek. G. M. Green and C. R. Havighorst, of Guthrie, interested. (Mar. 16, 1906.)

*OKLAHOMA & NORTHWESTERN. — Proposed line from Elk City, Okla., to point in Beaver County, 100 miles. Grading begun from Doxey northwest on 75 miles. E. B. Niess, 171 La Salle street, Chicago, President; Henry Jarvis & Co., Chicago, Engineers. (Mar. 16, 1906.)

OKLAHOMA & TEXAS.—Incorporated to build from Oklahoma City to Wichita Falls, Tex., 200 miles. Surveys made. G. B. Stone, Oklahoma City. (Mar. 16, 1906.)

*OKLAHOMA CENTRAL.—Contracts let for extension from Purcell, Ind. T., west to Chickasha, 42 miles. Surveys made from Lehigh southeast to Paris, Tex., 86 miles. F. C. Hand, Chief Engineer of Construction, Purcell.

OKLAHOMA CITY & SHAWNEE TRACTION.—To build from Oklahoma City, Okla., southeast to Shawnee, 40 miles. Sherman Collins, Ithaca, N. Y.; O. P. Wortman, W. F. Young, of Oklahoma City; W. H. Crane and Samuel Ketchum, of Adrian, Mich., incorporators.

OKLAHOMA NORTHERN. — To build from Thomas, Okla., northwest to Taloga, 35 miles. A. A. Patterson, of Benton Harbor, Mich.; C. D. Nichols, of Oklahoma City; F. L. Black, of Taloga, incorporators.

OKLAHOMA, TEXAS & GULF.—Incorporated to build from Clarendon, Tex., through Oklahoma to Hopb, Ark., 350 miles. Charles M. Meeker, President, 50 Broadway, New York. F. B. Wildman, of Blair, Okla.; E. A. Williams, of Roosevelt, Okla.; C. A. Huber, of Weatherford, Okla.; R. K. Wooten, of Chickasha, Ind. T.; J. W. Buchanan, of Van Buren, Ark.; R. Burge, Felix P. Both and L. B. Comer, all of Fort Worth, Ark., interested.

*OKLAHOMA, TEXAS & WESTERN.—Contract let to build from Clinton, Okla., northwest to Cheyenne, 20 miles. L. L. Collins, A. C. Miller, L. W. Pate and R. V. Converse, of Cheyenne, and D. D. Fitzgerald, of New York, Directors.

OMAHA & DENVER SHORT LINE.—Incorporated to build from Denver, Colo., east to Omaha, Neb., 500 miles. Offices in Denver and New York. C. M. Allaire, C. S. Revere, D. B. Ellis, C. L. Horton, P. Robinson, Samuel F. Rathvon, Secretary and Treasurer of the United Oil Co.; Frederick R. Ross and George A. H. Fraser, the last three of Denver, are interested.

OMAHA & NEBRASKA CENTRAL (Electric).—Projected from Omaha, Neb., to Hastings, 200 miles.

OPELOUSAS, GULF & NORTH EASTERN. See Texas & Pacific.

ORANGE & KEYSVILLE.—Projected from Dillwyn, Va., south to Keysville, 40 miles. Surveys made and grading finished for 10 miles. R. T. Hubard, Dillwyn, Va., President.

OREGON & EUREKA.—Projected extension from Luffenholtz, Cal., north 18 miles.

——Grading to be begun on extension of the Little River spur in California from Camp 15 to Camp 17—three miles.

OREGON & SOUTHEASTERN.—Projected extension from mile post 20, in Oregon, to Bonita, seven miles.

OREGON & WASHINGTON.—See Oregon Railroad & Navigation Co.

OREGON EASTERN.—See Southern Pacific.

*OREGON ELECTRIC.—Contracts let to W. S. Barstow & Co., of New York and Portland, for building this line from Portland, Ore., to Salem, 50 miles; eight miles built.

*OREGON RAILROAD & NAVIGATION CO.—The Oregon, Washington & Idaho is being built by the O. R. & N. and Northern Pacific jointly from Texas Ferry, Wash., opposite Riparia, east to Lewiston, Idaho, 72.3 miles. To be finished this year.

——*Building from St. John's, Ore. (near Portland) east 20 miles to main line near Troutdale, to form second line between Troutdale and Portland; part graded.

——*Contract let to Erickson & Peterson, of Portland, Ore., for extending the Ilwaco Railway & Navigation Co.'s line from Ilwaco, Wash., west 14 miles; projected three miles further to Knappton.

——*Contract let to Erickson & Peterson for 47 miles from Elgin, Ore., to Joseph, 63 miles.

——The Oregon & Washington, incorporated to build from Portland, Ore., north to Puget Sound, about 230 miles. Surveys made to Tacoma.

——The Umatilla Central, located from Pendleton, Ore., to Pilot Rock, 14 miles.

——Proposed extension of the Columbia Southern from Shaniko, Ore., south 50 miles. (Mar. 16, 1906.)

*OREGON SHORT LINE.—Contract let to Utah Construction Co., Ogden, Utah., to extend the Yellowstone Park Railroad from mile post 40, 23½ miles north of Marysville, Idaho, to west side of Yellowstone National Park, 46½ miles.

——*Contracts let to Corey Bros. Construction Co., Ogden, Utah, to extend the Minidoka & Southwestern from Twin Falls, Idaho, to Buhl, 15 miles. Graded for three miles; two miles of track laid. Projected ten miles further to point on Salmon river.

——*Contracts let to Utah Construction Co., Ogden, Utah, to build the Northwestern Railroad from Blakes spur north to Homestead, 58 miles; includes 2,200-ft. tunnel east of Huntington, Ore.

——*Contract let to Utah Construction Co., Ogden Utah, for spur from Tecoma, Nev., southeast to mine of Salt Lake Copper Co., 4.27 miles.

——Proposed 30-mile extension from Kemmerer, Wyo., north to coal fields.

OREGON, WASHINGTON & IDAHO.—See Oregon Railroad & Navigation Co.

OREGON WESTERN.—See Southern Pacific.

ORGAN MOUNTAIN.—Chartered to build from El Paso, Tex., to mining districts in New Mexico, 75 miles. N. D. Streeter, of Philadelphia; Adrien A. Jones, of Las Vegas, N. Mex.; Harris Walthall, D. Y. Hadley, S. A. S. Cox, A. M. Walthall, H. W. Fall, W. S. Crombie, Dan M. Jackson, J. W. Eubank, all of El Paso, incorporators.

*OSCEOLA, LITTLE RIVER & WESTERN.—Building from Osceola, Ark., west to Little River, 15 miles; 5½ miles built. J. E. Roberts, Osceola, Chief Engineer.

OTSELIC VALLEY.—To build from South Otselic, N. Y., northeast to Georgetown, 12 miles. E. F. Gladding, M. K. Perkins, D. W. Crumb, E. J. Stack and R. R. Brown, all of South Otselic, Directors.

OVERTON COUNTY.—May extend from Livingston, Tenn., north to Burnside, Ky., 60 miles.

OZARK & CHEROKEE CENTRAL.—See St. Louis & San Francisco.

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PACIFIC & EASTERN. — To build from South Bend, Wash., east to Chehalis, 45 miles. W. S. Cram and H. G. Shoemaker, South Bend, and T. H. Donovan, Raymond, Wash., incorporators.

PACIFIC & IDAHO NORTHERN.—Surveys made for extension from Evergreen, Idaho, to Meadows, 16 miles.

*PACIFIC RAILWAY & NAVIGATION CO.—Building extension from mile post 20 west to Tillamook, Ore., 69 miles; also branch from mile post 20 north to Vernonia, 13½ miles. Surveys north and south of Tillamook for line from Astoria south along the coast to Newport, 110 miles.

PADUCAH SOUTHERN.—To build from Paducah, Ky., northeast to Hickman, 50 miles. D. A. Archer, promoter. B. H. Scott, H. H. Loving, W. A. Martin and E. Wolfe, of Paducah, interested.

PARAGOULD & MEMPHIS.—Proposed extensions: Cardwell, north to Poplar Bluff, Mo., 50 miles; Cardwell west to Paragould, 12 miles; Manila southwest to Marked Tree, 30 miles, and Manila southeast to Osceola, 16 miles.

PARIS & MT. STERLING (Electric).—Incorporated to build from Paris, Ky., southeast to Mt. Sterling, 25 miles. H. A. Powers, R. J. Neely, of Paris; J. T. Collins, of Middletown; H. C. McKee and J. M. Bigstaff, of Mt. Sterling, interested.

PARIS, DEPORT & SOUTHEASTERN.—Organized to build from Paris, Tex., to Rosalie. R. F. Scott, President; George L. Terrell, First Vice-President; J. G. Wright, Second Vice-President; W. H. Grayson, Third Vice-President; C. I. Broad, Treasurer, and J. J. Dickerson, Secretary. (Mar. 16, 1906.)

PARKERSBURG BRIDGE & TERMINAL.—Surveyed from Johnson, W. Va., west to Little Hocking, Ohio, 11 miles. Rights of way secured. S. D. Brady, Parkersburg, W. Va., Chief Engineer.

PASCADERO RAILWAY & IMPROVEMENT CO. —See Ocean Shore.

PATAPSCO & SUSQUEHANNA.—See Baltimore & Ohio.

PAULS VALLEY.—Chartered to build from Ada, Ind., southwest to Wichita Falls, Tex. J. C. Amendt, Chicago, President; W. M. Freeman, Vice-President; Albert Kennie, Secretary and Treasurer; J. B. Thompson, S. J. Garwin and J. C. Hybarger, of Pauls Valley, and A. P. Williams, John Upshaw and P. J. Stovall, of Wanetta, Directors. (Mar. 16, 1906.)

PAYETTE VALLEY.—Extension to be built from New Plymouth, Idaho, to Emmett, 15 miles.

PEACH RIVER & GULF.—Extension from Midline, Tex., southeast to Beaumont, 65 miles; also from Timber northwest; 10 miles built last year.

PEA RIVER VALLEY & GULF.—Projected from Opelika, Ala., southwest to Portland, Fla., 200 miles. (Mar. 16, 1906.)

PEARL RIVER VALLEY.—Projected from Jackson, Miss., to Birmingham, Ala., 270 miles. Grading to be begun soon. Fred Herrick, Milwaukee, Wis., President; A. J. Wenjell, Chief Engineer; C. F. Lattimer, Vice-President; Arthur L. Hogue, Secretary, and Roy L. Hogue, Treasurer, all of Biloxi, Miss.

PELHAM & FLORIDA.—To build from Pelham, Ga., to Havana, Fla., 40 miles. J. B. Martin, J. F. Lewis, R. Black, J. Lane, W. T. Banburg, H. C. Briggs, of Valdosta; C. H. Butler, of Calvary; H. A. Sanders, of Whigham; C. J. Stevens, of Milltown, and W. L. Perkins, of Jennings, Fla., incorporators.

PELHAM, BAINBRIDGE & GULF.—To build from Pelham, Ga., southwest to Fairchilds, 52 miles. J. W. Everett and J. L. Hand, of Pelham, incorporators. (Mar. 16, 1906.)

PENINSULA (Electric).—To build from San José, Cal., to San Francisco, with branch to Los Gatos. C. A. Hale, F. E. Chapin, G. Lyon, W. C. Andrews and A. E. Wilder, Directors.

*PENNSYLVANIA. — Terminal improvements at New York being carried out by the Pennsylvania, New Jersey & New York Railroad west from center of the Hudson river, and east of that point by the Pennsylvania, New York & Long Island. New York Contracting Co. has contract for excavation of site for terminal station, which is about finished, and foundation work begun. Same company has contract for western approach between Eleventh avenue and Ninth avenue. Contract for construction of the terminal station building, and all electrical equipment and for the entire terminal and approaches let to Westinghouse, Church, Kerr & Co. Other work in connection under way as mentioned in following six paragraphs:

——New line from Harrison, N. J., the point east of Newark where the tunnel line leaves the present main line, to the Weehawken shaft of the Hudson river tunnel. Most of the bridges built; the one over the Hackensack river is nearly finished. Work being carried on from both ends and from a shaft in the center by William Bradley & Son, contractors, on two single-track tunnels under Bergen Hill. Excavation on tunnels and approaches well under way.

——*Two single-track tube tunnels from Weehawken under Hudson river to Eleventh avenue shafts; tubes completed and concrete lining being put in. O'Rourke Engineering Construction Co., contractors.

——*Tunnels under Thirty-second and Thirty-third streets, New York, from terminal station at Seventh avenue to East river. United Engineering & Contracting Co., contractors. About two-thirds finished; excavated from East river to point west of Fifth avenue.

*Four single track tubes under the East river from Manhattan shaft to a point on the Long Island side. Excavation and lining about one-fourth finished. S. Pearson & Son, Ltd., contractors.

*Tube tunnels from river shaft east under Long Island City nearly completed. S. Pearson & Son, Ltd., contractors.

*Tunneling under streets in Long Island City to Sunnyside yard; about two-thirds finished.

——*Franchise granted to the New York Connecting Railroad to operate a belt line through Brooklyn and Queens Boroughs, New York City and over the East river to a connection with the New York, New Haven & Hartford at Port Morris, on the Harlem river. This is to be accomplished by building a line from Manhattan Junction on the Long Island Railroad to the East river, and by a bridge over the East river and Wards and Randall's islands, with a connection to Long Island City to the Long Island Railroad terminal yards. The line is to include its south end through Brooklyn the Bay Ridge line of the Long Island Railroad from East New York to Bay Ridge, on which improvements are under way to eliminate 115 street grade crossings at a cost of about $7,000,000.

*Permission granted the New York Connecting to build a large terminal to be known as the Sunnyside yard between Jackson and Thompson avenues, Long Island City. To be over one mile long, average nearly one-third of a mile wide, and include about 100 acres. Contracts to be let shortly.

*At Greenville, N. J., the work of dredging the channel and filling in the yard is being continued.

——*The Pennsylvania & Newark is building a new freight line from West Morrisville, Pa. to Newark, N. J., 50 miles. With its completion the six-track system will extend from Trenton to Jersey City. Work includes new bridge across the Delaware river from Trenton, N. J., to Morrisville.

*Work under way on new yard at West Morrisville, Pa., the junction of the Pennsylvania & Newark with New York division. To be about 50 miles of track. John T. Dyer Co., contractor.

*Work on the four-track system on the Middle division completed between Granville, Pa., and Mayes. Work is being pushed revising alinement between Vandyke and Port Royal, and between Ryde and a point west of Mount Union. The latter involves heavy cutting, and two new stone arch bridges over the Juniata river.

——*On the Pittsburg division work being pushed to finish four-track system between Sang Hollow and Bolivar, requiring a change of line and two stone arch bridges over the Conemaugh river; also between Beatty and Southwest Junction. The contracts are as follows: For grading and masonry from Sang Hollow, Pa., to Seward, to H. S. Kerbaugh (Inc.), Philadelphia; from Seward to N F tower, at New Florence, to McMemanin & Sims, Philadelphia; from that point to the coke ovens east of Lock port (to include changing the course of the Conemaugh) to the Eyre Construction Co., of Philadelphia, and from the coke ovens to Bolivar, to Thomas F. Kerns & Son, of Pittsville. This work covers about 16 miles.

——*On the West Pennsylvania division, the line between Blairsville and Tunnelton, and the Sang Hollow extension are being revised and double-tracked, and some important changes made at other points.

——*Building extension of Monongahela division from West Brownsville, Pa., south 4½ miles to connection with Pennsylvania, Monongahela & Southern, under construction up valley of Monongahela river to Rice's Landing, 7½ miles.

——*Contract reported let to D. F. Keenan, of Philadelphia, for an extension of the Monongahela & Washington division from Ellsworth to point on Daniel's Run, 10 miles; 1,000,000 cu. yds. of earth excavation and building 70,000 cu. yds. of concrete masonry.

——*Double-track tunnel under Capitol Hill from Philadelphia, Baltimore & Washington to new union station at Washington, D. C. Nearly finished.

——*Contract for work on the Philadelphia, Baltimore & Washington in connection with the Washington improvements let to the Drake & Stratton Co., of Philadelphia. Includes the Maryland avenue subway from Ninth to Water streets, and delivery yards at Sixth, Ninth and Water streets. Excavation work started. Will involve shifting tracks and building temporary tracks and roadways for street traffic. Is roadbed for the southern trains will also be provided. Will be one under grade and three over head bridges

——*Contract let to John A. Kelley Co. for grading, masonry and track-laying on proposed cut-off on the West Jersey & Seashore, from a point on the Cape May division, north of Westville, east to connection with the Delaware River bridge line near West Haddonfield Junction five miles. The contract includes changing Delaware river bridge tracks in West Haddonfield.

——Proposed freight line over the Susquehanna river at Sunbury, Pa., and down the west side of the river to connection with the yards at Selinsgrove and Enola.

——Proposed freight line from Glen Loch, Pa., south of the main line to city limits of Philadelphia at Cobbs Creek between Coleman avenue and Woodbine street, thence to Fifty-sixth street, 20 miles. Considerable right of way secured.

——Proposed new yards at Buffalo and a line to connect the Buffalo & Allegheny Valley division with the Western New York & Pennsylvania. Cost estimated at $500,000.

——Proposed double-tracking of the Philadelphia & Erie division from Wilkesbarre to Sunbury, 64 miles.

——Surveys made for extending the Turtle Creek branch, which runs from Stewart, Pa., on the Pittsburg division, northeast to Export, 10.4 miles, and east to Blairsville, on the West Pennsylvania division, 18 miles. (Mar. 16, 1906.)

——*Agreement with city authorities of Philadelphia for elevation of tracks from Venango street to Norris street. From Venango to Cambria street a retaining wall will be built, and from Cambria street to Norris street a steel viaduct. The Philadelphia & Reading tracks will pass underneath at Trenton avenue near Lehigh avenue. Cost estimated at $1,500,000, of which the city will pay $750,000. (Mar. 16, 1906.)

PENNSYLVANIA & NEWARK.—See Pennsylvania.

PENNSYLVANIA LINES WEST. Work under way as follows:

——*On the Southwest system, completion of second track on the Logansport division from Logansport to Chicago, and track elevation work at Indianapolis and Cincinnati.

——On the Northwest system double-tracking of Cleveland & Pittsburg from Steubenville, O., to Bellaire, 25 miles. Some right of way purchased.

——*Work to be carried on by the Pennsylvania Co. during 1907 includes the track elevation in Cleveland between Superior avenue and Central avenue, 8,000 feet, and provides for the construction of nine subways; also elimination of grade crossing at Kinsman street by construction of a steel viaduct. Not yet under contract.

——*Work of elevating tracks in Chicago between South Park avenue and Stony Island avenue will be finished.

*A new double-track lift bridge will be built at Indiana Harbor, Ind. Contracts for superstructure and substructure awarded.

Proposed cut-off from Smiths Ferry, Pa., through Columbiana County, Ohio, to connection with P., F. W. & C. east of Alliance, Ohio, 40 miles.

——Proposed new yard at North Hammond, Ind., to accommodate 1,000 cars.

——Reported that the Pittsburg tunnel of the P., C., C. & St. L. will be bored through to Daylight and made 150 ft. wide.

——The Chartiers Southern incorporated in Pennsylvania to build through Cecil, North and South Strabane, Somerset and West Bethlehem Townships in Washington County, 18 miles. E. B. Taylor, 3d V. P. Pa. Lines West, President.

——The Pennsylvania Western to build from Red Bank Junction, Pa., to Enon, 60 miles. Surveys. (Mar. 16, 1906.)

PENNSYLVANIA, NEW JERSEY & NEW YORK.—See Pennsylvania.

PENNSYLVANIA, NEW YORK & LONG ISLAND.—See Pennsylvania.

PENNSYLVANIA WESTERN.—See Pennsylvania Lines West.

PENOBSCOT BAY.—To build from Rockland, Me., north 30 miles. M. S. Bird, E. S. Bird and H. I. Hix, of Rockland; H. L. Shepard, of Rockport; A. Pierce, of Frankfort; C. Wood, of Camden, incorporators.

PENSACOLA & NORTHEASTERN. — To build from Andalusia, Ala., southwest to Pensacola, Fla., 100 miles. F. C. Brent, J. S. Avery, C. M. Covington, S. B. Milligan and C. W. Lamar, all of Pensacola, incorporators. (Mar. 16, 1906.)

PEORIA, BLOOMINGTON & CHAMPAIGN (Electric).—Proposed line between Peoria, Ill., and Bloomington. The McKinley syndicate interested.

PEORIA RAILWAY TERMINAL. Incorporated to build from Peoria, Ill., south to point in Tazewell County, T. A. Grier, F. H. Smith, H. F. Seele and William J. Jack, of Peoria, and W. J. Conzelman, of Pekin, Directors.

PERTH AMBOY & STATEN ISLAND (Electric). Organized to build from Richmond, S. I., to Tottenville, and operate ferry to Perth Amboy. Office at New Brunswick, N. J. F. W. Schultz, E. White, M. F. Reiff and H. Lowersell, of New York; E. Biesenbach, of Newark, and J. W. Humphreys, of New York, incorporators.

PHILADELPHIA & READING.—Agreement made with the city officials of Philadelphia to elevate tracks.

——Proposed electrification of the Atlantic City line from Philadelphia to Atlantic City, 57 miles.

——Surveys under way for better line between Pottsville, Pa., and Shamokin. Would shorten line from Clinton to Sunbury by 15 miles. (Mar. 16, 1906.)

PHILADELPHIA & SCHUYLKILL VALLEY. — Chartered to build from Mill Road, Pa., to Bridgeport, 15 miles. Loren N. Downs, Bryn Mawr, President; W. Robinson Molinaird, W. Evans Smith, George A. Chrisman, Ernest S. Chrisman, William Darling and William H. Ford, of Philadelphia, Directors. (Mar. 16, 1906.)

PHILADELPHIA, BALTIMORE & WASHINGTON.—See Pennsylvania.

PHILADELPHIA, CAMDEN & INTER-CITY LINK.—Proposed tunnel under the Delaware river from the foot of Walnut street, Philadelphia, to Delaware avenue, Camden, N. J.

PHILADELPHIA, NORRISTOWN & NORTHERN. —To build from Villa Nova, Pa., north to Norristown, 8½ miles, with branch from West Oncocheague. Morris Bernheimer, President. G. B. Staples, E. H. Weeks, I. Pratt, C. H. Richardson, S. E. Staples and W. S. Huntington, all of Philadelphia, Directors.

*PHILADELPHIA RAPID TRANSIT.—Extension of three years granted for completion of the Market street subway. Contract let to E. E. Smith Contracting Co. for extension of the Market street subway from present terminus at Fifteenth street around the City Hall and eastward to Juniper street. Contract let to Millard Construction Co. for eastern section of Market street subway, extending under Market street from City Hall loop to Front street. Work on both contracts under way.

*PHILIPPINE RAILWAY.—Work under way by the Philippine Railway Construction Co., which has let contract to J. G. White & Co., New York, to build 300 miles of road on the islands of Negros, Panay and Cebu, P. I. Equipment ordered and partly delivered. William Salomon, Chairman, and Charles M. Swift, President, New York.

PHILIPSBURG RAILROAD. — To build from Chester Hill, Pa., to Jaynesville, 18 miles. David F. Kreb, Clearfield, President.

PIERRE & FORT PIERRE BRIDGE & RAILWAY CO.—See Chicago & North-Western.

PIERRE, RAPID CITY & NORTH-WESTERN.—See Chicago & North-Western.

PINAR DEL RIO NORTHERN.—Incorporated to build railroads in Cuba. F. H. Morrill, Presidents, and F. R. Barrett, Treasurer, both of Portland, Me.

PINE BLUFF & SOUTHERN.—Chartered to build from Pine Bluff, Ark., to Star City, Mo. S. C. Alexander, W. H. Langford and R. G. Atkinson, of Pine Bluff, Ark., Directors. (Mar. 16, 1906.)

PINE MOUNTAIN.—See Louisville & Nashville.

PINEVILLE & NORTHERN. — Incorporated to build from Pineville, Mo., northeast to Monett, 40 miles. John A. Sturges, Adair W. Noel and E. E. Coffee, of Pineville, interested. (Mar. 16, 1906.)

PITTSBURG & LAKE ERIE.—See Lake Erie & Pittsburg under Lake Shore & Michigan Southern.

PITTSBURG & NORTHEASTERN.—See Buffalo & Susquehanna.

PITTSBURG & TUBE CITY.—Organized to build a terminal road between Pittsburg and McKeesport. Charles S. Cameron, promoter, and former Senator Lee, Counsel.

*PITTSBURG, BINGHAMTON & EASTERN.—Building from Binghamton, N. Y., to Clearfield, Pa., 225 miles. Contracts let to Holbrook, Cabot & Rollins Corporation, Boston, to build from Powell, Pa., to Cedar Ledge, 21 miles. E. H. Gay & Co., Boston, financial agents. Thomas H. Watkins, Scranton, Pa., President; H. A. Schwanecke, Canton, Pa., Chief Engineer.

PITTSBURG, CONNELLSVILLE & WHEELING. —Projected from Wheeling, W. Va., to Masontown, Pa., 60 miles. A. A. Franzheim, of Wheeling, interested.

*PITTSBURG, HARMONY, BUTLER & NEW CASTLE.—To build from Allegheny, Pa., through New Castle to Butler. Contracts reported let. S. C. Vickers, E. L. Balsinger, T. G. Hamilton, C. C. Gerber and H. Ethridge, incorporators.

*PITTSBURG, SHAWMUT & NORTHERN.—The Brookville & Mahoning, projected from Hydes, Pa., southwest toward Pittsburg to Freeport, 101 miles. Contract let to Miller Construction Co., of Lockhaven, Pa., from Hydes southwest to Knoxdale, 36 miles. Contracts from Knoxdale to Freeport, 65 miles, to be let this year. W. W. Henshey, Chief Engineer, Brookville.

PITTSBURG SUBWAY.—Organized by Murray M. Verner and William B. Hayes, to build a subway to cost $10,000,000, from Oliver avenue and Smithfield street to Center avenue near Luna Park.

*PITTSBURG, SUMMERVILLE & CLARION.—Millcreek branch being extended from Millcreek, Pa., 10 miles by A. Cook's Sons Co., to connect with lumber properties. Three miles built.

PITTSBURG, WESTMORELAND & SOMERSET. —Proposed extension from Somerset, Pa., south to Meyersdale, 20 miles.

PLANT CITY, ARCADIA & GULF.—See Seaboard Air Line.

POCAHONTAS & WESTERN.—See Norfolk & Western.

POINT JUDITH.—Organized to build from Narragansett Pier, R. I., to Point Judith, 4 miles. Jeremiah Robinson, of New York, and Wakefield, R. I., President; Frank P. Sturges, Vice-President, and Isaac R. Robinson, Secretary and Treasurer, both of New York.

PORT ANGELES & OLYMPIA.—See Northern Pacific.

PORT ANGELES PENINSULA.—See Northern Pacific.

*PORT ARTHUR & HOUSTON SHORT LINE.—To build from Port Arthur to Houston, Tex., 85 miles. Contract let to H. S. Best, of Port Arthur, Tex., for 40 miles. F. J. Hart, 507 Missouri Trust Building, St. Louis, Mo., President. (Mar. 16, 1906.)

PORTLAND & NORTHERN (Electric). — Organized to build from Cumberland Mills, Me., to Bridgton, 38 miles. S. O. Hancock and R. Cook, of Casco; E. N. Mason, of Raymond; E. B. Jillson, Otisfield, interested.

PORTLAND & RUMFORD FALLS.—Projected extension from Rumford Junction, Me., south to Portland, 30 miles.

*PORTLAND & SEATTLE.—A joint project of the Northern Pacific and Great Northern to give them a direct low-grade line to Portland, Ore. Building from Portland up the north bank of the Columbia river to point 24 miles east of Pasco, whence connection projected to Spokane, and east along the Snake river to Texas Ferry, Wash., the eastern terminus of the Oregon, Washington & Idaho, which is being built jointly by the Northern Pacific and the Oregon Railroad & Navigation. From Portland to a point 17 miles east of Vancouver, Wash., and from Kennewick, opposite Pasco, to point 23 miles west will be double track, making 47 miles of double track, in which are included double-track steel bridges over the Columbia and Willamette rivers. Maximum grade eastbound, 11 ft. to the mile from Vancouver east to Texas ferry and 22 ft. to the mile on Spokane extension. The Portland & Seattle building 423 miles in all. Line from Portland to Texas Ferry to be finished by autumn and the Spokane extension early in 1908. Contract let to Siems & Shields, St. Paul, Minn., from Portland east to Kennewick, 230 miles. N. D. Miller, Chief Engineer, Vancouver, Wash.

PORTLAND & SOUTHWESTERN. — Incorporated to build from Scappoose, Ore., to Nehalem Bay. H. G. Platt and G. J. Perkins, of Portland, incorporators. (Mar. 16, 1906.)

*PORTLAND, NEHALEM & TILLAMOOK.—To build from Portland, Ore., west to Tillamook County. Contract let to the Atlas Construction & Supply Co., of San Francisco, for laying track on 20 miles. Other contracts let to Clark & Dixon, of Forest Grove, for clearing the right of way, and to Thompson Bros., for grading first three miles from Hillsboro. (Mar. 16, 1906.)

PORTLAND TERMINAL.—Projected line from Portland, Ore., to the Tualatin river, 20 miles. Address J. T. Burkhart, Portland, Ore.

PORT TOWNSEND SOUTHERN.—See Northern Pacific.

POUND GAP-ELKHORN.—To build a 25-mile line from Pound Gap, Ky., near the Kentucky-Virginia state line, C. T. Smith and G. W. Morehead, of Elkhorn City; W. Mereditn and J. Day, of Hellier, Ky., incorporators.

POWELLS VALLEY.—Surveys being made by James R. Russell, of Blackwood, Va., for a line from Blackwood up Powells river, 12 miles.

PRESCOTT & NORTHWESTERN.—Surveys being made from four miles west of Amity, Ark., to point near Kirby, eight miles.

PROVIDENCE TERMINAL CO.—See New York, New Haven & Hartford.

*PUYALLUP VALLEY NORTHERN (Electric).——Contracts reported let to the Engineering Construction Co., of New York, to build from Tacoma, Wash., east to Puyallup, nine miles, Fred. J. Chamberlain, of Puyallup, President; L. A. Nicholson, Tacoma, Chief Engineer.

R

RALEIGH & CHARLESTON.—Proposed extension from Lumberton, N. C., north to Fayetteville, 50 miles.

RALEIGH & PAMLICO SOUND.—See Norfolk & Southern.

RALEIGH & WESTERN.—Surveys being made for extension from Cumnock, N. C., to Greensboro, 50 miles.

RANDOLPH & CUMBERLAND.—Incorporated by E. V. Shedd and M. E. Caldwell, of Aberdeen, N. C., and T. J. Edwards, of Providence, R. I., to build from Fayette, N. C., northwest 117 miles, along Deep river, through Cumberland, Moore, Randolph and Guilford Counties.

RAYMONDVILLE & WADDINGTON.—See Norwood & St. Lawrence.

*RICHMOND & CHESAPEAKE BAY (Electric).—Building from Richmond, Va., north to Ashland, 15 miles; 9 miles built. Contract let to Phillips & Allport, Richmond, Va., for two miles, and John T. Wilson, Richmond, Va., for reinforced concrete viaduct 2,800 ft. long in Richmond. Projected extension from Ashland to Toppohannock, 42 miles. C. P. E. Burgwyn, Chief Engineer, Richmond, Va.

RIO GRANDE WESTERN.—See Denver & Rio Grande.

ROANOKE & NORTHERN.—Incorporated in Virginia to build railroads. L. H. Vaughan, President; J. P. Wood, Vice-President; W. P. Huff, Secretary, and J. L. Vaughan, Treasurer, all of Roanoke, Va.

ROANOKE & SALEM TRACTION. Incorporated to build from Roanoke, Va., west to Salem, 10 miles. O. L. Stearnes, President; Charles D. Denit, Vice-President; W. B. Dillard, Treasurer; W. H. Tinsley, Secretary; R. W. Kime, General Manager, all of Salem.

ROCHELLE & WESTERN.—To build from Rochelle, La., northwest to Winnfield, 20 miles; also from Rochelle east to Harrisonburg, 35 miles. Headquarters at Monroe. C. H. Denkman, J. C. Simpson, N. S. Cutright and E. T. Lamkin, incorporators. (Mar. 16, 1906.)

ROCHESTER, CORNING & ELMIRA TRACTION. —Incorporated by the Rochester Southern Construction Co., to build from Rochester, N. Y., southeast to Elmira, 120 miles. W. C. Gray and S. Fuerstein, 20 Exchange street, Rochester, Engineers. M. H. Schultz, C. O. Greer, H. G. Abel, F. Eckstein and F. S. Breckingham, of New York, Directors. Office, 42 Broadway, New York.

ROCHESTER, SYRACUSE & EASTERN (Electric).—Proposed extension from Lyons, N. Y., to Syracuse, 50 miles. Lyman C. Smith, Syracuse, President.

ROCKFORD RAILROAD.—Incorporated to build a belt line in Rockford, Ill. B. F. Lee, A. F. Humburg, S. F. Andrews, C. E. Foreich and W. E. Claflin, of Chicago, incorporators.

ROCK ISLAND, ARKANSAS & LOUISIANA.—See Chicago, Rock Island & Pacific.

ROCK ISLAND-FRISCO TERMINAL.—Organized by Rock Island-Frisco officers to build a terminal railroad in St. Louis; also in St. Clair County, Ill., and a line on the east bank of the Mississippi river near East Carondelet, 30 miles.

ROCKLAND, JASPER & NORTH-WESTERN.—Chartered to build from Rockland, Tex., east to Jasper, 25 miles. W. W. Kyle, S. K. Stone and W. W. Cunningham, of Beaumont, incorporators. (Mar. 16, 1906.)

ROCKPORT, LANGDON & NORTHERN.—Proposed extension from Rockport, Mo., north to Shenandoah, Iowa, 30 miles. Preliminary surveys.

*ROGERS SOUTHWESTERN.—Contract let to W. R. Felher Construction Co., and work under way on this line from Rogers, Ark., to either Gentry or Siloam Springs, Ark., 30 miles. W. R. Felher, of Rogers, Ark., President. (Mar 16, 1906.)

ROODHOUSE & VIRDEN (Electric).—Projected line from Roodhouse, Ill., east to Virden, 32 miles. C. W. Payne, Roodhouse, Secretary.

*ROSCOE, SNYDER & PACIFIC.—Projected from

Roscoe, Tex., northwest to New Mexico line, 200 miles. Contracts for grading 30 miles let to Col. N. T. Reed, Armour, Tex. Contracts for rails let. F. W. James, Abilene, President, and Martin Duval, Roscoe, Chief Engineer.

ROSWELL & EASTERN. To build from Torrance, N. Mex., south to Texas boundary. K. S. Woodruff, C. W. DeFrees, R. F. Barnett, George T. Veal and W. Wells, all of Roswell, incorporators.

S

SACRAMENTO & VALLEJO. Incorporated to build from Sacramento, Cal., southwest to Vallejo, 60 miles. W. Knight and B. Pringle, of Sausalito, and William G. Barr, of San Francisco, interested.

SACRAMENTO BELT.—Organized to build a belt line along the river levee on the city front of Sacramento, Cal.

SACRAMENTO SOUTHERN. See Southern Pacific.

SACRAMENTO VALLEY & EASTERN. Projected from Kennett, Cal., to Squaw creek, thence 16 miles to copper mines. F. J. Dearborn, Wintuop, Cal., Chief Engineer.

SAGINAW, OWOSSO & LANSING (Electric). Projected from Lansing, Mich., northeast to Saginaw. J. A. Thick, of Detroit, interested.

ST. JOSEPH & GRAND ISLAND. Bids asked on branch from Stouts, Kan., north to Highland, seven miles.

ST. JOSEPH & NODAWAY VALLEY. To build from St. Joseph, Mo., north to Graham, 35 miles. W. C. Wilson, T. E. Denny, A. C. Snyder and T. E. Fleming, incorporators.

ST. JOSEPH & SOUTHERN.—To build from St. Joseph, Mo., to Kansas City. John Donovan, John D. Richardson, N. D. Biles, Edward C. Smith, James N. Burns, Henry Krug, Jr., J. G. Schneider and Jesse T. Roberts, all of St. Joseph, incorporators.

ST. JOSEPH, ALBANY & DES MOINES. Proposed line from St. Joseph, Mo., northeast to Des Moines, Iowa, 200 miles. F. C. Mordaunt, Chicago, President. (Mar. 16, 1906.)

ST. JOSEPH, SAVANNAH & NORTHERN.—Incorporated with office at St. Joseph, Mo., to build from St. Joseph north to Savannah, 15 miles. T. B. Campbell, M. Tootle, F. J. Wheeler, of St. Joseph, incorporators.

ST. JOSEPH VALLEY TRACTION.—Proposed extension from Middlebury, Ind., west to Elkhart or southwest to Goshen, each about 12 miles.

ST. LOUIS & NORTHERN ARKANSAS.—See Missouri & North Arkansas.

ST. LOUIS & OKLAHOMA SOUTHERN. To build from Pineville, McDonald County, Mo., southeast 20 miles. I. E. Sturges, J. N. Christensen, O. St. John, A. W. Noel and C. D. Bennett, of Pineville, interested; office at Pineville.

ST. LOUIS & SAN FRANCISCO.—Surveys from Paris, Tex., to point south of Palestine, 140 miles.

——Proposed new low grade freight line from St. Louis, Mo., south to New Orleans, La. Surveys made.

——The Frisco, Oklahoma & Texas to build from Oklahoma City, Okla., south to Hewitt, Ind. Ty., thence east to Ardmore, 110 miles.

——*The Bonnerville & Southwestern has finished surveys and obtained right of way from Bonnerville, Ark., to Jelks, 65 miles. Contracts let to the Frisco Construction Co. Address J. F. Hinckley, St. Louis, Mo.

——*Contract reported let to McCade & Steen, of Irving, to build cut-off from Carrollton, Tex., to Irving, 11 miles.

—— The Memphis & New Orleans, chartered to build from Marion, Ark., to the Louisiana state line, 180 miles.

——Proposed branch from Dublin, Tex., north to Thurber, 50 miles, and from Dublin south to Lampasas, 100 miles.

——Projected extension from Brady, Tex., south to San Antonio, 150 miles.

——Surveys to extend the Arkansas Valley & Western from Avard, Okla., west into coal field in New Mexico.

——See Colorado Southern, New Orleans & Pacific.

ST. LOUIS, BARTLESVILLE & PACIFIC.—To build from Joplin, Mo., west across the Indian Territory and Oklahoma to Pond Creek, Okla., about 240 miles. Office at Ponca City, Okla. T. G. B. Keller, J. L. Overlees, F. M. Overlees, J. J. Curl and H. J. Holm, of Bartlesville: M. Cunyon and W. L. Barnum, of Ponca City; C. Steckler and J. W. Bird, of Pond Creek, incorporators.

ST. LOUIS BELT & TERMINAL.—Proposed extension to the St. Louis & San Francisco, two miles. E. C. Jackson, Chief Engineer, St. Louis, Mo.

ST. LOUIS, BROWNSVILLE & MEXICO.—Proposed extension from Robstown, Tex., northwest to San Antonio, 125 miles.

——Surveys made last year from northern terminus, Algoa, Tex., east to Galveston and north to Houston.

——Proposed bridge from Brownsville, Tex., over the Rio Grande river to Matamoras, Mex., and eventually an extension south along the east coast of Mexico to Tampico, 300 miles.

*ST. LOUIS, DECATUR & CHAMPAIGN (Electric).—Contract let from Champaign, Ill., southwest to Litchfield, 125 miles. W. D. McKinley, President, and W. H. Tarrant, Chief Engineer, both of Champaign.

ST. LOUIS, EL RENO & WESTERN.—Proposed extensions from Guthrie, Okla., north to Peru Junction, Kan., 120 miles, and from El Reno southwest to near Hobart, 75 miles.

ST. LOUIS, ENID & SAN DIEGO. Organized by residents of Guthrie, Okla., to build northeast and southwest from that place.

*ST. LOUIS, HILLSBORO & SOUTHERN (Electric). Contract reported let for building from St. Louis, Mo., southwest to Hillsboro, 50 miles. R. E. Williams, President, and H. D. Brandt, Secretary, of St. Louis; J. Winer, Treasurer, of Hillsboro, and H. M. Bower, General Manager.

ST. LOUIS, IRON MOUNTAIN & SOUTHERN. See Missouri Pacific.

*ST. LOUIS LAKEWOOD & GRANT PARK (Electric). Building from the terminus of the Southampton line of the United Railways Co. in St. Louis to the Grant farm.

ST. LOUIS SOUTHWESTERN.—Work to be carried out this year includes:

*Ballasting from Mt. Pleasant, Tex., to Fort Worth, 155 miles.

*Completion of improvements under way between Texarkana and Mt. Pleasant, Tex.

*Completion of bridge over the Red river and new freight yards near Shreveport, La.

*Laying 75-lb. rails on Shreveport branch and on main line between Tyler, Tex., and Waco.

——Proposed extension from Gatesville, Tex., to Hamilton. Surveys made some time ago for 35 miles. (Mar. 16, 1906.)

ST. LOUIS, SPRINGFIELD & OKLAHOMA WESTERN.—To build from Lawton, Okla., east to Sulphur, Ind. T., thence northeast through Ada, Alester and Stigler to Sallisaw, 225 miles. G. S. Stocker, of Sallisaw; W. T. Douglas, R. Downing and A. D. Goodnough, of Sulphur; J. D. Jennings and J. J. Beall, of Oklahoma City, incorporators.

ST. LOUIS, VANDALIA, TERRE HAUTE & EASTERN TRACTION.—Projected from Terre Haute, Ill., to Dexter, 80 miles; surveys. P. Chase, Decatur, Ill., interested.

ST. LOUIS, WEBSTER & VALLEY PARK.—Projected from West End Heights, Mo., southwest to Valley Park, 15 miles.

ST. MARYS & WESTERN.—Projected from Johnsonburg, Pa., to Benezette, 25 miles; 10 miles built. E. L. Willard, St. Marys, is Chief Engineer. (Mar. 16, 1906.)

ST. PAUL & DES MOINES.—See Des Moines, Iowa Falls & Northern.

SALEM-MEHAMA (Electric). — Projected from Salem, Ore., southeast to Mehama, 24 miles. Financed by A. Welch, of Portland. Surveys and rights of way secured by Walters Bros., Salem.

SALEM, SPRINGFIELD & PEORIA.—To build from the Chicago & Eastern Illinois north to Peoria, Ill., 200 miles. E. H. Sennef, A. N. Trueb, J. W. Duck, F. W. Krohn and Jonathan Proves, all of Chicago, incorporators.

SALINA & NORTHWESTERN. — Projected from Salina, Kan., northwest to Logan County, Nebr., 250 miles. Preliminary surveys. George H. Whitcomb, President; J. W. Going, Vice-President, and C. Hamilton, Secretary, Topeka, Kan.

*SALT LAKE & OGDEN.—Building with its own forces an extension from the Davis-Weber County line to Ogden, 5½ miles; also from Ogden to Ogden Canyon, 2½ miles. Grading about finished.

SAN DIEGO & ARIZONA.—Under this name the San Diego Eastern, sold to J. D. Spreckels, is to build from San Diego, Cal., east to the Colorado river, 200 miles.

SAN DIEGO EASTERN.—See San Diego & Arizona.

SANDUSKY, FREMONT & SOUTHERN.—To build from Sandusky, Ohio, southwest to Fremont, 30 miles. G. H. Kelly, M. G. McAlleman, T. H. Hogsett, H. H. Johnson and George C. Ford, incorporators.

*SAN FRANCISCO, IDAHO & MONTANA.—Projected from Butte, Mont., to San Francisco, with branch from Caldwell, Idaho, to Winnemucca, Nev. Under contract from Caldwell to Homedale, 16 miles. Surveys being made from Homedale, Idaho, to Winnemucca, 180 miles. Donald Grant, Faribault, Minn., President. I. H. Richardson, Caldwell, Idaho, Chief Engineer.

SANGAMON VALLEY.—Incorporated to build from Decatur, Ill., west to Quincy, 150 miles, with branches at Springfield and Petersburg. G. M. Skelly, J. E. Mellck, J. S. Sutton and C. F. Monrow, of Springfield, interested. (Mar. 16, 1906.)

SAN JOAQUIN VALLEY WESTERN.—See Ocean Shore.

SAN MARCOS VALLEY INTERURBAN.—Chartered to build from San Marcos, Tex., to Luling, 24 miles. A. T. Fisher, St. Louis, Mo., President; George W. Megrew, Houston, Tex., Chief Engineer. (Mar. 16, 1906.)

*SAN PEDRO, LOS ANGELES & SALT LAKE.—Contract let to Deal Brothers & Mendenhall Construction Co., Springville, Utah, to build the Caliente & Pioche from Caliente, Nev., north to Pioche, 32 miles. Graded some years ago for 29 miles.

——Final surveys for branch from Tintic Junction, Utah, west to Deep Creek, Nev., 115 miles; eventually to be extended southwest from Deep Creek to Ely, Nev., 60 miles.

SAN SABA VALLEY.—To build from Antelope Gap, Tex., west to Crothers, 50 miles. Surveys for 20 miles. W. S. Haywood, Jefferson, Tex., Chief Engineer.

*SANTA FE, LIBERAL & ENGLEWOOD.—Work under way on this line through New Mexico, Kansas and Oklahoma, consisting of four sections, first two of which already completed. First, the Santa Fe, Raton & Eastern, from Raton, N. Mex., east to Carissozo 15 miles, with two branches running north into the coal fields of Colfax County; second, the Santa Fe, Raton & Des Moines, from [illegible] brooke, N. Mex., east to Des Moines to [illegible] third, the Santa Fe, Liberal & Englewood proper from Des Moines, via Dodge City, Kan., to Woodward; fourth, the Canadian River, to run from Woodward, Okla., southeast to Wetonga, from which point there are [illegible] lines, one to Guthrie and the other to Oklahoma City. Jesse G. Northcutt, Raton, N. Mex., President.

SANTA FE, RATON & DES MOINES. See Santa Fe, Liberal & Englewood.

SANTA FE, RATON & EASTERN. See Santa Fe, Liberal & Englewood.

SANTA ROSA & SONOMA (Electric). To build from Santa Rosa, Cal., to Healdsburg, and thence up Dry Creek Valley. W. A. Tartell, E. T. McMurray, J. H. Sanford, W. G. Taylor and P. S. Scales, all of San Francisco, incorporators.

SAVANNAH, AUGUSTA & NORTHERN.—To build from Savannah, Ga., northwest to Rossville, 330 miles, with branch from McDuffie County east to Augusta, 30 miles. J. A. Brennan, J. R. Miller, R. F. Donaldson, E. B. Sorrier, S. L. Moore, of Bulloch County, Ga., and E. M. Rice, of New York, incorporators.

SAVANNAH, STATESBORO & WESTERN. To build from Statesboro, Ga., northwest to Atlanta, 210 miles. J. R. Anderson, T. F. Walsh, Jr., and W. E. O'Connor, of Savannah, incorporators.

SCHENECTADY & MARGARETSVILLE. — See Delaware & Eastern.

SEABOARD AIR LINE. — Extension authorized from Jacksonville, Ala., to Anniston, 20 miles.

—— Several short lines to mines in Calhoun County, Ala.

——*Contract let to Blair Burwell, of Jacksonville, for building part of extension from Wacissa, Fla., southeast to Perry, 80 miles; 11 miles built last year.

——Surveys reported for a branch from Odenville, St. Clair County, Ala., northeast via Asheville to Gadsden, 32 miles. (Mar. 16, 1906.)

——*Contract let to Davis & Bushnell, of Manatee and Plant City, Fla., on the Plant City, Arcadia & Gulf from Welcome, Fla., south to Chicora, 10 miles.

——Projected from Chicora south to Arcadia, 35 miles.

SEABOARD TRACTION. Organized to build from Smithfield, Va., to Manchester, opposite Richmond. L. R. Britt, Norfolk, President, and W. H. Robinson, General Manager. (Mar. 16, 1906.)

SEBASTICOOK & MOOSEHEAD.—Proposed extension north from Mainstream, Me., to connect with the Canadian Pacific, and south from Pittsfield to Albion on the Wiscasset, Waterville & Farmington, all about 75 miles.

*SEWARD PENINSULA.—Organized last year to build from Nome, Alaska, to Kangarok, 125 miles; building from Nome to Lanes Landing, 69 miles. C. L. Morris, Nome, contractor. Next work from Lanes Landing to mines, 30 miles. J. W. Dickson, 40 Pine street, New York, interested.

SHAWNEETOWN & WESTERN.—To build from Shawneetown, Ill., southwest to the Ohio river, 55 miles. John Gilbert, H. B. Pierce, J. L. Murphy and W. H. Moore, all of Golconda, and Charles E. Turner, of New York, incorporators. (Mar. 16, 1906.)

*SHELBY COUNTY.—Building from Shelbyville, Mo., south to Shelbina, eight miles. Office at Shelbina. W. C. Clark, R. L. Carter and J. E. Ragsdale, incorporators.

SHELBY LONG FORK.—Projected from Shelby, Ky., up Long Fork Valley through Pike and Letcher Counties to coal fields, 40 miles. J. M. Stewart, Ashland, Ky., and Eugene Zimmerman, Cincinnati, Ohio, interested.

SHENANGO VALLEY TRACTION.—Proposed extension from South Sharon, Pa., to New Castle, 18 miles.

SHORT LINE DEVELOPMENT & CONSTRUCTION COMPANY.—Chartered with headquarters at Seattle, Wash., to build railroads in Alaska. Thomas Flammer and Martin Bosworth, of Seattle, and Grant Hamilton, of Denver, incorporators. (Mar. 16, 1906.)

SHREVEPORT, HOUSTON & GULF.—Incorporated to build from point on St. Louis, Southwestern, in Angelina County, Tex., south to Houston, 120 miles. G. A. Kelley, R. D. Collins, of Lufkin, Tex.; A. J. Carroll, Jack Thomas, E. A. Carter, of Camden, Tex.; W. T. Carter and C. L. Carter, of Houston, Directors.

SHREVEPORT, JONESBORO & NATCHEZ.—To build from Jonesboro, La., southeast to Natchez, Miss.; also from Jonesboro north to Shreveport Office at Jonesboro, La. C. E. Neeley, St. Louis; W. W. Brown and W. W. Ramsey, of Camden, Ark.; W. D. Hutchinson, J. S. Craigo, of Jones, La.; R. N. Garrett, of Eldorado, Ark.; C. A. Henderson, of Arkadelphia, Ark., incorporators. (Mar. 16, 1906.)

*SHREVEPORT NORTHEASTERN. — Building from Shreveport, La., northeast via Minden and Homer, La., and Eldorado, Ark., to Memphis, Tenn., 285 miles. Contracts let to Northeastern Construction Co., of Homer and Shreveport, from Shreveport to Eldorado, 85 miles. Grading finished for 25 miles, and track laid for five miles. A. K. Clingman, Shreveport, La., President, and J. T. Hardeman, Minden, La., Chief Engineer.

*SIBLEY LAKE, BISTENEAU & SOUTHERN.—Contract let to Blackman Bros. for four-mile extension in Louisiana. J. H. Martin, General Manager, Yellow Pine, La.

SIERRA & EASTERN.—Incorporated with office

as Los Angeles, Cal., as the principal place of business, to build from Tehachapi, Cal., east to Searchlight, Nev., 200 miles. J. A. Chanslor and C. A. Canfield, of the Associated Oil Co., interested. H. M. McIntosh, of Chicago, a Director. (Mar. 16, 1906.)

SIERRA OF CALIFORNIA. Proposed extension from Angels, Cal., north to Gardners, 35 miles.
——Proposed extension of the Sugar Pine Railroad from Sugar Pine, Cal., northeast to Strawberry, 25 miles.
——*The Yosemite Short Line is building from Jamestown, Cal., east to the Yosemite National Park, 50 miles.

SIERRA PACIFIC.—See Eastern Sierra & Pacific.

SIKESTON & SOUTHWESTERN. To build from Sikeston, Mo., to the Mississippi river, opposite Hickman, Ky., 20 miles. J. F. Gould, F. M. Sikes and Walter L. Hensley, Farmington, Mo.; G. B. McCoy, Sikeston, and M. McGouey, St. Louis, incorporators. (Mar. 16, 1906.)

SIOUX CITY, PIERRE & NORTH-WESTERN. — To build from Sioux City, Iowa, northwest to Hughes County, S. D., thence east via Brookings County to Minneapolis, Minn., with branch from Sioux City north to Sioux Falls, S. Dak., a total of 600 miles. A. S. King, E. N. Thompson and G. N. Borden, of Minnesota; Marion Hoke and Phillip Lawrence, of Huron, S. Dak., Incorporators. Offices at Huron and Minneapolis. Reported to be project of Chicago & North-Western.

SIOUX FALLS & SIOUX CITY (Electric).—Organized in Pierre, S. Dak., to build 60 miles.

*SOUTH & WESTERN.—Building from Elkhorn, Ky., via St. Paul, Trenchport, Kingsport, Johnson City, Spruce Pine and Marion to Rutherfordtown, N. C. Work under way from Fink, Va., south to Johnson City, Tenn., 82 miles, and from Altapass, N. C., south to Bostic, 62 miles. Contracts let to Walton, Witten & Graham, Graham, Va., for 13 miles; Walton, Wilson, Oates & Co., Knoxville, Tenn., for 12 miles; Carpenter & Boxley, Clifton Forge, Va., 18 miles, and to Purcell, Allen, Sheehan Co., Harrisonburg, Va., for four miles, and to the Patton Richardson Construction Co., Newport News, Va., for tunnel one-half mile long near Marion, N. C.; 70 miles of track laid.
——See Spartanburg & Northern.

SOUTH BETHLEHEM & SAUCON (Electric).—Incorporated to build from South Bethlehem, Pa., to Centre Valley, seven miles. C. P. Hoffman and William H. Lauer, of South Bethlehem; U. H. Wieand, of Emaus; Hugh E. Crilly, P. F. Cannon and T. H. Mulligan, of Allentown, interested.

SOUTH CAROLINA PUBLIC SERVICE CORPORATION.—Incorporated in Georgia to build from Charleston, Ga., to Columbia, with extensions to Spartansburg and Charlotte, through Lexington, Saluda, Greenwood, Union and Newberry, and from Augusta via Aiken to Orangeburg, a total of 525 miles. J. J. Timmes, President; C. R. Van Etten, Vice-President; J. P. Bonney, Secretary, all of New York. J. C. Lott, R. H. Jennings and J. A. Craig, of Orangeburg, and L. M. Pinckney, of Charleston, interested.

SOUTH DAKOTA CENTRAL.—Projected extension, from Rutland, S. Dak., south to Watertown, 75 miles; six miles built last year.

*SOUTHEASTERN ELECTRIC.—Contract let to E. H. Abodie & Co., St. Louis, for building from Chanute, Kan., to Coffeyville; also from Chanute to Galena. R. C. Rawlings, Kansas City, President.

SOUTHEASTERN RAILROAD.—To build from Jackson, Ky., southeast to Letcher County, 70 miles. Woodson Poor, G. Dennis, A. T. Holcomb, Jr., and L. J. Hopp, all of Cincinnati, incorporators.

*SOUTHERN.—Contracts let to W. J. Oliver Co., Knoxville, Tenn., for laying second track from Charlotte, N. C., to Atlanta, Ga., 260 miles. The contract calls for its completion within five years. Line also to be straightened and grades reduced.
——Johnson City Southern, projected from Marion, N. C., to Johnson City, 80 miles. Some grading is finished. W. V. Oliver, Knoxville, Tenn., contractor. Work suspended.
——Projected line from Pineville, Ky., northeast to Harlan, 25 miles. Surveys.
——Surveys reported from Seneca, S. C., to Rosman for a cut-off between Asheville, N. C., and Atlanta, Ga.
——The Middlesboro Mineral projected from Middlesboro, Ky., to Harlem, 43 miles. Rights of way secured some time ago, but no work done or authorized.
——The Asheville Southern formed for local development in interest of the Southern. No change since last year. No track laid.

*SOUTHERN MICHIGAN (Electric).—Extension from Niles, Mich., to Buchanan, seven miles; five miles graded. A. J. Hammond, South Bend, Ind, Chief Engineer.

SOUTHERN PACIFIC. Proposed extension of the Gila Valley, Globe & Northern east to Clifton, Ariz., and Morenci.
——The Oregon Eastern is to build from Natron, Ore., southeast to Klamath Falls, 152 miles, to a connection with the California Northeastern.
——The Oregon Eastern is also projected from Natron, Ore., east to Ontario, 320 miles.
——This company has under construction:
*Fallon Railway, between Hazen, Nev., and Fallon, two miles.
*Sacramento Southern, between Sacramento, Cal., and Antioch, 50 miles.
*California & Northeastern, between Weed, Cal., and Klamath Falls, Ore., 64 miles.
*Inter-California, projected from Calexico, Cal., near international boundary, southeast through Mexico, thence northeast across the boundary near Colorado river to connection with the Southern Pacific near Yuma, Ariz., 54 miles. About 15 miles built last year.
*Gila Valley, Globe & Northern has given contract to Robert Scherer & Co., Los Angeles, Cal., for relocating 12 miles from Rice, Ariz., to Cutter.
——Agreement made with the Atchison, Topeka & Santa Fe to build the Northwestern Pacific to connect the California North-Western of the Southern Pacific at Willits, Cal., with the San Francisco & Northwestern, owned by the Santa Fe. Will make through line from Eureka via Willits to San Francisco, 290 miles. The joint line is to be controlled alternately by Southern Pacific and Santa Fe.
——*The Shattuck & Desmond Construction Co., of Los Angeles, grading the Coast Line Railway between Santa Cruz and Davenport, 12 miles, on extension from Santa Cruz, Cal., north via Davenport, San Gregoria, Pescadero and Half Moon Bay to Southern Pacific near Colma, 68 miles; 80 miles built last year.
——*The Oregon Western, grading from Drain, Ore., west to Scottsburg, thence southwest to Marshfield on the Coos Bay, Roseburg & Eastern, 72 miles. Contract for first 20 miles let to the C. E. Loss Co., of San Francisco.
——Proposed spur tracks along the northern city front of San Francisco as extension of the present Belt line.
——*The Central California is to build the Dumbarton cut-off from Niles, Cal., to Dumbarton Point and thence to Redwood City and San Mateo.
——*Changing gage of South Pacific Coast branch as far as Watsonville. The whole road through to Santa Cruz is to be widened to standard gage.
——Survey for tunnel through Siskiyou mountains, in northern California. (Mar. 16, 1906.)
——The Beaverton & Willsburg to build a connecting line from Beaverton, Ore., to Willsburg, 13½ miles.
——*The new Pacific coast line in Mexico is an extension of the Sonora Railway and is being built by the Cananea, Yaqui River & Pacific. Preliminary surveys made via Mazatlan to Guadalajara, 775 miles. In operation from Empalme, near Guaymas, the terminus of the Sonora, south to Valderrain, 90 miles. Grant Bros. Construction Co., Los Angeles, Cal., has contract for further extension to Alamos, 58 miles, to be finished by Jan. 1, 1908. Alamos is to be on a branch east of main line.
——*Branch of the Cananea, Yaqui River & Pacific from Corral, on Guadalajara line, north along Yaqui river. Projected to Nacozari. Built to Buena Vista, 17 miles. Grant Bros. Construction Co. have contract Buena Vista to Tonichi, 63 miles, to be finished by Jan. 1, 1908.
——The Harriman interests have bought the Corvallis & Eastern, which see.

SOUTH OMAHA & WESTERN.—See Union Pacific.

SOUTH SIDE COAL & RAILWAY CO.—See Arkansas Pacific.

SOUTH TEXAS GULF.—Incorporated to build from Artesia, Tex., northwest to Carrizo Springs, 40 miles. Incorporators include: W. H. Myers and A. W. Raht, of Henrietta; C. M. Wright, R. H. Westfake, A. M. McElenee and M. Schott, of Fort Worth, and J. C. Davis, of Temple.

SOUTHWESTERN INTERURBAN.—Incorporated to build from Arkansas City, Kan., via Parsons to Coffeyville.

SOUTHWESTERN MISSOURI (Electric). — To build lines aggregating 101 miles in Jasper County, Mo., and southeastern Kansas. H. Rogers, of Joplin; E. E. Wallower, E. Bailey, A. Riley, of Harrisburg, Pa.; I. W. Frey, Joplin, Mo.; Samuel McReynolds, of Carthage, Mo., and W. S. Chinn, of Webb City, Mo., incorporators.

SOUTH WILMINGTON & SOUTHERN.—To build from South Wilmington, Grundy County, Ill., south to Wilson, Livingston County. Office at Chicago. A. L. Sweet, W. Farmer, R. H. Gruschow, C. A. Sweet and T. A. Lemmon, incorporators.

SPARTANBURG & NORTHERN.—Proposed line from Spartanburg, S. C., to the North Carolina state line. Geo. L. Carter, of the South & Western, President.

SPOKANE & BIG BEND (Electric). — Projected from Spokane, Wash., to Davenport, 120 miles. Surveys.

*SPOKANE & INLAND EMPIRE (Electric).—The Spokane & Inland building from Spokane, Wash., south to Spring Valley Junction, where the line will divide into two branches; the east arm to extend south to Moscow, Idaho, and the west arm to Colfax, Wash., 146 miles. Proposed connecting link from Colfax southeast to Moscow; also a connecting line further north from a point near Steptoe, Wash., northeast to near Oakdale. Contracts let to Grant, Smith & Co., of Rosalia, and others, for building the entire road. Track laid 97 miles. J. D. Graves, Spokane, Wash., President.
——Surveys being made for a tunnel three-fourths of a mile long in the business district of Spokane.

*SPOKANE-COLUMBIA RIVER RAILROAD & NAVIGATION.—Grading under way from Spokane, Wash., southwest to Ringold Bar, 150 miles. Contracts for grading and bridge work let to M. P. Zindorf, of Connell, Wash., and for track-laying to the Edenbell Construction Co., New York. William F. Kyle, President, and W. S. Foster, Chief Engineer, both of 112 Wall street, Spokane, Wash.

SPOKANE FALLS & NORTHERN.—Route located for cut-off from Denton's spur to point near Chewelah, 22 miles. Work to be begun this month.

*SPOKANE-PEND D'OREILLE RAPID TRANSIT CO.—Building from Spokane northwest to Lake Pend d'Oreille, Idaho, 34 miles. R. A. Hutchinson, General Manager.

SPRING CITY, ATHENS & PIKEVILLE.—To build from Pikeville, Tenn., east to Athens, 40 miles. T. C. Davidson, G. Young, M. V. Reed, A. S. Holloway, J. C. Locke and W. M. Snyder, incorporators.

*SPRINGFIELD, CLEAR LAKE & ROCHESTER (Electric).—Building between Springfield, Ill., and Rochester, 10 miles. Extension from Rochester to Pawnee, 15 miles, projected. J. E. Nelick, Springfield, Ill., Superintendent.

SPRINGFIELD RAILWAY (Electric).—Proposed two-mile extension through the factory district of Springfield, Ohio.

SPRINGFIELD, WILMINGTON & CINCINNATI (Electric).—Incorporated to build from Springfield, Ohio, to Cincinnati, with branch to Xenia. Headquarters at Springfield. Frederick Gargenhire, William C. Morton, Gustav Von Den Steinen, Richard Ingliff, Julian W. Tyler and Horace Andrews, incorporators.

SPRINGFIELD SOUTHWESTERN.—See Missouri Pacific.

SPRING, HAZEL & TRINITY RIVER.—Organized to build from Spring, Tex., east to the Trinity river, near Liberty. Office at Hazel, Montgomery County.

STANDARD & BATON ROUGE.—Organized with headquarters at Monroe, La., to build from Monroe to Standard and south to Cheneyville, 115 miles. J. B. York, President; J. F. Rutherford, Vice-President; C. J. Santag, Secretary and General Manager. (Mar. 16, 1906.)

STATESBORO & MIDVILLE.—To build from Statesboro, Ga., northwest to Louisville, 60 miles. Office at Savannah. C. G. Ogburn, J. A. Doyle, R. Meldrin and G. N. Jones, of Savannah, incorporators.

STEPHENSVILLE, NORTH & SOUTH TEXAS.—To build from Stephensville, Erath County, Tex., south to Hamilton, 35 miles. B. C. Cage, Marshall Ferguson and W. S. Watson, of Stephensville, and John Spurlin, of Hamilton, incorporators.

STEUBEN TRACTION CO.—This company, consolidation of the street railroads in Hornellsville, N. Y., and Canisteo, proposes to build south 15 miles to Jasper.

STEUBENVILLE & EAST LIVERPOOL. — Will build an eight-mile connecting line between Toronto, Ohio, and Wellsville. Van Horn Ely, of Buffalo; E. McDonnell, C. A. Smith, J. C. Rothery and G. H. Owen, incorporators.

STILLMORE AIR LINE.—See Wadley Southern.

SUFFOLK TRACTION CO.—See Brooklyn Rapid Transit Co.

SUGAR CREEK & NORTHERN.—See Wheeling & Lake Erie.

SUGAR PINE RAILROAD.—See Sierra of California.

SUMPTER VALLEY.—Proposed extension from Austin, Ore., southwest to Prairie City, 20 miles.

SUMPTER & CHOCTAW. — Proposed extension from Witfield, Ala., five miles south into Choctaw County. E. F. Allison, President, Bellamy, Ala.

SWAN CREEK.—Incorporated to build from Mt. Pleasant, Tenn., to Weatherly, 17 miles. W. H. Northcutt, W. H. Bruce, E. W. Hines and J. B. Keeble, incorporators.

T

*TALLULAH FALLS.—Contract let to A. & C. Wright, Atlanta, Ga., for an extension under the name of the Blue Ridge & Atlantic from Dulaney, Ga., to Franklin, N. C., 17 miles; 11 miles built. W. A. Seymour, Otto, N. C., Chief Engineer.

TAMPA & JACKSONVILLE.—See Gainesville & Gulf.

*TAMPA NORTHERN.—Building an extension from Hillsboro, Fla., to Brooksville, 44 miles; 31 miles graded and track being laid.

TAYLOR, BRENHAM & HOUSTON.—Projected from Taylor, Tex., southeast to Brenham, 71 miles. Headquarters at Brenham. All right of way reported secured.

TECUMSEH-NORMAN TRACTION.—Surveys being made to build from Tecumseh, Okla., west to Norman, 40 miles. W. F. Powell, Tecumseh, President.

TENNESSEE & ATLANTIC.—Organized to build from Harriman to Tellico Plains, Tenn. E. C. Myers, President, and Samuel P. Sparks, Secretary. (Mar. 16, 1906.)

TENNESSEE & GULF.—Projected from the mouth of Harpeth river to Clifton, Tenn., 70 miles; also branch from Lobelville to Nashville. (Mar. 16, 1906.)

TENNESSEE & NORTH CAROLINA.—Surveys being made for an extension from Waterville, N. C., to Canton, 35 miles.

TENNESSEE COALFIELDS & SOUTH ATLANTIC TRANSCONTINENTAL. — Projected from Knoxville, Tenn., via Waynesville, N. C., to Greenville, S. C.; with branch from Waynesville to Asheville, and one to Rutherfordton, N. C. Total length about 250 miles. Office at Asheville, N. C.

*TENNESSEE RAILWAY.—Contracts let to Walton, Wilson, Rodes & Co., of Knoxville, Tenn., for extension from Smoky Creek, Tenn., to Beech

Fork, six miles, and from Smoky Creek to Asher's Fork, 8½ miles. Plans made to reduce grades between Oneida and Almy, eight miles. W. O. Dyer, Chief Engineer, Oneida, Tenn.

TENNESSEE ROADS.—Plans being made by O. G. Wales, of Chicago, to build from Florence, Ala., north via Waynesboro and Linden, Tenn., to Waverly, Tenn., 90 miles.

TEXAS & GULF.—See Gulf, Colorado & Santa Fe.

*TEXAS & PACIFIC.—The Opelousas, Gulf & Northeastern building from Opelousas, La., northeast to point on the Mississippi and southwest to Gulf. Contracts let to Myrick & Andrews, of Opelousas, La., from Melville, La., to Crowley, 58 miles; work under way. C. C. Genung, Chief Engineer, Opelousas, La.; 23 miles built.

——Reported that the Weatherford, Mineral Wells & Northwestern is to be extended from Mineral Wells, Tex., west 25 miles, and ultimately northwest to Trinidad, Col., 600 miles. Final surveys for 150 miles from Mineral Wells made.

*TEXAS, NEW MEXICO & PACIFIC.—Chartered to build from McKinney, Tex., west to Roswell, N. Mex., 500 miles. General contract let to the Rock Island Construction Co., Chicago, and subcontracts to Callahan & Frye. Jesse Shaine, President, and M. J. Healy, General Manager, McKinney, Tex.

TEXAS NORTHERN.—To build from Fort Worth, Tex., south to Egan, and thence northeast to Dallas, 60 miles. Office at Fort Worth. Oscar Wells, G. H. Colvin and J. B. Daniel, of Fort Worth; S. Baker, S. Reinhard, R. A. Ferris and H. E. Jackson, of Dallas; W. A. McDonald, of Cleburne; B. P. McDonald, of Fort Scott, and David Bedell, of Iola, Kan., incorporators.

TEXAS, OKLAHOMA & NORTHWESTERN.—Organized last year to build from the Indian Territory-Oklahoma line in Caddo County, Okla., northwest to the Cimarron river in Woodward County, 450 miles; also branch from Blaine County east to Guthrie and one west through Roger Mills and Day Counties. Patterson Bros., of Benton, Mich.; A. H. Huston, John Devereaux, Charles Seeley and C. E. Carpenter, of Guthrie, Okla., and Henry Knapp, of New York, interested.

*TEXAS RAILWAY.—Building from Port O'Connor, Tex., to San Antonio, 190 miles, and from Gonzales to Smithville, 40 miles. W. S. Hipps & Co., Houston, Tex., contractors. L. A. Gueringer, Chief Engineer, Victoria, Tex.

TEXAS ROADS.—Large improvements in terminal facilities at Galveston ordered by Railroad Commission, including a causeway across Galveston Bay.

——Plans reported made by Charles M. Schwab for road from Vernon, Tex., to Roswell, N. Mex., 365 miles. J. E. Lutz, of Vernon, Tex., interested. Temporary surveys.

——(Electric).—Stone & Webster, of Boston, Mass., to build projected interurban road from Houston to Galveston, 51 miles, with branches to points on Galveston bay. E. M. House, Austin, Tex., interested.

*TEXAS SOUTHEASTERN.—Building extension from Vair, Tex., to Lufkin, 10 miles.

TEXAS TRACTION.—To build from Dallas, Tex., to Sherman. W. R. Brents, of Grayson County; F. A. Jones, of Harris County, and J. F. Strickland, D. A. Templeton and J. N. Simpson, of Dallas, incorporators.

THOMASVILLE & GULF.—Surveys from Thomasville, Ga., southwest to the Apalachicola Northern, 50 miles. C. R. Knight, Thomasville, interested.

THOMASVILLE & NORTHEASTERN.—Incorporated to build from Thomasville, Ga., northeast to Sparks, 50 miles. J. F. Harris and C. C. Shellay, of Pavo; B. Croft, of Hempstead, and J. J. Hodges, incorporators.

*TIDEWATER.—Building from Norfolk, Va., via Roanoke, west through Virginia, 332 miles, and from that point under the name of the Deepwater north in West Virginia to Deepwater, 118 miles. Grading from Norfolk to mile post 103 finished last year. Contract from m. p. 103 to m. p. 123 let to J. G. White & Co., 20 miles, finished last month. Other contracts let for grading from m. p. 123 west as follows: Wright & Bonsal, 22 miles; McDermott Contracting Co., 26½ miles; Butler Bros. Construction Co., 15 miles; Carpenter, Frazier, Boxley & Co., 20 miles; Lane Bros. Co., 32.1 miles; the D. A. Langhorne Co., Inc., 20 miles; MacArthur Bros. Co., 111 miles. Track laid on Tidewater 105 miles and on the Deepwater 73 miles. The various contractors mentioned above have let some of the work to the following sub-contractors:

Wright & Bonsal to R. C. Collins, Polland & Haw.

Butler Brothers to Johnson & Edwards Engineering & Construction Co., H. H. Perrow & Co., Jamieson & Dyer.

Carpenter, Frazier, Boxley & Co. to Suiter & Dillon, Vaughn & Boxley, P. S. Boxley & Co.

Lane Brothers Co. to J. E. Ellis & Co., Coleman & Daniels, Roberts, Ferguson & Co., J. F. Lane & Co., A. Veitch & Starritt, Adams & Jennings, F. H. Sprague, P. H. Marshall, Son & Co., G. M. McDonald, Lane, Wisely & Bealley.

The D. A. Langhorne Co., Inc., to Roberts, Ferguson & Co., John Saloney, W. O. Lipscomb Co., Pitts & Calligan, Howland & Wright, J. L. Pitts & Co., Campbell & Ballard, Ballard Craig & Co., A. Farrio & Co., S. W. Calder & Co., D. A. Allen & Co., Berry & Ferrata.

MacArthur Brothers Co. to Bates & Rogers Construction Co., Jerry Connelly, W. H. Johnson, W. H. Winston & Co., Price, Griscom & Co., Standard Construction Co., Callahan, Hornick & Co., Effore Ferrata, Harmon Lindsay & Co., Ingles & Shelvurne, P. J. Millett, J. C. Zobrist & Co., Cahill & Connell, Mike Lamore, Pikeville Grading Co., F. H. Holstein, Leonard, Beckman & Co., Robert Woods & Co., D. J. McDonald, Mason, Hanger, Goodman & Co., Carpenter & Boxley, W. N. Camp & Co., Winston & Co., James Hearn & Co., Garland, Lutz & Co., Douglass Brothers Co.

The Marsh Fork incorporated to build an extension of the Deepwater from Surveyor Station, W. Va., 100 miles to the Ohio river at the mouth of the Great Kanawha river.

See Virginia Railway.

TIDEWATER DEVELOPMENT CO. (Electric).—To build from Gadsden, Ala., southwest to Tuskaloosa, 125 miles. From this point the company to operate steamers south on the Warrior, Tombigbee, Alabama and Mobile rivers to Mobile. J. M. Dewberry, President; Lewis Miller, Vice-President, and J. W. Donnelly, Secretary.

TIOGA & CLINTON.—Incorporated to build from Morris, Tioga County, Pa., to point in Chapman Township, Clinton County, Pa. H. T. Hall, Lock Haven, Pa., President. B. F. Geary, James C. Smith, H. T. Hudson, C. O. Dunlap, John T. Cupper, H. T. Hall, all of Lock Haven, Pa., and E. S. McNaul and M. W. Denman, of Philadelphia, Directors.

TOLEDO & INDIANA (Electric).—Preliminary surveys for extension from Bryan, Ohio, west to Waterloo, Ind., 30 miles; also for a branch from Delta, Ohio, southwest via Napoleon to Defiance, 30 miles.

TOLEDO, MARSHALL & NORTHERN.—Proposed line from Bay City, Mich., southwest to Montpelier, Ohio. Office at Marshall, Ohio. (Mar. 16, 1906.)

TOLEDO RAILWAY & LIGHT CO.—New branch to be built from Toledo to Ottawa Beach, 15 miles.

TOMBIGBEE.—Proposed extension from Healing Springs, Ala., north to Butler.

*TONOPAH & GOLDFIELD.—Building extension from Goldfield, Nev., southeast to Bullfrog, 80 miles.

TONOPAH & GREENWATER. — Incorporated in February in California, to build from Amargosa Borax Works in Inyo County, Cal., to Greenwater. F. M. Smith, of Oakland, Cal.; C. B. Zabriskie, of New York; De Witt Van Buskirk, of Bayonne, N. J., incorporators.

*TONOPAH & TIDEWATER.—Building from Ludlow, Cal., north to Tonopah, Nev., 250 miles. In operation from Ludlow north to two miles beyond Sperry, 80 miles. Contract let to R. R. Coleman, Los Angeles, Cal., for building from the San Bernardino-Inyo County line north to Lila C mine, 45 miles.

TONOPAH TERMINAL.—Incorporated to build from Liberty, Cal., to Silver Peak, 100 miles. Camp Bros., of Philadelphia, said to be interested. W. C. Wynkoop, President, and S. H. Park, Secretary. (Mar. 16, 1906.)

TOPEKA & NORTHWESTERN.—See Union Pacific.

TRANS-ALASKA-SIBERIAN. — Incorporated in New Jersey by Loicq de Lobel, No. 11-bis Rue d'Edinbourg, Paris; J. A. L. Waddell, Kansas City, Mo.; John J. Healy, Seattle, Wash.; William H. Black, 11 Wall street, New York, and John R. Turner, of the Corporation Trust, 15 Exchange place, Jersey City. To build in Alaska and Siberia, with tunnel under Behring straits. Proposed western terminus is Kansk, on the Siberian railway, and the eastern on the Alaska-Canada boundary, 3,750 miles, and branches 2,250 miles.

TRINITY & BRAZOS VALLEY.—See Colorado & Southern.

TRINITY VALLEY & NORTHERN.—To build from Dayton, Tex., north to Cleveland, 25 miles. L. Fouts, A. L. Rutt and J. B. Sterling, of Dayton; C. B. Wood, C. Ross and W. B. Cottingham, of Houston; J. C. Johnson, of Richmond; C. L. Rutt, of Beaumont, and W. H. McGregor, of Carson, incorporators.

TULSA, TEXAS & GULF.—Organized by L. Howard Lee, of Oklahoma City, to build from Matagorda Bay, Tex., north to Oklahoma City, Okla., and Tulsa, Ind. T., about 600 miles. M. H. Smythe, Gainesville, Tex.; H. V. Pentecost, Guthrie; J. W. Helt and M. S. Lee, Oklahoma City; D. D. Merry, Roswell, N. Mex., Directors. (Mar. 16, 1906.)

TUSCARORA TRACTION CO.—Incorporated to build from Addison, N. Y., west to Jasper, 15 miles. Thomas E. Hardin, of Addison; George R. Brown and John M. Connelly, Directors.

U

UMATILLO CENTRAL.—See Oregon Railroad & Navigation Co.

UNIONTOWN & WHEELING SHORT LINE.—See Western Maryland.

*UNION PACIFIC.—Contract let to the Kilpatrick Bros. & Collins Contracting Co., of Beatrice, Nebr., to extend the Topeka & Northwestern from Onaga, Kan., to Marysville, 32½ miles.

——*Also for building the South Omaha & Western *cut-off from South Omaha, Nebr., west to Lane, 11¼ miles. Half graded.

——*Branch from O'Fallon, Nebr., northwest to Northport, 114 miles; all graded; track laid to Lewellen. Contract let to W. C. Bradbury & Co., Denver, from Lewellen northwest to Northport, 56 miles.

——*Connecting line from Stromsburg, Nebr., west to Central City, 23 miles. Finished to Hordville, 18 miles. Contract let to Wood, Bancroft & Doty, of Omaha, for five miles from Hordville west to Central City.

Surveys reported for double cut-off from Laramie, Wyo., south to Platteville, Colo., 90 miles. Loucks estab one part from [illegible] 20 miles south of Cheyenne to [illegible] west up Lone Tree Valley to join [illegible] southwest of Cheyenne, while [illegible] two branches, one running northeast to Cheyenne, and the other northwest [illegible] the line between Rock Creek and [illegible]. Surveys reported from Kansas City to Memphis, Tenn., 550 miles.

Proposed extension of the Cedar Rapids branch from Spalding, Nebr., northwest 150 miles into South Dakota. (Mar. 16, 1906.)

See Missouri, Kansas & Gulf.

UNION TRACTION OF IOWA.—To build from Marshalltown north to Waterloo; also from Marshalltown south to Newton, a total of 78 miles. Office at Marshalltown, Iowa. D. T. Denmead, Marshalltown, President; J. E. Sedgewick, Waterloo, Vice-President; L. C. Norris, Marshalltown, Secretary, and George L. Liehty, Waterloo, Treasurer. (Mar. 16, 1906.)

*UNITED RAILWAYS OF ST. LOUIS.—Planning to rebuild each year 25 to 30 miles of line, until its 470 miles of lines are rebuilt.

UTAH & IDAHO.—Organized to build from Provo, Utah, north to Logan, 150 miles. Office at Ogden. David Eccles, President; M. S. Browning, Vice-President; C. H. Kircher, Secretary, and H. H. Spencer, Treasurer.

UTICA SOUTHERN (Electric).—Incornorated to build 26 miles of road in Oneida and Madison Counties, New York. M. W. Terry, of Waterville; F. K. Baxter, of Utica, and W. M. West, of Hamilton, Directors.

V

*VALDEZ, MARSHALL PASS & NORTHERN.—Building from Valdez, Alaska, to Eagle City, 412 miles; 10 miles graded. E. D. Pierce, F. H. Huck, John D. Fearlake and Kenneth Rose, all of New York, and La Grand Bouker, of Jersey City, incorporators. Office at 243 Washington street, Jersey City.

VALDOSTA & NASHVILLE.—To build railroads in Georgia. H. B. Peeples, J. A. Alexander, J. W. E. Poell, of Nashville; R. D. Stevens, of Valdosta, Ga., incorporators.

VALDOSTA SOUTHERN.—See Georgia & Florida.

VALLEJO & NORTHERN (Electric).—Incorporated to build from Vallejo, Cal., northeast to Woodland, with branches, 70 miles; location surveys; rights of way being secured. Office at 327 Georgia street, Vallejo, Cal. Melville Dozier, Jr., 649 Mariposa street, Oakland, Cal., President and Chief Engineer.

VALDOSTA, MOULTRIE & NORTHWESTERN.—Incorporated to build from Valdosta, Ga., northwest to Moultrie, 38 miles. E. P. Rose, C. R. Ashley, H. C. Briggs, J. A. Dasher, R. F. Ousley, J. Y. Blitch and D. C. Ashley, all of Valdosta, interested.

*VANDALIA.—Extending second track from point two miles west of Union Station at Indianapolis, Ind., top of grade at Ben Davis, 4¼ miles.

——*Second track being laid by Jones Bros., Columbus, Ohio, from Knightsville to the East Yard, Terre Haute, 14 miles. This includes a better line between Brazil and Seelyville, eight miles.

——*Second track from west end of Wabash river bridge at Terre Haute to Macksville, one mile being laid.

——Permission granted to lay 12 additional tracks at grade across Belmont avenue at Indianapolis, Ind.

VEBLEN & NORTHWESTERN.—Grading completed from Veblen, S. Dak., east to the Minnesota line, 32 miles. M. J. Hawley, Brandt, S. Dak., President.

*VERSAILLES & SEDALIA.—Building from Versailles, Mo., northeast six miles to property of the Missouri Cannel Coal Mining Co. Half the grading finished. Office at Versailles. J. Applewhite, President, and H. A. Bailey, Chief Engineer.

VICKSBURG, NATCHEZ & GULFPORT.—Organized to build from Vicksburg, Miss., southeast to Gulfport, 225 miles, with branch west to Natchez, 100 miles.

VIRGINIA & CAROLINA COAST.—See Norfolk & Southern.

VIRGINIA & KENTUCKY.—Proposed extension from Wise, Va., north toward the Kentucky border.

VINING & COLEMAN.—Projected from Coleman, Tex., southeast to Austin, 150 miles. W. L. Vining interested.

VINITA & WESTERN.—Projected from Vinita, Ind. T., north to Coffeyville, Kan., 50 miles; first 10 miles graded; work suspended. H. A. Genung, Vinita, Ind. T., is Chief Engineer.

VIRGINIA & POTTS CREEK.—See Norfolk & Western.

*VIRGINIA & SOUTHWESTERN.—Contract let to Callahan Construction Co., of Knoxville, Tenn., for extension from Moccasin Gap, Va., to Persia, Tenn., 37½ miles. E. S. Fraser, Bristol, Tenn., interested.

VIRGINIA AIR LINE.—Chartered to build from point between Keswick and Gordonsville, Va., south to Farmville, 60 miles. T. O. Troy, Amherst, President, and J. M. Robertson, Charlottesville, Secretary.

*VIRGINIA ORE & LUMBER COMPANY.—Contract let to Vaughan Construction Co., of Roanoke from Town Creek, Va., west to Stuart's Knob, 12 miles. F. A. Hill and H. D. Lafferty, interested. Office at Roanoke, Va.

VIRGINIA RAILWAY.—Chartered this month to take over the Deepwater Railway and the Tidewater Railway.

W

*WABASH.—About 30 miles of double track to be built each year until the entire line is double-tracked between St. Louis and Chicago.
——Proposed double-tracking 30 miles of the Detroit division.
——Proposed revision of the Moberly division.
——See Wheeling & Lake Erie.

WABASH SOUTHERN.—See Missouri Pacific.

WABEE & WAWASEE.—Projected from Syracuse, Ind., west via Wabee lake, in Kosciusko County, to Milford, with branch from Syracuse to Lingle lake, 12 miles. A. St. Newberry, W. D. Frazer, C. I. Reilly and J. P. Nolan are interested.

WACCAMAW RAILROAD.—Organized to build from near Oldtown, N. C., west to Maulyville, 50 miles. E. Nelson, of Detroit; E. S. Hartwell, Chicago; J. E. Clark, C. E. Clark, E. H. Stillman and W. H. Chadbourn, of Wilmington, all of Waccamaw Land & Lumber Co., incorporators. (Mar. 16, 1906.)

WADSWORTH & WESTERN TRACTION.—Planning to build from Cleveland, Ohio, southwest to Cincinnati, with a branch through Medina, Wayne, Ashland and Richland Counties.

WADLEY SOUTHERN.—Formerly the Stillmore Air Line; projected extension from Wadley, Ga., north to Comak, 40 miles, and ultimately north to Elberon, 50 miles.

WARREN, JOHNSVILLE & SALINE RIVER.—Chartered to build from Warren, Ark., southeast 25 miles. S. H. Fullerton, President, and C. L. Robinson, Secretary, both of St. Louis; and J. F. Forsyth, of Warren, Ark., General Manager. (Mar. 16, 1906.)

WASHINGTON & GETTYSBURG.—Incorporated to build from Gettysburg, Pa., to Harpers Hill, eight miles. J. W. Le Gore, of Le Gore, Md., President; W. H. O'Neill and W. T. Ziegler, Gettysburg; J. R. Birkholder, Lancaster; R. S. Potter, Philadelphia; C. A. Welker and W. B. Stanbaugh, Woodsboro, Directors.

WASHINGTON & GREAT NORTHERN. See Great Northern.

WASHINGTON-ALASKA TRANSPORTATION RAILROAD CO.—Organized in Phoenix, Ariz., to build from Nome City, Alaska, northwest to Cape Prince of Wales, for the northern division; from Nome City northeasterly to Council City, thence easterly to Koyukuk on Norton bay; thence southeasterly up the Yukon and crossing it to Tanana river; thence south to White Pass, Skagway and Juneau; thence across Stikine river to Vancouver, in all 2,000 miles.

*WASHINGTON, BALTIMORE & ANNAPOLIS (Electric).—Building from Baltimore to Washington, 31 miles, with branch to Annapolis, 14½ miles. Half graded.
——The Baltimore Terminal Co. incorporated to build a terminal line at Baltimore.

*WASHINGTON, IDAHO & MONTANA.—Contract let to Wren & Greenough, of Spokane, Wash., for extension from Harvard, Idaho, to Bovill, 19 miles.

WASHINGTON, PATUXENT & DRUM POINT.—Incorporated to build from point on Chesapeake Beach Railway, southeast to Drum Point and Solomon's Island, on Chesapeake Bay, 30 miles.

WASHINGTON ROADS (Electric).—Proposed line from Big Falls, Wash., along the Pend d'Oreille river to point north of Newport, 31 miles. David T. Ham, interested.

*WASHINGTON, WESTMINSTER & GETTYSBURG.—Contract let to Ira Taylor, 20 Broad street, New York, for building from Washington, Va., northeast to Gettysburg, Pa., 90 miles. I. B. Colegram, President, Sterling, Va.

WAUPACA & GREEN BAY.—Incorporated to build from Waupaca, Wis., northeast to Scandinavia, 11 miles. A. G. Nelson, A. M. Renner, W. B. Johnson, J. Gordon and A. A. Aggerbeck, interested.

WAYCROSS, BAXLEY & VIDALIA.—To build a line from Waycross, Ga., north to Vidalia, 65 miles. C. W. Dean, of Baxley; J. S. Bailey, W. H. Buchanan and J. T. Myers, of Waycross, incorporators.

WAYNESBURG & WASHINGTON.—Proposed extension from Waynesburg, Pa., south to Dotysburg. Final surveys. (Mar. 16, 1906.)

WEATHERFORD, MINERAL WELLS & NORTHWESTERN.—See Texas & Pacific.

WEST COAST TRACTION.—To build from Olympia, Wash., to Tacoma, 320 miles, including branches. C. H. Weeks and Cyrus Bradley, Spokane; B. J. Weeks, Tacoma; A. D. Leverson, London, England; J. W. Reynolds, Chehalis, and F. B. Hubbard and W. W. Cannon, Centralia, Wash., incorporators.

WESTERN & GULF.—Surveys from Hawkinsville, Ga., to Dawson, 85 miles. Contracts were to be let early this spring. Crawford Wheatley, Americus, President.

WESTERN MARYLAND.—The Uniontown & Wheeling Short Line projected from Uniontown, Pa., west to Wheeling, W. Va., 68 miles. Surveys and some work done.
——The Pittsburg, Westmoreland & Somerset projected from Zufali, Pa., to Somerset.
——*Contract reported let to Fisher, Gilmore & Reiley, of Baltimore, for reconstructing and double tracking from Owings Mills, Md., north to Emory Grove, 6½ miles.
——Proposed low-grade line from Emory Grove, Md., west to Williamsport, 73 miles.

WESTERN MISSOURI INTERURBAN.—To build from Odessa, Mo., south to Greenfield, 125 miles. Office at Clinton, Mo., and at Sioux Falls, S. Dak. D. J. Haugeberg, F. S. Gray, E. W. Campbell and S. S. Halliday, of Clinton, Mo., incorporators.

WESTERN NEW YORK & PENNSYLVANIA.—See Pennsylvania.

WESTERN OKLAHOMA.—See Atchison, Topeka & Santa Fe.

*WESTERN PACIFIC.—Building from Salt Lake City, Utah, west to Oakland, Cal., 929 miles, of which 122 miles are in Utah, 427 miles in Nevada and 380 miles in California. Contracts let to the Utah Construction Co., Ogden, Utah, for 110 miles in Utah, 107 miles in Nevada and 174 miles in California, and to E. B. & A. L. Stone, of Oakland, Cal., for 185 miles in California. Contracts for remaining 326 miles in Nevada were to be let last month. Grading in Utah finished and 94 miles of track laid; 130 miles graded in California and 10 miles of track laid. There are now about 5,000 men at work at various points on the line. There will be 48 tunnels, aggregating 48,263 lineal feet.

WESTERN TEXAS & GULF.—Incorporated to build from San Angelo, Texas, to Stanton, and ultimately north to Amarillo. E. H. D. Caston, J. T. Witt, and E. P. Speers, of Dallas; W. P. Edwards and J. W. Pinson, Big Springs, interested.

WEST JERSEY & SEASHORE.—See Pennsylvania.

WEST MICHIGAN INTERURBAN.—Projected from Grand Rapids, Mich., to Hart, 80 miles. H. H. Christ, Grand Rapids, Chief Engineer.

WEST PENN (Electric).—Greensburg & Western projected from Greensburg, Pa., west to Irwin, 12 miles.

WEST SHORE TRACTION.—Incorporated to build from Orangeburg, Rockland County, N. Y., north to Haverstraw. Frank J. Whan, A. J. Whan, E. J. Welsh, N. E. Heine, G. P. Fail, G. S. Fulton, of New York; A. S. Brown, Brooklyn; E. G. Roff, Jr., Orange, N. J., and E. A. Hilton, Paterson, N. J., Directors.

WEST TEXAS & NORTHERN.—To build from Kerrville, Tex., north to Amarillo, 450 miles. Office at Big Springs. E. P. Sears, J. T. Pinson, J. W. Pierson, John T. Witt, E. H. D. Gaston, J. A. Wilhite, all of Dallas; Will P. Edwards, W. R. Cole, G. L. Brown and S. H. Morrison, all of Big Springs, incorporators. (Mar. 16, 1906.)

WEST VIRGINIA, PITTSBURG & ATLANTIC.—To build from Rowlesburg, W. Va., to Durbin, 100 miles. C. W. Mosser and C. E. Mower, Hendricks, W. Va.; E. D. Baker, Beverly, W. Va.; H. A. Armstrong, Parsons, W. Va., and R. F. Whitner, Philadelphia, incorporators. (Mar. 16, 1906.)

*WEST VIRGINIA MIDLAND.—Incorporated to build from Suiton, W. Va., to Marlinton, 50 miles. Has bought the Holly River & Addison from Holly Junction to Webster Springs, 30 miles, as part of its line. Building extension up Elk River valley above Webster Springs, 20 miles.

*WHEELING & LAKE ERIE.—Building the Lorain & West Virginia from Wellington, Ohio, north to Lorain, 20 miles. Contracts let to G. M. Kepner, of Connorsville, and to F. J. Peterson, of Cedar Rapids, Iowa; 15 miles built last year.
——*On the Sugar Creek & Northern cut-off from Bolivar, Ohio, northwest to Orrville, 26 miles. J. C. Carland & Co., of Toledo, contractors. Fifteen miles were finished in 1906; work stopped because of lack of funds.
Second track from Pittsburg Junction to Huron Junction, 124 miles, to be built when funds available.

*WHITEHALL & GRANVILLE (Electric).—Work reported begun on extension from Middle Granville, N. Y., southeast to West Pawlet, Vt. F. B. Gridley, Troy, N. Y., Engineer of Construction.

WHITE PASS & YUKON.—Plans made by Close Bros., of London, to build in Alaska from the coast to Orca, 70 miles; thence to Fairbanks. G. M. Rice, Chief Engineer.

WHITE RIVER VALLEY.—See Chicago, Milwaukee & St. Paul.

WHITE SULPHUR SPRINGS.—Chartered to build from Van Buren, Ark., to Uniontown, 15 miles. R. P. Allen, Van Buren, President; Jas. H. Van Brunt, St. Joseph, Mo., Vice-President; J. L. Rea, Secretary, and B. E. Powers, Treasurer, both of Van Buren. (Mar. 16, 1906.)

WHITE TOP.—To build from Grassy Ridge, Va., south to Upperford; also from Grassy Ridge to Blevins Gap. Office at Azeu, Va. W. A. Hassenger, of Lamona, President, and J. L. Hurt, of Abingdon, Secretary. R. M. Page and G. E. Barnes, incorporators.

WICHITA MOUNTAIN & ORIENT.—To build from Lawton, Okla., north to Day County, and from Lawton, east to Atoka, Ind. T. W. M. Smith, H. A. Loyd, E. W. Moll, J. E. Thomas and C. A. Rising, of Lawton, incorporators.

WILKES & LINCOLN.—Incorporated to build from Washington, Ga., to Lincolton, 50 miles.

WILKESBARRE & HAZLETON (Electric).—Terminal improvements to be made in Wilkesbarre and Hazleton, Pa.

*WISCONSIN & NORTHERN.—Successor of the Green Bay, Oshkosh, Madison & South-Western. Building from Menasha, Wis., to North Crandon, 125 miles. Contract let to McDonnell, O'Connor & Co., of Shawano, from Gresham to Langlade, 25½ miles; built from Shawano to Neopit, 21 miles, and from Crandon to connection with the Soo Line, seven miles. Grading completed from Gresham to Neopit, 11 miles; additional contracts soon to be let. William Cambier, Oshkosh, Wis., Chief Engineer.

*WISCONSIN CENTRAL.—The Lake Superior & Southeastern building from Ladysmith, Wis., north to Duluth, Wis., 125 miles. Considerable grading finished.
——Projected connecting line from Portage, Wis., south to Janesville, 40 miles.

WISCONSIN VALLEY (Electric).—Incorporated to build from Grand Rapids, Wis., northeast to Stevens Point, 15 miles, and via Wausau to Merrill, 60 miles. Incorporators include George A. Whiting, of Neenah; H. F. Whitcomb and George Lines, of Milwaukee.

WISE TERMINAL.—Surveys being made for extension north from Glamorgan, Va., to the Kentucky state line, 15 miles.

WOODLAWN STREET RAILWAY (Electric).—To build from Beaver to New Sheffield, six miles. Office at Aliquippa. D. G. Dugan, S. J. Dugan, James A. Newell, J. E. Wilson and R. Burgher, incorporators. J. F. Reed, of Beaver, Pa., interested.

WYNNE, NEWPORT & WESTERN.—Incorporated to build from Wynne, Ark., to Newport, 40 miles. O. N. Killough, Wynne, President; Isaac Goldman, St. Louis, Vice-President; W. H. Barnes, Wynne, Secretary; Sigmund Wolf, St. Louis, Treasurer, and M. M. Stuckey, Newport, Ark., Attorney.

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YAKIMA VALLEY TRACTION.—Incorporated to build 120 miles in Spokane and Yakima valleys, Wash. W. A. Bell, North Yakima, interested.

YAZOO & MISSISSIPPI VALLEY.—See Illinois Central.

YELLOWSTONE PARK.—See Oregon Short Line.

*YELLOWSTONE PARK.—To build from Bridger, Mont., southwest to Cook, 125 miles. Contracts let to Western Development Co., of Belfry, Mont., 26 miles in operation. No connection with Oregon Short Line road of same name.
——See Oregon Short Line.

YOSEMITE SHORT LINE.—See Sierra of California.

*YOSEMITE VALLEY.—Building with own force extension from Bagby, Cal., east to the Yosemite National Park, 30 miles.

*YOUNGSTOWN & OHIO RIVER.—Building from Salem, Ohio, to East Liverpool. Contracts let to Cleveland Construction Co., Salem, Ohio, for 16 miles from Washingtonville to West Point. Graded for eight miles. George L. Wells, Salem, Ohio, Chief Engineer.

*YOUNGSTOWN & SOUTHERN.—Contract let to J. G. White & Co., of New York City, for the electrification of this road between Youngstown and Columbiana, 16 miles.
——*Building extension to Leetonia, five miles, to be electrified by J. G. White & Co. To be eventually extended from Leetonia south to East Liverpool, 30 miles.

YREKA RAILWAY.—Preliminary surveys under way for extension from Yreka, Cal., to Etna, 40 miles.

YULE CREEK.—Incornorated to build from Bryant, Colo., through Pitkin and Gunnison Counties to headwaters of Yule creek. G. W. Bowen, S. I. Hern, Pope Clerk, A. E. Davis and R. E. Black, of Denver, and J. B. Bowen and W. R. Jewell, of Redstone, interested. (Mar. 16, 1906.)

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Canada.

ALBERTA & FLATHEAD.—Projected from point on Crow's Nest Pass branch of the Canadian Pacific, near Pincher Station, to the source of Flathead river. A. C. Kommis, Pincher Creek, Alb., applicant.

ALBERTA RAILWAY & IRRIGATION CO.—See Crawford Bay & St. Mary's.

ASHCROFT, BARKERVILLE & FORT GEORGE.—Projected from Ashcroft, B. C., to Fort George, 300 miles. C. S. Riley and H. C. Crowe, of Winnipeg, Man., applicants. (Mar. 16, 1906.)

ATHABASKA RAILWAY.—Authorized from Edmonton, Alb., north to Fort Murray, 240 miles; projected from Fort Murray north to Fort Smith, on Slave river, 250 miles.

ATLANTIC, QUEBEC & WESTERN.—To build from Gaspe, Que., west to Amqui, thence south to Edmundston on the St. John river, 260 miles.
——To build from a point near Gaspe south along coast to Paspebiac, 102 miles. Charles Brien and Joseph Lavoie, of Gaspe, Directors, and E. Stanley Elvey, Secretary.

BARRIE & ORILLIA.—Projected from Grenfell, Ont., via Barrie, to Orillia. W. A. Boys, Barrie, Ont., solicitor.

BURRARD-WESTMINSTER BOUNDARY RAILROAD & NAVIGATION CO.—Organized to build from Vancouver, B. C., to Burrard Inlet. Tupper & Griffen, Vancouver, B. C., solicitors.

CANADIAN EASTERN.—Incorporated to build from Montreal northeast to the Gulf of St. Lawrence. E. B. Garneau, of Quebec; L. Moore, V. Cussow, D. W. Campbell and A. Geoffrion, of Montreal, Directors. Office at Montreal.

CANADIAN NORTHERN SYSTEM.—Work under way or projected as follows:

*CANADIAN NORTHERN.—Contract reported let to MacDonald-McMillan Contracting Co. from Etcimami, Sask., on Prince Albert line, northeast to The Pas, Keewatin, 80 miles, the first section of projected line to Fort Churchill, on Hudson bay.
——*Work reported under way on branch from Dalmeny, Sask., to Coulter, Man., 45 miles.
——Projected connecting line from Brandon, Man., via point on Hartney Junction-Virden line, south of Virden, west to Regina, Sask., 175 miles.
——Proposed extension in Minnesota from North Lake, Ont., the terminus of the Stanley Junction branch, west to connection with Detroit & Iron Range.

——*Building extension of Rossburn Junction Rossburn branch, from Rossburn, Man., northwest to western boundary of Manitoba. Further extensions projected, one northwest to Buchanan, Sask., on main line, the other west via Dundurn, on the Q., L., L. & S. to point near western boundary of Saskatchewan.

——*Building from Edmonton, Alb., north to Athabasca Landing, 100 miles; work under way on 21 miles.

——Proposed connecting line from Aberdeen, Sask., on main line, north to Fenton, on Prince Albert line.

——Proposed extension of Thunder Hill branch from Benito, near western boundary of Manitoba, west to proposed Aberdeen-Fenton connecting line.

——Proposed connecting line from Prince Albert, Sask., southwest to main line at North Battleford.

——Proposed branch from main line at Langham, Sask., northwest to Carlton.

——Proposed branch from Vermilion, Alb., west to Wetaskiwin.

——Proposed extension from Edmonton, Alb., northwest to western boundary of Alberta.

——This company has asked authority to build the following lines:

——Branch from Humboldt, Sask., southwest to Township 29, west of the third meridian, then westerly and southwesterly to Calgary, Alb.

——Branch from point in Township 29, west of third meridian, southwest to point on Qu'Appelle, Long Lake & Saskatchewan, between Craik and Bladworth.

——Branch from Humboldt, Sask., northwest to a point in Township 43, west of second meridian.

——Branch from South Battleford, Sask., west to point in Township 44, Range 27, west of third meridian.

——Branch from North Battleford, Sask., northwest to Township 59, west of fourth meridian.

——Branch from Strathcona, Alb., south to Calgary.

——Branch from Regina, Sask., southwest to international boundary.

——From Saskatoon, Sask., southwest to South Saskatchewan river.

——From junction of Athabasca and McLeod rivers in Alberta southwest to the headquarters of the McLeod river.

——From Battleford, Sask., west 100 miles.

——Branch from a point near Strathcona, Alb., southwest to Pigeon Lake, Alb.

——Branch from point south of Neepawa, Man., northwest to main line, near the crossing of the South Saskatchewan river.

——From Regina, Sask., west to point on Red Deer river in Alberta, with a branch west of the Saskatchewan river, running north to point in or near Carlton, on North Saskatoon river.

——Map in annual report shows Duluth, Rainy Lake & Winnipeg as Canadian Northern line under construction. See D., R. L. & W. under United States.

*CANADIAN NORTHERN ONTARIO.—Building from Parry Sound northwest to Sudbury; projected thence north to Moose Mountain iron mines.

——*Contract let to Central Contracting Co., Toronto, to build from Nepigon, Ont., north to Lake Nepigon.

Proposed branch from nine miles above Parry Sound, Ont., northeast to North bay, 75 miles.

——Plans filed for extension from Sudbury to Batchewaung bay, Lake Superior, and along the north end of Lake Superior to Canadian Northern at Kashabowie, west of Port Arthur.

——*Line projected from Key Inlet, near Sudbury, Ont., east to Ottawa, Ont., 350 miles. Contract reported let to J. Y. Schell from Ottawa east to Hawkesbury, 50 miles.

——Application made for authority to build extensions and branches in Ontario as follows: Washago west to Lake Huron near Kincardine; Arnprior south to St. Lawrence river between Kingston and Brockville; Pembroke southwest to Lake Ontario between Toronto and Belleville; Toronto-Ottawa line northwest to Georgian bay, near Collingwood or Owen sound; Toronto-Ottawa line west through or near Toronto, Hamilton and London to Windsor, with branches to St. Thomas and Sarnia and loop north of Toronto; Niagara river northwest via Hamilton to Lake Huron near Goderich; Lake Erie west of Port Colborne north through Brantford or Berlin to Georgian bay; from point near Washago to Georgian bay east of Collingwood; Montreal-Ottawa line north of Montreal, west to line authorized in Leeds or Lanark County.

*CANADIAN NORTHERN QUEBEC.—Contract let last year to O'Brien & Mullarkey, of Montreal, on extension from Garneau Junction, Que., to Quebec, 84 miles. Graded from Carneau to St. Casimir, 35 miles.

——*Contract let to same firm for branch from St. Jerome, Que., to Montfort, 15 miles; all graded, but no track laid.

——Charter reported granted for proposed line from Quebec bridge east to Moncton, N. B.

——Proposed line from Quebec east, via Moncton, N. B., to Pugwash, N. S., with branch in New Brunswick south to St. Johns.

*CANADIAN PACIFIC.—Double-tracking from Winnipeg, Man., east to Fort William, 427 miles; 91 miles finished, the rest to be finished this year. Foley Bros., Larsen & Co., Winnipeg, general contractors. Includes a cut-off from Winnipeg, east to Molson, Man., 35 miles. Subcontracts let a year ago as follows: Hoagland & Sharpe, for change of line, four miles, at Eagle river; John E. Bostrom, two miles at Cross Lake; Larsen Bros., two miles at Kilmar, including 400 ft. tunnel; Fred Peterson & Co., three miles between Ostersund and Busteed.

——*Contract let to Foley Brothers, Larsen & Co. for work on Toronto-Sudbury line from Bolton, Ont., north to Romford, 226 miles; about 70 miles built.

——*Contract let to Toronto Construction Co. for building the Georgian Bay & Seaboard from Victoria Harbor, Ont., on Georgian bay, southeast to Peterborough, 96 miles.

——Surveys from Bondon, Ont., west via Strathroy and Petrolia to Corunna on the St. Clair river, 60 miles.

Proposed branch from Flesherton, Ont., northwest to Southampton, 55 miles.

——The line between Montreal and Quebec, 172 miles, to be double-tracked this spring.

——*Grading contract let to J. D. MacArthur, of Winnipeg, for extension of Stonewall branch from Teulon, Man., north 20 miles; eight miles built last year.

——*General contract let to Foley Bros., Larsen & Co., on Wetaskiwin branch from Wetaskiwin, Alb., east to Battleford, 250 miles. Surveyed and 97 miles built last year. Sub-contract reported let to J. D. MacArthur, of Winnipeg.

——*Projected branch from Moose Jaw, Sask., northwest to Lacombe, Alb., 375 miles. Grading contract let to P. R. Lamb, of Winnipeg, for work from Moose Jaw north via Tuxford to point 30 miles beyond Rutland, 50 miles. Track being laid by the railroad and finished to Tuxford, 15 miles. Work also under way from Lacombe east 100 miles toward Moose Jaw. Surveyed and in operation

HAMILTON, WATERLOO & GUELPH (Electric). —To build from Hamilton, Ont., west to Galt; also from Hamilton northwest to Guelph, 60 miles. Address Thomas E. Hilliard, Hamilton Provident Loan Bldg., Hamilton, Ont.

HILLCREST RAILWAY, COAL & COKE.—Organized to build from Morrisey, B. C., to Hillcrest Junction and Cardston, Alb., with branches to Pincher Creek and to coal and oil fields.

*INTERCOLONIAL.—Contract let to Willard Kitchen, of Fredericton, N. B., for the Colton Factory Branch from Richmond, N. S., to Kempt Road, Halifax, two miles. Grading to be begun in April.

Proposed second double track between St. John, N. B., and Hampton, 22 miles, and between Moncton and Painsee Junction, seven miles.

INTERNATIONAL OF NEW BRUNSWICK. Projected from Campbellton, N. B., to St. Leonards on St. John river, 110 miles; 33 miles built by Thos. Malcolm, contractor. Contracts for 60 miles to be let this month.

KAMLOOPS & YELLOW HEAD PASS.—Chartered to build between Kamloops north to Tete Jaune Junction Cache, B. C., 250 miles.

KAMLOOPS, BOUNDARY & CARIBOO.—To build from Grand Forks, B. C., north and northwest to Grand Prairie. Pringle & Guthrie, Ottawa, may be addressed.

*KETTLE VALLEY LINES.—Contract reported let to P. Tierney, Nelson, B. C., for 60-mile extension from Grand Forks, B. C., west; also to Lewis Woodward, of Graud Forks, for 16 miles.

——Survey for extension from Republic, Wash., southeast to Spokane, 145 miles.

KINGSTON, SMITH'S FALLS & OTTAWA.—See Grand Trunk.

*KLONDIKE MINES.—Granted concession to build about 80 miles from Dawson City, Yukon, to the Stewart river. Contract let to Dawson, Grand Forks & Stewart River Railroad Corporation. Sub-contract let to O'Brien & Mackenzie, of Dawson City. Partly built. A 55-mile extension from Sulphur Springs to be built this year. J. A. C. Seybold, President, and H. Blackfield Smith, Chief Engineer, Ottawa, Can.

KOOTENAY CENTRAL.—See Canadian Pacific.

LOTBINIERE & MEGANTIC.—Projected extension from Lyster, Que., to Lime Ridge, 60 miles.

MANITOBA RADIAL.—Projected from Winnipeg northwest to Lake Manitoba. Arthur Wagner, Ottawa, interested.

NEW BRUNSWICK ROADS (Electric).—Projected line from St. Johns, N. B., to Grand Forks, 130 miles. James Burgess and J. F. Tweedie, Victoria County, N. B., interested.

*NIAGARA, ST. CATHERINES & TORONTO.—Contract let to Joseph Battle, Thorold, Ont., for extension from Fonthill, Ont., to Welland, five miles.

——Surveys being made from St. Catherines, Ont., to Niagara-on-the-Lake, 12 miles.

NORTHEASTERN RAILWAY.—To build the following lines:

——From point near Ville Marie, Ont., on Lake Temiskaming, east, south of Lakes des Quinze, Victoria and Kakebonga, to Quebec.

——From Lake Temiskaming to the National Transcontinental near Lake Abitibi.

——From near Lake Kakebonga to Maniwaki.

——From near the Gatineau river to Nominigue. J. C. Heintz, P. Harnischfyer, New York; J. T. Marchand, J. B. Lapointe, Montreal, and R. Chevrier, Ottawa, incorporators.

NOVA SCOTIA EASTERN.—New syndicate to build from Halifax to Guysboro, with a branch line to New Glasgow. Sir Montague Allan, of Montreal, interested.

ORFORD MOUNTAIN.—Runs from Mansonville, Que., to Windsor Mills. Projected extensions from Windsor Mills south to Bromptonville, eight miles, and from Mansonville, south to North Troy, Vt., four miles.

——Application made for more time to finish extension of the Bolton branch 10 miles. Grading completed six miles.

PACIFIC & EASTERN.—Projected from Victoria, B. C., northeast via Edmonton and Prince Albert to Hudson Bay. Sir Henry Pellatt, of Toronto, interested.

PONTIAC CENTRAL.—Projected from Bryson, Que., to point on James Bay, Ontario. Ryan & Bickerdyke, Montreal, applicants.

*PRINCE ALBERT & NORTHERN SASKATCHEWAN.—Reported building from Prince Albert, Sask., northeast to Hudson's Bay. Office at Prince Albert.

QUEBEC & JAMES BAY.—See Quebec & Lake St. John.

*QUEBEC & LAKE ST. JOHN.—Building branch from La Tuque Junction, Que., to La Tuque Falls, 40 miles. Graded 35 miles; track laid 30 miles. Joseph Paquet, Levis, Que., contractor.

——*Contracts let to Edward Conway, Quebec, for building the Gosford branch, from Valcartier Station, Que., to Riviere aux Pius, six miles. Track laid for five miles.

——Surveys made for the Quebec & James Bay from Roberval, Que., to Chute a L'Ours, 30 miles.

QUEBEC MIDLAND.—Organized to build from Quebec-Ontario boundary line to the west shore of Lake Mattagami, Que. Office at Ottawa. A. Wilson, R. B. Owens, H. Mitchell and J. E. Hurdman, of Montreal, and F. H. Chrysler, Ottawa, Directors.

QUEBEC, MONTREAL & SOUTHERN.—See Delaware & Hudson, under United States.

REGINA & HUDSON BAY.—Proposed line from international boundary between second and third meridians, via Regina, Sask., to Fort Churchill. Kerwarin, Incorp. McGiverin & Hayden, Ottawa, Ont., solicitors.

ST. LEON.—Organized to build from St. Leon, Que., north to St. Elie, 20 miles, with branches east to Three Rivers and west to Lake Maskinonge, together 40 miles. Office at Louisville, Que.

ST. MARY'S & WESTERN ONTARIO.—Bids asked last month for clearing right of way, grading, track-laying, bridging, ballasting, fencing and telegraph lines complete for a section of this line between St. Mary's and Embro, Ont. J. G. Macklin, Chief Engineer, St. Mary's, Ont.

SASKATCHEWAN & ALBERTA.—Organized to build from Moose Jaw, Assin., south to international boundary, 100 miles, with a branch west to Swift Current, 100 miles. Charles E. Armstrong, Calgary, Alb., solicitor.

SASKATCHEWAN VALLEY & HUDSON'S BAY.—Projected from Edmonton, Alb., to Prince Albert, and thence to Fort Churchill on Hudson's Bay, 1,500 miles. G. E. McCraney, Ottawa, is interested.

SHERBROOKE & QUEBEC.—Projected from Sherbrooke, Que., to the Quebec bridge, 110 miles. F. N. McCrea and E. W. Tobin, Sherbrooke, Que., applicants.

*TEMISKAMING & NORTHERN ONTARIO.—Building extension from McDougall's Chute, Ont., 54 miles north of Englehart, north to junction with the projected Grand Trunk Pacific, 112 miles north of Englehart. Contracts let to A. R. McDonnell, of New Liskeard, for first seven miles, and to McRae, Chandler & McNeil, of Quebec, for remaining 51 miles.

——Contracts for clearing and grading branches let as follows:

——*Charlton branch, Englehart to Charlton, eight miles, to the Canadian Construction Co., of Montreal.

——*Kerr Lake branch, Cobalt to Kerr Lake, four miles, to A. Spencer, of Niagara Falls.

——*Haileyburg Spur, Haileyburg wharf to main line, 1.75 miles, to McQuigg & Hunt, of Arnprior, Ont.

TORONTO, NIAGARA & WESTERN.—Planning to build a high speed electric line from Niagara Falls, Ont., to Toronto, 90 miles.

VANCOUVER, VICTORIA & EASTERN.—See Great Northern, under United States.

WINNIPEG & LAKES (Electric).—More time allowed to build lines from Winnipeg to Lake Manitoba, Lake Winnipeg and Portage la Prairie, Man. G. Hunter, Winnipeg, promoter.

WINNIPEG & NORTHWESTERN.—Projected from Winnipeg, Man., north via Lake Manitoba to Lopstick river, Sask. A. T. Drummond, Toronto, solicitor.

WOLFE, MEGANTIC & LOTBINIERE.—Chartered to build from Lime Ridge, Wolfe County, Que., north to Quebec, 100 miles. Right of way secured. W. H. Lamby, Inverness, Que., Secretary.

Mexico.

CANANEA, YAQUI RIVER & PACIFIC.—See Southern Pacific under United States.

COAHUILA COAL.—Surveys made for extension from Muzquiz, Puebla, to Paredon, about 143 miles. (Mar. 16, 1906.)

HIDALGO & NORTHEASTERN.—Surveys for extension from Pachuca, Hidalgo, to Tuxpan.

*INTEROCEANIC OF MEXICO.—The Teziutlan branch being extended from Teziutlan, Puebla, east to port of Nautla, about midway between Vera Cruz and Tuxpan.

——Line from Mexico City east to Vera Cruz, 350 miles. Final surveys made.

*KANSAS CITY, MEXICO & ORIENT.—See under United States.

*LA DICHA & PACIFIC.—Building from La Dicha, Guerrero, west to Port San Marquez, 12 miles south of Acapulco, on the Pacific coast of Guerrero, 75 miles. Office at La Dicha. The Mitchell Mining Co. owns the road. Several miles graded.

LINARES & SAN CARLOS.—Projected extension from San Carlos, Tamaulipas, probably to the port of Barra de Soto la Marina.

*MEXICAN CENTRAL.—Building Manzanillo extension from Tuxpan, Jalisco, to Colima, capital of Colima, 45 miles. Hampson & Smith, Mexico City, contractors. Number of important bridges and 12 tunnels. Some heavy work to be done between Colima and the port of Manzanillo. Connection at Colima with Mexican National Construction Co.'s Railroad.

——Large terminal to be built at Manzanillo. About 1,000 acres of land bought.

——Projected cut-off from Amuico, Hidalgo, north 130 miles, to Tamos on the San Luis division, to give a more direct connection between Mexico City and Tampico.

——Authorized to build branch from Zacatepec, on Cuernavaca division, to Jojutla and Tlaltenango, Morelos; also other short branches. All to be finished within three years.

——Proposed line from Guanajuato, Guanajuato, to Marfil.

MEXICAN INTERNATIONAL.—About 24 miles of second track to be laid from Adjuntas, Coahuila, south to Castano.

——Proposed extension from Durango, Mex., to Guadalajara, about 400 miles. Located from Durango to Chalchihuites, 150 miles.

——Extension from Durango southwest across the Sierra Madres to port of Mazatlan, state of Sinaloa, on Pacific coast, 225 miles. Surveys approved by Mexican Government, but construction not yet authorized.

——Extension of Panuscuaro line to mining camp of Guanaceri, Durango. Projected.

Proposed branch from Allende to the Rio Grande river, opposite Delrio, Tex. Final surveys.

MEXICAN PACIFIC.—Surveys made from Jalisco, Chiapas, northeast to Campeche. Pedro A. Gonzalez, Chief Engineer; J. M. Aeeland, promoter.

MEXICAN ROADS.—Concessions granted to A. S. Mackenzie to build from Carbo, on Sonora Ry., to Copeta, Sonora. To be completed in five years. Headquarters at Hermosillo, Mexico.

——*Mexican Coal & Coke Co., proposed extension from mines at Las Esperanzas, Coahuila, to Nogalitas, 24 miles, eventually to Monterey, 150 miles further. Surveys finished. Hampson & Smith, City of Mexico, contractors. G. A. Stranahan, Engineer in Charge. (Mar. 16, 1906.)

——Vice-Consul J. H. Brickwood, of Nogales, reports road projected from Port Lobos, on Sonora side Gulf of California, northeast to Caborca, 50 miles. Concessions obtained by John Henderson. After surveys, decided to extend 150 miles farther to Tucson, Ariz., crossing boundary line near junction of Altar and Magdalena districts.

——Concession granted to Ricardo Crombe for line from Culiacan, Sinaloa, to Tepehuanes, Durango, 100 miles.

——Company being organized to carry out the concession granted to Gualterio C. Palmer, of Zacatecas, to build from Gutierrez, Zacatecas, west via Sombrerete and Chaichihuites to Durango, 190 miles.

——Andres Bermejillo & Co., of Mexico City, planning to build in Guanajuato and Michoacan. Concession granted.

——Projected line from Temosachic, Chihuahua, to timber lands of the Sierra Madre Land & Lumber Co. Col. W. C. Greene interested.

——An English syndicate reported planning to build from San Jose del Sitio, Chihuahua, south to Parral and north to the Kansas City, Mexico & Orient.

——Concession granted to John Lureno Gonzalez Trevenino, of Monterey, to build from Garza Galau, Coahuila, to Allende, 75 miles. (Mar. 16, 1906.)

——William Niven, Balsas, Guerrero, organizing company to build from Balsas down the Balsas river to Cayuca de Catalan, 100 miles. (Mar. 16, 1906.)

MEXICO, OAXACA & YUCATAN. — Projected from Mexico City southeast via Oaxaca and Santa Lucretia to Merida, the capital of Yucatan, 1,300 miles. Preliminary surveys made and construction to begin soon. Branch projected from Concepcion, Oaxaca, southeast to port of Belize, in British Honduras. W. G. Seaver, President; W. S. Carter, St. Louis, and W. J. Allen, Vice-Presidents; R. E. Briggs, formerly on the Mexican Central, Chief Engineer; Serstiago Mendez, Inspector General of National Lines of Mexico, Consulting Engineer; R. C. Fraser, 10 Wall street, New York, Secretary and Purchasing Agent.

*MONCLOVA & PANUCA.—Work reported begun on this road from Monclova, Coahuila, south to Panuca, 50 miles.

*MORELIA & TACAMBARO.—Building from Irapuato, Guanajuato, south via Piruandiro, Michoacan, Morelia and Tacambaro, to Ario, 225 miles. Concessions granted. Contract for the first section of 50 miles has been let to Hampson & Smith, of Mexico City; nearly finished. Edson J. Chamberlin, formerly General Manager of the Canada Atlantic, President; Gilbert E. Fauquier, of the Pacific Construction Co., Ottawa, Vice-President and General Manager. Jacob L. Greatsinger, former president of the Brooklyn Rapid Transit Co., and Alnert J. Peyton, of A. J. Peyton & Co., of New York, interested.

NATIONAL OF MEXICO.—Planning to make standard gage the old line from Gonzalez Junction to Mexico City, 231 miles.

——Surveys from San Felipe on the main line to Guadalajara; also from Salamanca on the Jaral branch to Guadalajara.

ORIZABA RAILWAY.—To build from Orizaba, Vera Cruz, east to Vera Cruz, with branches, 20 miles. Offices at Mexico City, Orizaba and Guthrie, Okla. H. W. Pentecost and C. B. McKennon, incorporators.

*PAN-AMERICAN.—Contract let to R. T. Davis, from Tonala, Mex., to the Guatamala line, 100 miles; 35 miles graded and 50 miles cleared.

*PARRAL & DURANGO.—Contracts let to Dudley & Co., Parral, Chihuahua, for extension from Mesa de Sandia, Durango, south, 12¼ miles.

*RIO GRANDE, SIERRA MADRE & PACIFIC.—Work under way on extension from Nueva Casas Grandes, Chihuahua, building under the name of the Sierra Madre & Pacific, to Temosachic, 150 miles.

ST. LOUIS, BROWNSVILLE & MEXICO. — See United States.

SAN GREGORIO.—The Dwight Furness Co., of Guanajuato, Guanajuato, has bought this road, and will extend it from Marfil, Guanajuato, to Irapuato. Now in operation to the San Gregorio mines. Dwight Furness, of Guanajuato, President.

*SAN JUAN DE OAXACA.—Building from San Pablo Zimatlan, Oaxaca, to Taviche, 17 miles. All but two miles finished. Houston & Buckner, Oaxaca, contractors. William Waters, Ocotlan, Chief Engineer.

SIERRA MADRE & PACIFIC.—See Rio Grande, Sierra Madre & Pacific.

SONORA RAILWAY.—See Southern Pacific under United States.

TEHUANTEPEC NATIONAL.—Concession granted to S. Pearson & Son, Ltd., of London, for branch to Minatitlan, 10 miles.

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CONTENTS

EDITORIAL:
- Two Kinds of Permissive Blocking..... 397
- The Legislative Pass..... 397
- The Dangers of Municipal Ownership.... 398
- What is Stock Watering?..... 399
- Train Accidents in February..... 399
- United States Steel Corporation 401
- The Lackawanna Rebate Case..... 401
- Pennsylvania Railroad 401

ILLUSTRATED:
- New Bronx Freight Terminal of the Central R.R. of N. J. 404
- Reinforced Concrete Bridge over the Cumberland River. 409
- Four Members of the Isthmian Canal Commission 413
- Comparative Effects of Steam and Electric Locomotives on a 3-deg. Curve. 414
- Track Deformations and Their Prevention 416

CONTRIBUTIONS:
- Steel Ties on the Pennsylvania..... 403

MISCELLANEOUS:
- New Railroad Laws in 10 States..... 403
- New and Old Signaling Problems..... 405
- Suspension of Freight Transportation on the Hungarian Railroads 408
- A Bulletin of Traffic News for Shippers... 408
- Mr. Harriman on the Present Railroad Situation 411
- Pacific Locomotive for National of Mexico 412
- Electric Night at the New York Railroad Club. 415
- Foreign Railroad Notes 416
- Superheated Steam in Germany 409

GENERAL NEWS SECTION:
- Notes 421
- Trade Catalogues 424
- Obituary 425
- Meetings and Announcements 425
- Elections and Appointments..... 425
- Locomotive Building 426
- Car Building 426
- Railroad Structures 426
- Railroad Construction..... 427
- Railroad Corporation News..... 428

VOL. XLII.. No. 12. FRIDAY, MARCH 22, 1907.

In referring, March 8, p. 292, to the crude utterances of the New York State Railroad Commission concerning block signaling, we were guilty of a crudity ourselves, for which we beg the reader's pardon. In condemning permissive blocking as unsafe, we referred, of course, to that which actually has proved unsafe, namely, that of freight trains on long block sections under manual signaling; but the careless omission of qualifying words made the condemnation apply to all permissive movements, as, for example, the movement of a passenger train past an automatic block signal which stands in the "stop" position because of the breakage of a wire or a battery jar. An esteemed correspondent, writing to point out the error, asks if we should expect to operate automatic block signals in any other way than by permissive rules. Certainly not. At this point the question naturally arises, Why has permissive blocking resulted in more collisions under the telegraph block system than under the automatic? We have no statistical information that it has; but such is the impression from the accident records. So far as this is a fact, the reason appears to be that with block sections two or three miles long, and longer, enginemen take more risks than where the sections are only one mile long or less. Just what this indicates concerning the relative efficiency of the discipline under the two kinds of blocking, we are not prepared to say; possibly runners who are not disciplined at all would do better with short block sections; but it ought to be easier to maintain good discipline with short than with long blocks. It is true that collisions have occurred under permissive blocking, on lines equipped with automatic signals and divided into short blocks; and it may be that the New York State Commissioners know of so many such cases that they really desire to enforce something like absolute blocking everywhere. If this is the case, the only practical test of the reasonableness of their demand is that to be found in the results. What is the best record that can be shown? The object of block signaling is the entire prevention of collisions. Absolute blocking will do this. With automatic signals absolute blocking would mean waits of 10 or 15 minutes when signals are out of order, and, perhaps, flagging ahead, or a telephone connection from every signal to the nearest station. This would be expensive and troublesome. But if, some day, a train running under a permissive indication collides with the train ahead of it and thereby kills a dozen passengers (passing in an express train on an adjacent track) what can that railroad say to the Commission? Public opinion would support the state in demanding controlled manual (absolute) signaling on such a line at once. Like a two cent fare law, which proves profitable by increasing the volume of passenger traffic, this demand might not prove an unmixed evil. The way to stave it off, however, is to make permissive blocking so safe that nobody can complain. One way to "jack up" the discipline under automatic blocking, where jacking up is needed, would be to enforce for a time a five-minute wait at every signal remaining in the stop position.

THE LEGISLATIVE PASS.

There's a kind of divinity, a species of fascinating halo, that doth hedge about the railroad free pass. He who is undeserving and yet gets it, feels stamped deep on his mental and moral sensorium that satisfying human concept of getting something for nothing. He who deserves it contemplates the pass as a symbol and token of personal virtue blended with the practical utilities of free transit. Even the railroad official, entitled to his pass by law, by propriety, even by necessity, and wonted to it by custom, probably never quite outgrows the pass as a signet of his official dignity, and there is just a little extra chest inflation as the conductor, cognizant and respectful, passes him by without demand for the potential pasteboard. This dignity of the pass, partly natural, partly artificial, even reaches from the vulgate into the language of euphemism. Do not railroad companies, not a few, substitute for the harsh but expressive "free pass" such gentler infinitives as "to supply transportation"? But the free pass under the new interstate commerce law has had a sudden area of atmospheric and moral depression and has passed from the realm of dignity to the limbo of criticism and restriction. And, in that transition period it brings to light no attitude of human nature more diverting than that of some of the state legislatures beset by the cry of the corporation baiters on the one hand and the charms of the free pass on the other.

Not to mention some amusing instances of this dilemma in western states one comes to an illuminating case in New Hampshire. There, it will be recalled, in the dominant Republican party there was last summer and autumn a red-hot campaign waged against legislative free passes with the novelist, Winston Churchill, and his new "Lincoln party" in the van of conflict. Mr. Churchill lost the nomination for Governor by a small margin, but he and his followers hewed out a drastic anti-pass plank and got it nailed in the party platform. It called for a penal statute restricting the free pass to railroad, express and mail officers and employees and "persons in misfortune who are unable to pay their fares." The legislature has now been in session for some weeks wrestling with the railroad pass question, confronting a condition as well as a pre-election pledge and harassed by survivals of the Puritan conscience battling with the seductions of the adversary marked in the free pass. The sub-climax is amusing as a study in the humanities and legislative ethics. Recently, by a vote of 221 to 100, the New Hampshire lower house voted to substitute free railroad tickets for free passes. Satan thus came out uppermost, throned on a compulsory law in which the "big stick" was tied to railroad obligation. The lower house of the New Hampshire legislature contains 413 members, and is by far the largest state legislative body in the Union. Students of legislative ethics and responsibility will find here an object lesson in the moral values of big legislative bodies "fresh from the people," and, in contrast to state senates,

so large—in theory—as to be impervious to corporate temptation.

In its wider horizons the theme opens itself to more sober thoughts. The interstate commerce law does not bear on intrastate passes and thus touches but remotely on the question of legislative freedom on the rail. It may be said also that—unless honor be deemed a makeweight—legislators in many states are sadly underpaid, provided, of course, that they hold down their seats punctually at legislative sessions, do their full work on committees and scorn "perquisites" in both large and small significations. Casuists may also try to stretch the free pass statute for the state railroad commissions, who administer the law, to the men who make the law; but their logic and analogy are indifferent at best. There is sounder reasoning for the policy of states which commute legislative mileage for a session pass paid for by the state treasury. Meanwhile, as the various American commonwealths are slowly toiling through the free pass equation, the philosophic mind must be permitted to dwell on its very human phenomena; on the legislative temper which makes the pass criminal in several states and leaves it full swing in another; on the fundamental charm of the free pass as aforesaid; and on the Miltonian struggle of Good and Bad, of Duty versus Pocket, when a legislator hotfoot from a constituency clamorous for railroad "reform" fronts the grim actualities of paying his own fare. It all contributes to that mirth of man which goes so far to soften the hardest of life's problems.

THE DANGERS OF MUNICIPAL OWNERSHIP.

Mr. Robert P. Porter's study of the workings of municipal ownership, based on conditions existing in England within his own observation and supplemented by references to the instructive experiences of the colonies and foreign cities as well, comes as a very timely contribution to a subject that ought to be understood a great deal better than it is. England has passed through a sharp attack of the municipal ownership fever. We say it has passed through rather than it is passing through, because the County Council election a few weeks ago, from which the returns are now at hand, resulted in a sharp defeat for the Progressives, who had the full support of the Liberal party, and advocated municipal trading in extension. Apart from municipal water supply, which is generally conceded to be a proper function of the municipality, municipal trading in England did not become an issue until after 1882, and has been an issue of first class importance only within the last fifteen years. During that time it has flourished amazingly, and received its first real setback in the London County Council election just reported.

The first and most helpful point to be kept in mind in reviewing this subject throughout its complexities, is that municipal trading, in extension, embracing not only the control of water works, but of lighting, street railways, and especially of housing, is a form of socialism. The London *Times*, in 1902, recognized that the aims of the municipality and of the socialists were identical, and boldly christened the whole movement as "municipal socialism, pure and simple," bringing forth angry protests from the municipality, but making a designation none the less correct.

The strength which the movement has acquired in England may doubtless be attributed in large measure to the universal desire to have one's burdens borne by someone else. Mr. Porter points out that in England and in America alike, the people who control elections are not the people who pay taxes, as a characteristic. The Midland Railway pays one-eighth of all the taxes of Derby; one shipbuilding company pays one-sixth of all the taxes at Jarrow; there is also a colliery company which pays almost all the taxes of one township, while colliers who do not pay a cent can vote down the one or two officials in the colliery and the few farmers and shopkeepers in the neighborhood. Corporate bodies, such as railroad companies, and, in fact, all limited liability concerns, whose contributions to local taxation form an enormous sum, do not possess a municipal vote and are, therefore, denied any voice in the disposition of the money they pay to their local authority. It is an easy matter, therefore, for a municipal ownership party to gather around it the vote of the non-responsible, and put into effect all sorts of improvements designed to compete with the efforts of private capital, holding forth, on the one hand, promises (almost never realized) of lower prices or better service, and, on the other hand, of employment for all, with the highest pay and the shortest hours.

The general truths embodied in such a presentment of the situation have been known for some time, but it has remained for Mr. Porter to show clearly and strikingly some easily remembered ways in which municipalities show profits from their ventures where no actual profits exist, and thus create the illusion that their improvement works actually tend to decrease taxes instead of swelling taxes beyond all bounds, as has actually been the case. At the foundation of the so-called profit from municipal trading lies a bad balance sheet. A private company, operating a street railway, for example, has no place to hide inconvenient expenditure. It must just go on the balance sheet, and if it has first created a deficit in the income account, that deficit must be set off against whatever profit has been carried forward. But the municipality labors under no such necessity. Mr. Porter cites the case of Liverpool, where the local debt at the end of 1905 had been increased by over $5,000,000 for street widenings made on account of the municipal tramways, but when it was proposed to charge the tramway undertaking with a portion of the expense, the motion was defeated. Another municipality, which boasted of large street railway profits, had charged $1,500,000 to the public works committee for street widening, necessitated entirely by the installation of street railways. The London County Council, however, has, as usual, been the leading light in this as in most other forms of municipal extravagance and bad accounts. It seems that a recent report which the Council was compelled to make, shows that $20,224,220 has been spent on street improvement, necessitated by tramway extensions, of which only $1,886,300 was debited to the tramway undertaking, the people of London being saddled with the rest. Moreover, it was shown that since the Council has entered into the tramway business, the cost of the central office has amounted in all to about $6,000,000, towards which has been charged on the tramway accounts only $40,800. As the author well says, the profits of such undertakings may be likened to the profits of a child from the egg industry, when his parents supply him with the chickens and the corn with which to feed them.

After this first device of not debiting to the expense side of the account all outlays made, the second common fallacy in municipal accounting is the failure to provide sufficient sums for depreciation, renewal of plant and sinking fund. Mr. Porter shows that the average yearly amount set aside for depreciation of reproductive municipal undertakings during the four years ended March 31, 1902, was less than one-sixth of 1 per cent. of the capital invested, while quite a large number of undertakings were not debited with any depreciation at all. As a result, the communities which have gone most heavily into municipal trading now find themselves equipped with out-of-date and inferior apparatus which they have no power to replace except through a fresh burden of taxes on the community.

The most striking demonstration of illusive profits, however, is that relating to municipal houses. This is a branch of municipal trading which has been undertaken quite widely in England, with the avowed object of supplying workingmen with proper and sanitary houses at a price within their means. But in the first place, the municipality is a bad buyer, and is regularly imposed upon by speculators who hold land ahead of it; in the second place it has almost always happened that the rents in the new municipal houses have been placed materially higher than those in the rookeries which they displaced, with the result that they accommodate a better class of people, for whom no such provision was necessary, while they drive the original tenants to seek other slums. The municipalities, to gain support for their undertakings, are fain to show a profit from the operation of these houses, but as the land they have to buy is so high priced that actual ground rents would place the houses quite out of the workingmen's reach, they are wont to write down the price at which the undertaking is carried on their books. Mr. Porter cites a parcel of land bought by the London County Council at Clerkenwell at a cost of $1,000,000, the value of which, for housing purposes, was written down to $225,000. The difference between these figures, $775,000, represents the loss in this particular case, which had to be borne by the taxpayers, although they were shown a profit on the Council's books.

It is well known that Australasia, especially New Zealand, has been widely advertised as the happy hunting ground of municipal traders. Mr. Porter shows how this has been accomplished. In 1905, the debit of the Australian commonwealth was $1,151,172,385, the debt of Australasia was $1,450,732,385, and the debt of the United States, $989,866,772. This works out to $11.91 per capita in the United States, to $288.60 in Australia and to $309.66 in the whole of Australasia, while in New Zealand the debt per capita was $348.10. Mr. Porter quotes the *Sydney Bulletin* to the effect that there were one or two gorgeous years in West Australia when the amount borrowed, if it had been divided equally among the people, would have enabled everybody to live in a humble but

honest fashion without doing any work at all. As a result, prosperity in Australasia is now chained down under this dead load of debt which has been accumulated; capital and industry are frightened away, and the good old days of indiscriminate borrowing are over, because credit is no longer equal to the strain placed upon it.

To sum the matter up in a brief sentence, Mr. Porter can see no good in municipal trading beyond the brief limits of water supply, and he presents an array of facts and figures that may well occasion the American cities around the southern tier of the Great Lakes, now coquetting with this subject, to stop and reflect where they are and whither they are tending.

WHAT IS STOCK WATERING?

Never before in the annals of American railroads has the phrase "stock watering" been heard so frequently as during the year past and at the present time. Legislators and commissions have voiced it; orators on the party stump have cried it; the newspapers and magazines have scored it with anathema; and very real over-capitalization of street railway corporations and "industrial" combinations have thrown it into bold relief. The Harriman inquiry is one of the recent official researches which have given the subject added prominence. It is becoming very evident that, in the future determination of the relation of the public to transportation interests, the question of capitalization is to fill a great space. From the viewpoint of both theory and practice, of academic searches on the one hand and of railroad capitalist on the other, the query, "what is real stock watering?" rises to terms of high import.

It seems at the first flush very easy to answer the query. Watered capital, one would say at the outset, is simply capital not paid in as cash—a denominational capital in a certain number of dollars raised to a sum exceeding the dollars actually contributed to an enterprise. Assuming no economic wastage in construction and in financing a project the same idea can be carried back a step further and reduced to the law of replacement value. Thus modified, stock watering would signify capitalization—of course not only in share capital but in debt also—exceeding the cost of replacing the property were it to be swept away. These definitions are primary and alphabetical and the ones most generally accepted. They evidently exclude franchise value, which introduces a disturbing factor to be referred to later. It may be said right here, however, that the foregoing definitions, nominally fundamental, have the fault of focussing attention over much on the face of the capitalization rather than on the equity or inequity of the return which that capitalization exacts from the public. Another way of stating the theorem is that too much stress has been laid on the investment rather than on its charges. The two, in fact, should be considered together and almost as synonymous terms just as in an ordinary note of hand, reckoned as an investment, we blend principal and interest.

In that broader and deeper sense the two conventional tests of stock watering, namely, cash paid in and replacement value, undergo some radical changes. Of two railroad projects, in both of which capital has been honestly paid in, one may have been successful from the start, the other waiting years for its dividend—intelligent operation and development in both cases being the same. Here is clearly a divergence in moral obligation to the public. "Cash paid in" in the one case has had its return; in the other case it has had no return. In the one case—from the public viewpoint—a gratuitous stock dividend would signify stock watering; in the other, under conditions of belated prosperity, it would signify merely a just return on vested cash to which return the public can raise no valid objection. This principle reaches out far. It includes the old value of railroad properties snuffed out by reorganization—at least so far as the original investors have shared in the reorganized enterprise as distinguished from later investors. The relative investment rights of the two groups and how to harmonize them with the rights of the public to lower rates is one of the obscure elements of the problem. The economist may, if he has the time, follow out this branch of the question to still more remote and nebulous ethics, as, for example, the railroads built by municipal aid and since reorganized with private profit.

Pushing this idea of valid return on cash paid in there opens up yet another circle of questions solid at its center but cloudy at its edges. One is the corporate right of capitalizing improvements, especially if those improvements—as they almost always do—pertain to public necessity and convenience. A railroad corporation may spend during ten years as many millions demonstrably separate from both ordinary operation and ordinary improvements. Yet new capitalization to that amount is almost sure to be charged up as stock watering and—in the case of a road paying good dividends—so classed even if the new stock is paid for at par. But if the same company increases its dividend and maintains it permanently no charge of "watering" is raised against it though, in public aspects, the situation may be exactly the same as though it "watered" capital and maintained the old dividend rate. The Delaware, Lackawanna & Western "stands pat" on stock and double dividend up to 20 per cent, while the shares rise to five fold par value. Yet who charges the company with watering stock! *Per contra* the Great Northern, regarded as a railroad, has for years stood pat on dividend rate while much expanding stock and is bitterly attacked for over-capitalization. Illustrating further the subject of valid capital may be taken some of the original telephone companies many of them at first, no doubt, over-capitalized. But costly replacements compelled either by new inventions, popular demand or both, have often squeezed out original water and forced a capital expenditure exceeding first capitalization; and, in the case of the telephone, unlike the railroads, there was the early perils of capital entering upon a new and untried invention subject to the risks of rival inventions that might prove better.

There are other elements that enter into this recondite question as to what constitutes the unwatered capital that renders at the same time equitable return to the investor and equitable rates as well as due convenience to the public. For example, shall or shall not the public service corporation be credited in new capitalization with the enhancement of the value of its franchise by a "going" concern? Where also shall the line be drawn in the division of the increment of railroad prosperity which assuredly belongs neither to the railroad corporation nor the public exclusively? Such misty queries must not, obviously, be used to befog stock watering actual, direct and speculative and which the merest tyro in finance can detect. But they do show that, in a vast number of cases where stock watering is charged, what may be called "solidifying" components must be considered; that no two instances are alike, and that each instance calls for its own analysis; and that in the general proposition we have no inflexible rules or absolute data. What we know is that in the present effort to detect and, if possible, penalize stock watering there is much confusion of vested rights, public rights and fiscal values, ratios and equities; and that penalty itself prompts the problem of the transfer of the watered security from the culpable promoter to the innocent buyer. But if that penalty has to pause in its correction of the past there is no reason why it should do so in the preventions of the future.

Train Accidents in February.[1]

Our record of train accidents occurring on the railroads of the United States in February includes 26 collisions, 20 derailments and three boiler explosions, 49 accidents in all. This record is not published in full, as was formerly done, except in the cases of the few accidents which are especially prominent—in the present instance five collisions and five derailments. The record of "ordinary" accidents—which term includes, for our present purpose, only those which result in fatal injury to a passenger or an employee or which are of special interest to operating officers—will henceforth be given as below, in the shape of one-line items for each accident, showing date, location, class and number of deaths and injuries.

This record is based on accounts published in local daily newspapers, except in the cases of accidents of such magnitude that it seems proper to send a letter of inquiry to the railroad manager. The official accident record published quarterly by the Interstate Commerce Commission is regularly reprinted in the *Railroad Gazette*.

The 10 prominent accidents in February are distinguished in

[1]Abbreviations used in Accident List:
rc.....Rear collision.
bc.....Butting collision.
xc.....Other collisions; as at crossings or in yards. Where only one train is mentioned, it is usually a case of a train running into a standing car or cars or a collision due to a train breaking in two on a descending grade.
b.....Broken.
d.....Defective.
dr.....Defect of roadway.
eq.....Defect in car or engine.
n.....Negligence.
unf.....Unforeseen obstruction.
unx.....Unexplained.
derail....Open derailing switch (negligence of engineman or signalman).
ms.....Misplaced switch.
acc. obst...Accidental obstruction.
malice....Malicious obstruction of track or misplacement of switch.
boiler.....Explosion of boiler of locomotive on road.
fire.....Cars burned while running.
Pass.....Passenger train.
Ft.....Freight train (includes empty engines, work trains, etc.
*Wreck wholly or partly destroyed by fire.
†One or more passengers killed.

the list by printing the name of the road in italics. Following are condensed accounts of the circumstances of these 10 accidents. The three most prominent are Williamsbridge, Mineral Point and Saylor, all derailments.

The derailment at Williamsbridge on the 16th occurred about 7 p.m. It caused the death or fatal injury of 24 passengers and the injury of about 141 other persons. The train, a northbound passenger train of two electric locomotives and five passenger cars, was running at full speed over a 3 deg. curve. Four cars were dragged on their sides a considerable distance. This accident was reported in the *Railroad Gazette* of February 22, page 230, and March 8, page 292. The conclusion of General Manager A. H. Smith was that some foreign substance derailed the trailing wheels of the leading locomotive. Nothing more definite than this has yet been discovered as to the cause.

The derailment at Mineral Point, Pa., on the 22d, occurred in the night, and, like that at Williamsbridge, was due to some accidental obstruction, the nature of which has not yet been discovered. This accident was reported in the *Railroad Gazette* of March 1, page 272. On the editorial page of the same issue there are some interesting comparisons between this and the New York Central derailment.

The derailment at Saylor, Iowa, on the 4th, about 5.30 p.m., was due to the failure of one of the trucks of a gondola car loaded with coal, an arch bar breaking. This car and all in the train behind it, four cars of coal and a caboose, were knocked off the track and fell down a bank. The persons killed were miners riding on the cars of the freight train; and of the injured seven were miners, two were employees and two were young women being carried in the caboose by the courtesy of the conductor. It appears that the miners usually ride home from their work on a passenger train which, on the day in question, was behind time. Some 20 or 30 of these men boarded the freight train in spite of the protest of the conductor and brakemen. Thus while the victims appear to have been trespassers the public is likely to look upon the record as an addition to the list of casualties to passengers.

The butting collision near Colby, Ky., on the 5th between two freight trains wrecked both engines and the boiler of one of them exploded, killing one engineman and two trainmen; three other trainmen were injured.

The collision near Pelham, Ga., on the 7th, was due to the failure of a coupling between the passenger car and the freight cars of a mixed train of the Flint River & North Eastern, running on the Atlantic Coast Line track. The train was moving at moderate speed on a descending grade, and the forward portion when stopped was run into at the rear by the passenger car. Seven passengers and three employees were injured, but only three of them seriously. The train consisted of engine, two freight cars and one passenger car. Air-brakes were in operation on the engine and freight cars, but the trainmen had neglected to connect the air to the passenger car.

The collision at Ossining, N. Y., on the evening of the 8th was due to a slight miscalculation by the engineman of a heavy northbound freight train. This train, which was running on a middle siding, ran a few feet beyond the fouling point, at the outgoing end of the siding, just as a northbound passenger train came along, and the passenger engine was pushed over into the ditch and its engineman and fireman killed. The road at this point is block signaled and interlocked, but it would appear that there is no derailing switch at the outgoing end of the siding. This accident is one of a number of cases which have occurred recently wherein the men in charge of the train have been arrested and held on criminal charges, without much regard to the practical question whether they were or were not presumably guilty of criminal negligence. The men arrested at Ossining were the conductor, the engineman, the fireman and a helper on the freight train. As the freight train was running at low speed it is difficult to see how the conductor should bear any responsibility in the case, unless he was riding in the locomotive; and the engineman, himself—however grave may be his fault technically or morally—cannot, in any appreciable degree, be guilty of that gross negligence which is contemplated in most laws which class offenses of this kind as criminal.

The collision near Ypsilanti, Mich., on the 21st, was between a train of five express and mail cars, carrying no passengers, and an ice train which was switching on the main track. The express train ran into the engine of the ice train at full speed and six men were killed, two of them being postal clerks. The express train had a clear (automatic) block signal and was properly within the block. A brakeman of the ice train had failed to see that the indicator was at danger before he turned the switch, and the ice train engine pulled out from the siding to the main track in the face of the express train. The coroner who investigated this case sustained the reputation of his "profession" for rare wisdom by declaring that the accident happened because the employees were "required to place too much reliance on the automatic block signals." We have been trying to figure out what this means. Probably the coroner's idea is that, as a brakeman may forget to note that the automatic system forbids him to turn a switch, there should be some other and non-automatic means to hold him to a more careful performance of his duty. Before doing anything to carry out this idea the coroner should post himself as to the attitude of other public authorities who criticise railroad practice in regard to the safety of trains. These, he will find, are nearly or quite unanimous in demanding automaticity in everything. They would depend on machines more, not less. Next we shall know, an automatic locomotive will be demanded, which, with complete automatic stopping apparatus, will give enginemen a chance to ride in the parlor car. Seriously, it looks as though a time release should be applied to those switches which are so far from the entrance to the block section as to allow heedless men to so freely indulge their heedlessness.

The collision near Leith, Nev., on the 28th, was between a part of a work train and some standing cars, the train being bound for a washout, and near to it. Two freight cars filled with workmen were pushed violently against other cars, heavily loaded, and a large number of men were crushed under a car body. Eight or more of these men, badly hurt, had to be carried 430 miles to have limbs amputated.

The derailment at German Valley, Ill., on the 7th, occurred about 2 o'clock in the morning, and was caused by a heavy passenger train of six cars running into a side track at full speed, about 50 miles an hour. The engine ran into and partially demolished a grain elevator, and the wreck was immediately buried, nearly out of sight, by a large quantity of grain falling down from the elevator upon it. The baggage cars and first passenger car were badly damaged. The engineman and two postal clerks were instantly killed. An order had been issued notifying all trains to run slow at German Valley, as the main track was obstructed, and trains were temporarily being run over the side track. The fireman of the train, who was not dangerously injured, said after the accident that the engineman had done a number of reckless things on that trip and that he made an impertinent reply when the fireman reminded him of the slow order. It is believed that the engineman had become mentally unbalanced. The switch light showed red, and this should have caused the engineman to stop if he had been attending to his duty.

The derailment near Indian Creek, Pa., on the 28th occurred at about 7 p.m., and all the five cars of the train, passenger train No. 49, westbound, fell down a bank. The cars immediately took fire probably from the firebox, and were completely burned. The engineman was caught under the engine and burned to death; the fireman and two other trainmen and six passengers were injured. It is believed that the train was derailed by a rock which had fallen from the hillside.

TRAIN ACCIDENTS IN THE UNITED STATES—FEBRUARY, 1907.

Collisions.

Date.	Road.	Place.	Kind of Accident.	Kind of Train.	No. persons reported Killd.	Inj'd.
1.	Chic., Rk Isld & Gulf	Hicks.	bc.	P. & Ft.	0	7
2.	Baltimore & Ohio	Pittsburg.	rc.	Ft. & Ft.	2	2
5.	*Chesapeake & Ohio*	Colby.	bc.	Ft. & Ft.	3	3
†6.	Mo., Kan. & Texas	Alvarado.	rc.	Ft. & Ft.	2	2
7.	Bessemer & Lake Erie	Mercer.	bc.	Ft. & Ft.	1	3
*7.	Pennsylvania Lines	Mingo Junctn.	xc.	Ft.	0	15
7.	*Flint River & N. E.*	Pelham, Ga.	xc.	Pass.	0	10
8.	*New York Central*	Ossining.	xc.	P. & Ft.	2	6
8.	Chic., Mil. & St. P.	Chicago.	xc.	P. & Ft.	1	12
8.	Chic., L. S. & Eastn.	Chicago.	bc.	Ft. & Ft.	1	3
10.	Norfolk & Western	Clark.	bc.	Ft. & Ft.	1	4
11.	M., Jackson & K. C.	Lucedale.	xc.	Ft. & Ft.	1	0
12.	Southern.	Johnston.	rc.	Ft. & Ft.	2	3
13.	Mo., Kan. & Texas	Wade.	bc.	Ft. & Ft.	1	4
14.	Chicago Gt. West'n	Pearl City.	rc.	Ft. & Ft.	1	1
15.	Char. & W. Car.	Jackson.	xc.	P. & Ft.	0	4
15.	Missouri Pacific	Jefferson City.	bc.	P. & Ft.	0	10
18.	Yazoo & M. V.	Alligator Lake.	bc.	P. & Ft.	1	13
20.	Chic., Cin. & Louisvl.	Kitchell.	rc.	Ft. & Ft.	1	1
21.	Chic., Mil. & St. P.	Beaver Dam Jc.	bc.	P. & Ft.	0	3
21.	*Michigan Central*	Ypsilanti.	xc.	Ft. & Ft.	6	1
22.	Chicago Gt. Westn.	Sargent.	rc.	P. & Ft.	0	15
26.	Trinity & Brazos V.	Limestone.	bc.	Ft. & Ft.	0	5
27.	Wabash	Mexico, Mo.	bc.	P. & Ft.	1	20
28.	Chic., Burl. & Quincy.	Chariton.	xc.	Ft. & Ft.	2	1
28.	*San Pedro, L. A. & S. L.*	Leith.	xc.	Ft.	3	40

Derailments.

Date.	Road.	Place.	Kind of train.	Cause of derail't.	No. persons reported Killd.	Inj'd.
2.	Louisvle & Nashvle	Bracktown.	Ft.	unx.	1	2
4.	Northern Pacific.	Grafton.	Ft.	snow.	0	3
4.	*Chic. & North-Westn.*	Saylor, Ia.	Ft.	b. truck.	8	11
5.	Wisconsin Central	Oshkosh.	Pass.	unx.	0	2
†7.	*Chic. Great Westn.*	German Val'y.	Pass.	n.	3	3
8.	Gulf & Ship Island.	Bond.	Ft.	unx.	1	1
8.	Lehigh Valley	W. Danby.	Pass.	unx.	0	7
8.	Chic., Burl. & Quincy.	Peoria.	Pass.	d. switch.	1	2
9.	St. L. & San Fr'isco.	Pratt City.	Pass.	b. rail.	2	7
13.	Williams Valley	Brookside, Pa.	Pass.	b. rail.	0	20
*15.	N. Y., Ont. & Westn.	Luzon.	Pass.	boiler.	3	15
14.	Iowa Central	Geneva.	Pass.	b. truck.	0	2
16.	Mo., Kan. & Texas.	Brookshire.	Ft.	b. flange.	1	0
†16.	*New York Central.*	W'msbridge.	Pass.	unx.	24	141
18.	Southern.	Littleton.	Pass.	d. switch.	0	2
22.	Chic., Mil. & St. P.	Wash'n Mills.	Pass.	b. flange.	2	12
†22.	*Pennsylvania*	Mineral Point.	Pass.	unx.	0	54
*25.	G. S. & Florida	Luzon.	Pass.	d. switch.	1	3
*27.	N. Y., N. H. & Hart.	Bellingham.	Pass.	unx.	0	1
*28.	*Baltimore & Ohio.*	Indian Creek.	Pass.	unx.	2	9

Other Accidents.

10.	Boston & Albany	Chester.	Ft.	boiler.	0	3
19.	Galveston, H. & S. A.	Strang.	Ft.	boiler.	1	1
28.	[illegible]	Englewood, Ill.	Ft.	boiler.	2	1

United States Steel Corporation.

Both gross and net earnings of the United States Steel Corporation reached new high records in the year ended December 31, 1906. The largest previous gross earnings were those of 1905, which were last year surpassed by 19 per cent. The net earnings increased 18 per cent, as compared with those of 1902, the largest net earnings heretofore recorded. The average prices received for steel products for domestic consumption were 5.3 per cent. higher than in 1905 and 8 per cent. lower than in 1902. It has been decided to make no change in prices at present, in spite of the increased cost of production. At the end of the year the company had unfilled orders booked for 8,489,718 tons of fabricated steel and iron, as compared with 7,605,086 tons at the end of 1905. Since January 1, 1907, orders have fallen off somewhat from the demand in the months immediately preceding, but are larger than in the corresponding months of 1906. The export shipments last year amounted to 1,079,319 tons, an increase of 13 per cent.; the gross receipts from this business increased 28 per cent.

The following table shows the iron ore mined and the output of the company's products during the last two years:

	Tons.	
	1906.	1905.
Iron ore mined:		
From Marquette Range	1,442,290	1,359,722
" Menominee Range	1,874,680	1,871,979
" Gogebic Range	1,465,375	1,671,747
" Vermilion Range	1,794,186	1,578,626
" Mesaba Range	14,068,617	12,004,482
Total	20,645,148	18,486,556
Coke manufactured	13,295,075	12,242,909
Coal mined*	1,912,144	2,204,950
Limestone quarried	2,227,436	1,967,355
Blast furnace products:		
Pig iron	11,058,526	9,940,799
Spiegel	150,044	158,071
Ferro-Manganese and Silicon	58,807	73,278
Total	11,267,377	10,172,148
Steel ingot production:		
Bessemer ingots	8,072,655	7,379,188
Open-hearth ingots	5,438,494	4,616,051
Total	13,511,149	11,995,239
Rolled and other finished products for sale:		
Steel rails	1,982,042	1,727,055
Blooms, billets, slabs, sheet and tin plate bars	1,096,727	1,253,682
Plates	836,399	780,717
Heavy structural shapes	620,823	484,048
Merchant steel, skelp, hoops, bands and cotton ties	1,240,548	982,782
Tubing and pipe	1,025,913	911,346
Rods	111,488	84,049
Wire and products of wire	1,399,717	1,283,943
Sheets—black, galvanized and tin plate	1,112,542	924,439
Finished structural work	643,622	404,732
Angle and splice bars and joints	176,730	150,265
Spikes, bolts and rivets	70,233	61,496
Axles	181,913	149,596
Sundry iron and steel products	79,736	28,236
Total	10,578,433	9,226,386
Spelter	28,884	29,781
Copperas (sulphate of iron)	21,933	20,040
Universal Portland cement, bbls.	2,076,000	1,735,343

*Not including that used in making coke.

Since the company was organized on April 1, 1901, $208,231,000 has been spent for additional property, construction and the payment of capital liabilities. Of this amount, $139,094,000 was for additional property and construction. These expenditures have been met as follows: sinking, depreciation and improvement funds, $52,527,000; issues of securities, $38,586,000; appropriated from surplus, $117,118,000. The increased earning power resulting from these outlays is indicated in the following table:

	Percentage of increase in capacity Jan. 1, 1907, with Apr. 1, 1901.		
In production of products for further conversion.	Due to purchase of other companies.	Due to additions and improvements made.	Total increase.
Pig iron and blast furnace products	16.50	46.62	63.12
Bessemer and open-hearth stl ingots	13.35	43.20	56.64
Blooms, billets and slabs	17.08	44.69	61.77
Sheet and tin plate bars	7.90	81.15	89.05
Wire rods	20.95	Dec. 7.77	13.18
Products for sale.			
Finished steel and iron products	14.32	30.01	44.33
Universal Portland cement	....	406.67	406.67

The lease of the Great Northern ore lands will be taken over by the Great Western Mining Company, a subsidiary of the steel corporation. Concerning the new plant at Gary, Ind., the report says:

There have been organized the Indiana Steel Company, which will construct the steel plant, and the Gary Land Company, which will own and improve the site for the city and will construct a large number of dwellings and business buildings. It is proposed to sell improved and unimproved property in the city to residents at about cost plus a fair interest charge, but under such restrictions as to the uses to be made of the property as may be found to be fair and reasonable. During the year substantial progress was made in the construction work, both on the steel plant and the city; the expenditures, including payments made for real estate, amounted to $4,720,158.91. There has been acquired for use for plant purposes, for the city of Gary, and for railroad yards and terminals, about 7,500 acres of property, with a large frontage on the shore of Lake Michigan. The appropriations approved to this date for construction work at the steel plant comprehend eight blast furnaces, together with the unloading and handling machinery, 56 open hearth furnaces, blooming and rail mill, various finishing mills, central power plant, foundries, machine shop and equipment, central pumping station and other accessory works; also the construction of harbor and docks. For the city of Gary the appropriations cover 381 dwelling houses, school and hotel buildings, waterworks, sewerage system, gas works, paving, sidewalks, grading, etc. The estimated amount yet to be expended on account of the foregoing approved work, and including payments to be made in 1907 for balance cost of real estate, is $40,000,000. On December 31, 1906, there was reserved in special fund available for account of these expenditures a balance of $26,867,797.89.

The income account for 1906 and for the preceding year follows:

	1906.	1905.
Gross earnings	$696,756,926	$585,331,736
Operating expenses	539,991,634	458,583,806
Net earnings	156,765,292	126,747,930
Other income	9,159,864	6,057,134
Net income	98,128,987	68,885,192
Dividends	*35,385,727	†25,219,677
Appropriation for Gary plant	21,500,000	10,000,000
Other appropriations	28,500,000	16,300,000
Surplus for the year	12,742,860	17,065,815

*7 per cent. on preferred and 2 per cent. on common.
†7 per cent. on preferred.

The Lackawanna, charged with illegal rebating on sugar, gets off by the disagreement of the jury, and probably the prosecution will not be renewed. There appears to be an important difference between the Lackawanna's transactions and those for which the New York Central and the Sugar company were fined in the aggregate $312,000 (*Railroad Gazette*, Oct. 26 and December 14, 1906); and the Government not only lacked a statute defining the Lackawanna's offense but was also prosecuting for the wrong kind of offense. But the Lackawanna's rebates were against public policy as clearly as were those of the New York Central. Like the heavy payments made several years ago by the transcontinental railroads to the Pacific Mail Steamship Company, to avoid a rate war, they were essentially violations of the pooling law, though perhaps not technically contrary to the terms of the law. Pooling cannot be carried on with the approval of the public except under government supervision and full publicity. The Lackawanna evidently paid Mr. Palmer for doing nothing at all; which is interpreted usually in the only way that it can rationally be interpreted, namely, as paying for immunity from a rate war. Between such payments and pooling there is no important difference.

Pennsylvania Railroad.

The calendar and fiscal year 1906, the sixtieth in the history of the company, was in several different ways an unusually important one for the Pennsylvania. Fundamentally, it was a year of unprecedented traffic and earnings. Financially, the annual dividend was increased from 6 to 7 per cent., and there were tremendous issues of new capital obligations, though only a small increase in stock outstanding. More important still, a large part of the stocks of the other principal bituminous coal roads reaching the Atlantic seaboard acquired in 1900 and 1901 were sold. From the standpoint of the management of the system, the death of Mr. Cassatt and the succession of Mr. McCrea as President, were of large importance, because this marked not a distinct change in the policy of the company, but rather the drawing to a close of an era in its development.

It must be remembered in considering the results achieved by the Pennsylvania Railroad that these returns do not include the operations of a very large part of the Pennsylvania system. East of Pittsburg the operations of the Philadelphia, Baltimore & Washington; Northern Central; West Jersey & Seashore; Cumberland Valley; New York, Philadelphia & Norfolk; Baltimore, Chesapeake & Atlantic; Maryland, Delaware & Virginia and Long Island railroads, with over 2,000 miles of line, are not included, nor are any of the more than 5,000 miles of line west of Pittsburg. The figures which are considered in this review are those for the 3,750 miles of line operated directly by the Pennsylvania Railroad Company. This is in four grand divisions, the Pennsylvania Railroad division, the United Railroads of New Jersey division, the Philadelphia & Erie Railroad division and the Buffalo & Alleghany Valley division.

The gross earnings of these lines (3,897 miles, including trackage rights) in 1906 were $148,200,000, an increase of $14,300,000, or 10 per cent. over 1905. Operating expenses increased 9 per cent., leaving net earnings of over $46,400,000, a gain of $5,900,000, or 14 per cent. over the previous year. These earnings are at the rate of $37,661 gross and $11,915 net per mile, but these large figures by no means represent the normal financial strength of the Pennsylvania

Railroad, for other income, which comes principally as return from investments, contributed $12,780,000, or $3,280 net per mile last year to the gross income of the company. Net income after fixed charges and other payments, was $35,670,000, an increase of $5,570,000 over 1905. From this $19,870,000 was paid in dividends, $4,200,000 as principal of car trusts, $8,700,000 spent and $2,500,000 reserved for extraordinary expenditures. No part of net income was transferred to profit and loss account for the year. Nor was the $15,200,000 profit from the sales of stock, which was all applied to betterments and improvements—$13,000,000 toward construction of the New York Tunnel Line and $2,200,000 transferred to the extraordinary expenditure fund. The amount to credit of profit and loss on December 31, 1906, was, therefore, the same as a year ago, $24,725,000. It is interesting to observe that the total amount spent and reserved out of income for betterment and improvement expenditures, including principal of car trusts, was over $30,600,000.

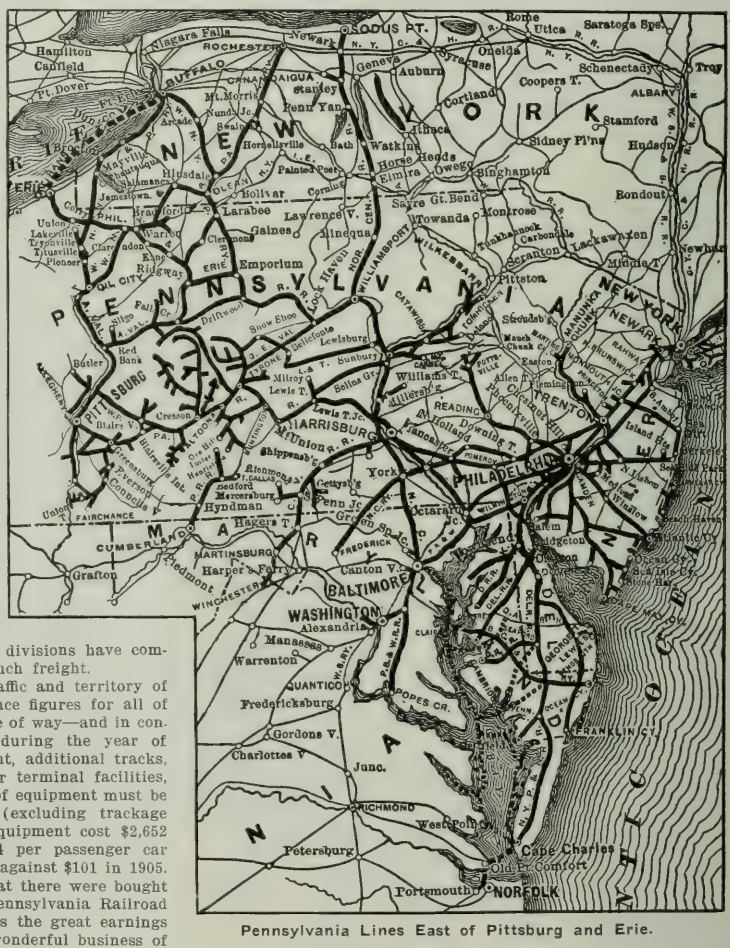
This income account of the Pennsylvania's is as remarkable a showing of railroad prosperity and large provision for the future as can be found. It should go far to reassure those who feel that the company has committed itself to plans too expensive for it to safely carry out. The territory served by the road is such that nothing short of a complete prostration of the primary industries, coal, iron and steel, could dangerously impair the earning powers of the road. By the time the Pennsylvania passes its dividend a large number of the rest of the railroads of the country will be in bankruptcy.

The traffic of the road is so large that it is difficult even to get an intelligent view of the operations of the less than 4,000 miles directly operated. In order to thoroughly understand the operations of the whole, the traffic and operating statistics of each grand division would have to be examined separately as can be done from the report. It is, however, possible to get a fairly accurate idea of the operations represented by the total figures for the lines directly operated by recalling that the Pennsylvania Railroad division runs from Philadelphia to Pittsburg, carries on its main line the heaviest traffic of any similar stretch of road in the country, both in tonnage and density, and by its branches reaches a tremendous area of bituminous coal workings. The United Railroads of New Jersey division includes the lines from Philadelphia to New York, Camden to South Amboy and branches, carrying the heavy traffic, particularly passenger traffic, of the New York division. The Philadelphia & Erie Railroad division runs from Sunbury, Pa., 50 miles north of Harrisburg, to Erie, on the Lake, with branches, and the Buffalo & Alleghany Valley division from Pittsburg to Buffalo and Rochester, with branches. The last two divisions have comparatively light passenger traffic, but carry much freight.

Taking into consideration the different traffic and territory of these four grand divisions the unit maintenance figures for all of them together are strikingly high. Maintenance of way—and in considering this figure the actual expenditure during the year of $8,700,000 for revision of grades and alinement, additional tracks, shops, yards, bridges, piers, stations and other terminal facilities, abolition of grade crossings and improvement of equipment must be remembered—cost $4,547 per mile operated (excluding trackage rights), against $4,091 in 1905. Repairs of equipment cost $2,652 per locomotive against $2,935 in 1905, $1,114 per passenger car against $945 in 1905, and $103 per freight car against $101 in 1905. In this connection also it must be observed that there were bought through car trusts during the year for the Pennsylvania Railroad Company alone, 23,803 cars. Fully as much as the great earnings these maintenance figures give proof of the wonderful business of the Pennsylvania.

Since the year 1899, 6 per cent. yearly has been paid on Pennsylvania stock. The increase in the rate last fall to 7 per cent. was like the increase in the New York Central rate from 5 to 6 per cent., in that it depended both upon increased earnings and larger dividend payments on stock of controlled companies. The Vandalia Railroad, the Pittsburg, Cincinnati, Chicago & St. Louis and the Pennsylvania Company increased their dividend payments during the year. The stock of the two former is held by the latter, and the Pennsylvania Company stock, by the Pennsylvania Railroad.

The new issues of securities during the year were made mostly through the Pennsylvania Company, whose credit was, for the time being, more available than that of the parent corporation with its large capital issues already outstanding. On May 1, 1906, that company issued $50,000,000 4½ per cent. 18-months' collateral notes, guaranteed by the Pennsylvania Railroad, to whose credit the proceeds were placed. The Pennsylvania Company also issued on June 15, 1906, and sold in France 250,000,000 francs, or about $48,000,000, of 3¾ per cent. 15-year trust obligations, the proceeds being used for securing a permanent water supply on the Lines East and for additional equipment. Besides this the Pennsylvania Company on April 2 issued $20,000,000 15-20 year 4 per cent. bonds for the needs of the Lines West, particularly the Northwest system. The capital requirements of the Pennsylvania Railroad for the current year are being met through the issue of $60,000,000 3-year 5 per cent. collateral notes put out since the close of 1906. Furthermore, in order that the directors may be free to make a new capital issue promptly when they deem the time available, the shareholders gave authority at the annual meeting this month to issue in future additional stock or bonds to the amount of $100,000,000. This brings up the total stock authorized to $500,000,000. These are large figures, all of them, so large that they have caused considerable anxiety in the minds of many as to the future of the Pennsylvania's finances. Yet they represent, not extravagant experiments, but rather simply a living up to marvelous opportunities.



Pennsylvania Lines East of Pittsburg and Erie.

The Baltimore & Ohio, Norfolk & Western and the Chesapeake & Ohio stocks were acquired to promote a more conservative policy in their management and to do away with discrimination between shippers. As these results have been largely obtained and maintenance of tariff rates appears secured by the present Rate Law and as, further, the securities could be sold at a large profit, all the Chesapeake & Ohio stock and a majority of the Baltimore & Ohio and Norfolk & Western holdings were disposed of. The disposition of the Baltimore & Ohio stock has been made public. It went to the Union Pacific and marks the first large entrance of the Harriman influence on the Atlantic seaboard.

The events of Mr. Cassatt's administration are briefly reviewed in the minute adopted by the directors after his death. The building of a complete new double track line from the summit of the Alleghanies to tidewater at New York, the new station and approaches at Washington and the Pennsylvania tunnel into New

York and under the East river, as well as to a connection with the Long Island, and the great new passenger station, all well under way or nearing completion, are mentioned as the most striking constructive achievements of his administration. The New York terminal, with its North and East river tunnels, has proved a more expensive project than he anticipated, but there is little doubt that it will, in the end, amply repay its great cost. The fact that the Pennsylvania is able to build it is only another way of saying that the business of the road demands it.

The following table shows the principal results of operation:

	1906.	1905.
Mileage worked	3,897	3,839
Freight earnings	$109,960,888	$100,093,828
Passenger earnings	31,231,338	27,302,393
Gross earnings	148,239,882	133,921,992
Maint. way and structures	17,060,498	15,121,800
Maint. of equipment	26,201,245	24,363,199
Conducting transportation:		
Traffic	1,772,012	1,435,417
Operation	53,504,168	49,473,234
Operating expenses	101,805,644	93,390,410
Net earnings	46,434,238	40,531,582
Other income	12,784,262	12,136,918
Net income	35,674,301	30,102,518
Dividends	19,869,661	18,113,978
Payments account of principal of car trusts	4,246,039	3,249,238
Extraordinary expenditures	8,701,475	8,424,881
Transferred to extraordinary expenditure fund	2,500,000	.....

CONTRIBUTIONS

Steel Ties on the Pennsylvania.

Philadelphia, March 13, 1907.

To the Editor of the Railroad Gazette:

Relative to the report made of the recent accident to train No. 29 on the Pennsylvania Railroad in the vicinity of Mineral Point, full copy of which appeared in your issue of Friday, March 1, 1907, I think you have written a very fair and creditable editorial on the subject, including not only the Pennsylvania Railroad accident but the accident on the New York Central which occurred recently. The general impression seems to prevail, however, in nearly all the papers which have been brought to my observation that the steel cross ties for railroad track purposes are a failure.

I would be greatly obliged if you would call the attention of your readers to the fact that after most careful observation and study of the subject I am more than ever impressed with the necessity in the near future of a substitute for wooden cross ties, and so far no material has been offered as a substitute that will meet the requirements except metal. I think, however, that all ties tested are a little lighter than they should be and am firmly of the opinion that none of the fastenings for holding the rail in position to the tie is adequate to the requirements. This was emphasized in the accident we had, above referred to.

When any suitable fastening shall have been designed, and there is no doubt in my mind that it will be in the near future, either by the Carnegie Steel Company or by someone else, I have not the slightest doubt that the experiments in connection with the steel ties will go forward, not only on this system but on other leading railroads.

On the Pennsylvania Railroad alone we are using about 4,000,000 cross ties a year, and with the increased price for cross ties in the last five years and the difficulty in purchasing even at the increased price, it is obvious that some substitute must be secured before long. The quality of the timber also has depreciated enormously in the last five years, so that it becomes imperative that we should either purchase the best cross ties that the market affords and creosote these ties and use heavy tie-plates, or secure a steel cross tie or one of some other composition which will answer the requirements.

This company a number of years ago laid four sections of track with the steel tie as used at that time by some of the English railroads. These were of the inverted trough design, but did not give satisfactory results.

What I am afraid of is that the general public, and the engineering profession in particular, will dismiss the subject of steel ties as a failure, when in reality they must come sooner or later, and the more intelligent thought given to this matter the sooner a suitable steel tie will be furnished which will be satisfactory in every particular.

A. C. Shand,
Chief Engineer, Pennsylvania Railroad.

A consular report from Nagasaki, Japan, says that the government will build three lines of road in addition to those to be built in accordance with the 15-year plan recently given out. The additional lines will be as follows: Kumamoto to Oita, 84 miles; Oita to Miyazaki, 181 miles, and Miyazaki to Yoshimatsu, 47 miles. The estimated cost is $20,734,000, and it is probable that the work will begin soon.

New Railroad Laws in 10 States.

The *Wall Street Journal*, in its issue of March 18, prints a summary of railroad legislation recently enacted or discussed, in most of the states where railroad laws have been proposed, from which we make below liberal extracts. It will be seen that many drastic laws have already been passed, and two-cent fare bills have been passed by Ohio, Kansas and Missouri, and similar bills are pending in New York, Pennsylvania, Michigan, Illinois, Texas and Minnesota.

New York.—The usual number and variety of bills have been introduced. The great majority are still in committees' hands. It seems unlikely that the more drastic of these bills will pass. Thus far, none of the so-called anti-railroad measures have passed both houses. There are several two-cent fare bills, but until the public utilities bill (general railroad law) has been disposed of none of the pending railroad legislation will be sent to the Governor.

Pennsylvania.—During the present session 48 bills affecting steam and trolley railroads have been introduced. The opinion is freely expressed both by legislators and railroad men that a two-cent passenger rate bill will be passed. Chances also favor a railroad commission bill becoming a law. The house has already passed the two-cent bill. The House committee has reported favorably on the Dunsmore bill to create a State Railroad Commission. Under its provisions the law will take effect May 1 and five commissioners are to get $6,000 a year.

Illinois.—No anti-railroad law has passed the legislature, but several will be passed. Over 60 bills are pending, many of them, however, largely duplicates. The most important bill to pass will be the two-cent fare measure. The next most important will be the employers' liability bill. No anti-pass bill will go through. Bills are pending on the following: Two-cent fare, seven in the House, one in the Senate; anti-pass, four in the House, two in the Senate; employers' liability, personal injury, reciprocal demurrage, live stock train speed, power to the railroad commission to enforce uniform accounting, grade crossings; taxation, outside of the Illinois Central matter, one in the House, giving power to the Railroad Commission to inquire into the subject. There are nine House bills and five Senate bills regarding accidents and protection to the public.

Politics and hostility between Governor Deneen and the anti-Deneen factions make the outlook very uncertain. It is impossible to say what railroad bills will pass, but there will be some kind of legislation. Governor Deneen also intends to have a bill introduced limiting the right of railroads to issue new capital.

The Governor wishes to leave the two-cent fare matter in the hands of the Railroad Commission, which now has sufficient power. Public sentiment is stronger than ever for passenger fare legislation since Indiana passed the two-cent fare bill. The Illinois law will probably give the railroads an opportunity to show the Railroad Commission whether a two-cent maximum is reasonable.

Minnesota.—Nothing seriously hostile has been enacted in this state, but several bills have passed the House and are now before the Senate. Many others, some very drastic, are pending in the House. There are bills for a tax on iron ore; for an income tax, applicable to persons and corporations; raising the tax on telephone, telegraph, express and private freight lines; imposing a license upon foreign corporations doing business in Minnesota; taxing transactions in grain and produce; and for raising railroad gross earnings tax from 4 per cent. (two bills, the Spooner bill to make it 6 per cent., and the Miller bill to make it 5 per cent.). The reciprocal demurrage bill has passed the House, but it is likely to be killed in the Senate. The two-cent passenger fare bill is likely to be compromised by concessions on the part of the railroads. The distance tariff bill, the bill for state supervision of railroad bond issues, and the bill requiring all corporations to make reports to the state auditor were killed. There are nine other minor bills covering loading of live stock, safety appliances and other railroad matters.

Legislative committees are investigating the alleged coal, timber and iron ore trusts, the harvester trust, the Hill ore land deal, and the matter of putting a valuation on railroad properties in the state and regulating rates accordingly. The Railroad and Warehouse Commission has reduced freight rates and the railroads are fighting it in the courts. The attorney general is suing the Great Northern for payment of back taxes on gross earnings, the Great Northern claiming that 3 per cent. is guaranteed by the charter, while the present advanced rate is 4 per cent. The attorney general is therefore seeking to annul the charter of the St. Paul, Minneapolis & Manitoba, the basic company of the Great Northern. The attorney general has also secured an injunction preventing the Great Northern issue of $60,000,000 new stock, on which a supreme court decision may be expected at any time.

Texas.—The anti-free pass bill will go to the Governor for approval at once. The bill reducing passenger fares to two cents has been reported favorably by the Senate and House committees, but there is a prospect of the measure not passing the Senate. A bill providing for reciprocal demurrage is pending in the House and Sen-

ate, requiring perishable freight to be moved not less than 265 miles a day and that all cars shall be moved at least 60 miles per day.

A bill requiring railroads to equip all of their locomotives with electric headlights has been passed. A bill prohibiting blacklisting of discharged employees by railroads is pending in both houses. A bill authorizing railroads to issue bonds to buy equipment is pending in the Senate, and a bill authorizing the Railroad Commission to require railroads to buy additional rolling stock when it is deemed such is needed has been reported favorably by the House and Senate committees.

Georgia.—Railroad laws will be passed in July for the supervision of bond and stock issues, and prohibiting free passes, campaign contributions and lobbying. The power of the Commission will be enlarged to compel the construction of side tracks. The state-owned road, the Western & Atlantic, now leased to the Nashville, Chattanooga & St. Louis, will probably be extended to the sea, 300 miles, the extension to be operated by the state.

Michigan.—The rate bill compelling railroads earning $1,000 a mile and over to give two-cent fares has been introduced in the Senate and is favored by the Governor. A bill is being drawn by the Michigan Manufacturers' Association for the formation of a Railroad Commission of three members, with powers similar to those of the Interstate Commerce Commission, as to the regulation of freight rates, etc. A bill has been introduced on reciprocal demurrage. The reciprocal demurrage feature is included in the commission measure, but was repudiated after a hearing, though it may be restored later.

Under the law of 1889, lower peninsula roads, whose gross earnings are $3,000 a mile or upward, must carry passengers at 2 cents; those earning $2,000 to $2,999 a mile, at 2½ cents, and roads earning less than $2,000 a mile may charge 3 cents. Upper peninsula roads, owing to sparse population, were not then included. Many legislators favor Senator Wetmore's idea of further reduction of fares based on earnings. They believe the minimum gross, warranting 2 cents a mile in the lower peninsula and 2½ cents a mile in the upper peninsula, should be $1,500 a mile.

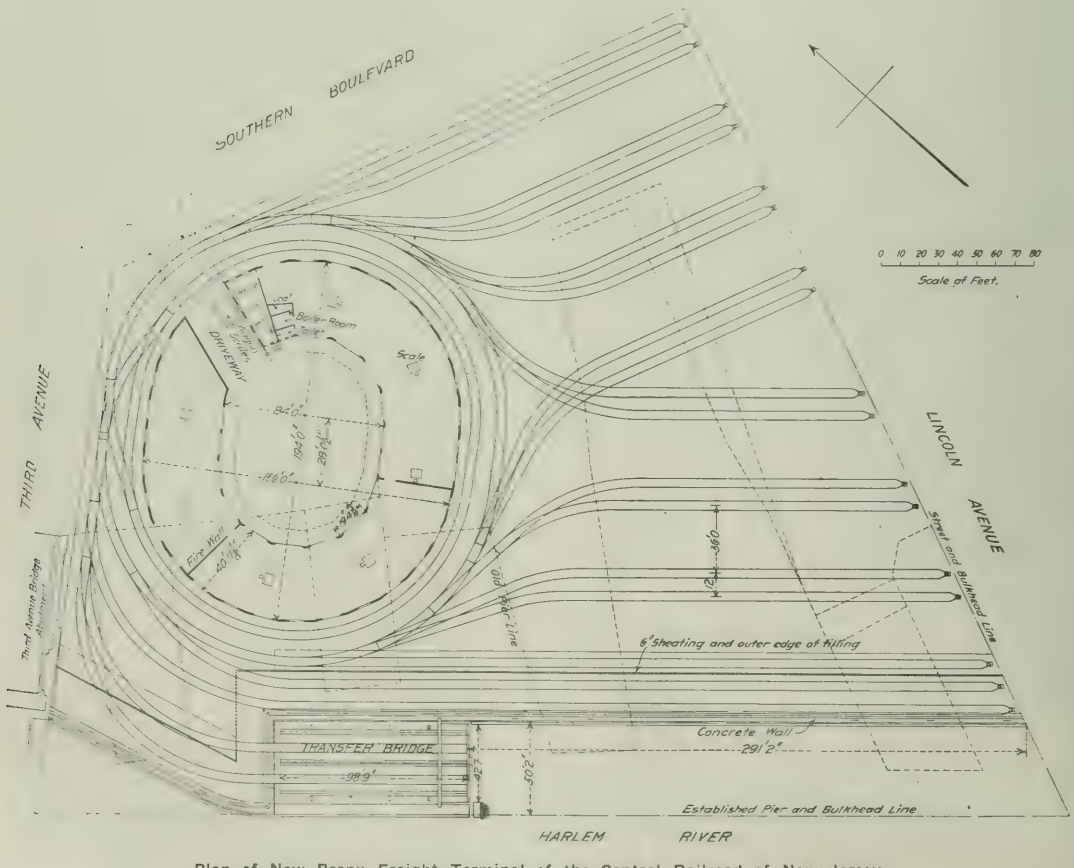
Missouri.—The only legislation passed by the present legislature was a two-cent passenger fare bill signed by Governor Folk February 28. This fixes a two-cent flat rate on all main line railroads. Independent and branch lines under 45 miles in length may charge the old rate, four cents. The former rate on the main lines was three cents. Other legislation has made changes in some freight rates established by the law of 1905. No other legislation is before the legislature that will especially affect railroads.

Wisconsin.—The legal rate of railroad fare in Wisconsin has been 3 cents a mile since the seventies. The State Railroad Rate Commission recently made an order requiring a 2½-cent rate on the principal lines, which has been accepted by the roads and is in force. Smaller lines will have to follow. The Commission recommended the sale of 500-mile books for $10, and the roads are now selling them. Half a dozen bills are before the Wisconsin legislature for a 2-cent rate, but the reduction to 2½ cents and the sale of mileage books at 2 cents has practically killed them.

Kansas.—The Kansas legislature has adjourned. Seventy-three railroad bills were introduced. Of these, 10 were passed, as follows: To prohibit passes; to reduce grain rates 15 per cent.; to limit the hours of trainmen to 16 a day; to require that freight trains be run 15 miles an hour; to prohibit the confiscation of coal; to increase the power of the railroad board; to authorize the state board to intervene in interstate commerce cases; to provide for reciprocal demurrage charges; to authorize the state board to establish terminals; to require railroads to furnish sheds for employees; and to sell 500 miles of transportation for $10.

New Bronx Freight Terminal of the Central Railroad of New Jersey.

The Central Railroad of New Jersey is building a somewhat unique freight terminal and transfer station on an irregular shaped piece of ground between Third and Lincoln avenues on the north bank of the Harlem river, New York. In order to utilize to the greatest advantage all of the small available ground space an ellip-

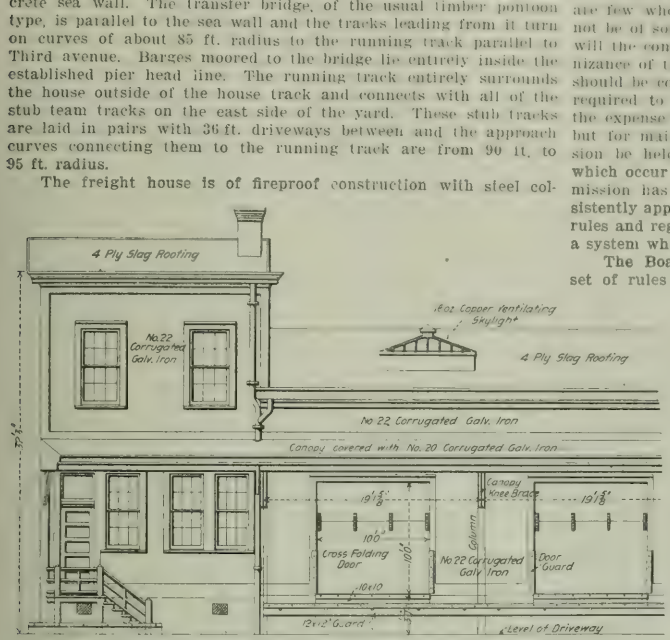


Plan of New Bronx Freight Terminal of the Central Railroad of New Jersey.

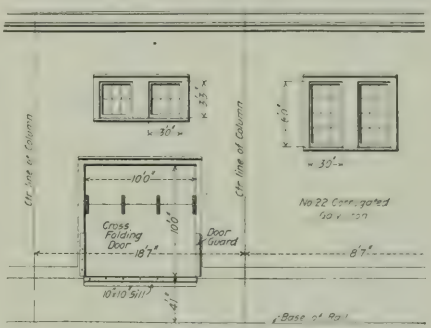
tical freight house is to be built, 194 ft. x 166 ft. over all. This scheme, while it involves the use of very sharp curves in the yard, has proved successful in the terminal of the Harlem Transfer Co. a short distance up the river, which was designed by Mr. Walter G. Berg, Chief Engineer of the Lehigh Valley.

The yard is built on made ground which is retained on the river side by a wall of 6-in. sheathing, outside of which is a concrete sea wall. The transfer bridge, of the usual timber pontoon type, is parallel to the sea wall and the tracks leading from it turn on curves of about 85 ft. radius to the running track parallel to Third avenue. Barges moored to the bridge lie entirely inside the established pier head line. The running track entirely surrounds the house outside of the house track and connects with all of the stub team tracks on the east side of the yard. These stub tracks are laid in pairs with 36 ft. driveways between and the approach curves connecting them to the running track are from 90 ft. to 95 ft. radius.

The freight house is of fireproof construction with steel columns and roof framing and corrugated galvanized iron sides. It rests on concrete foundations supported on piling and is roofed with four-ply slag roofing. The roof slopes to the inner circle and the water is carried off by a gutter at the eaves. As a protection to teams backed up against the house a continuous canopy supported by light structural steel brackets extends completely around the inner circle. There is no canopy or platform on the track side.

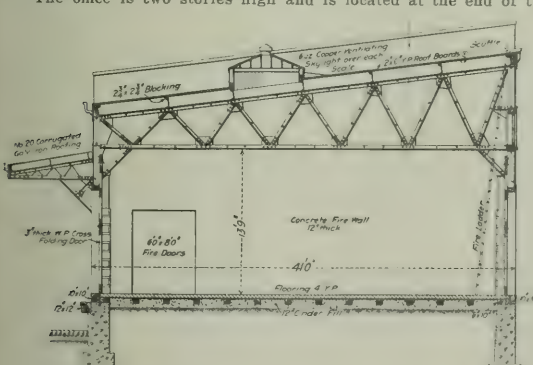


Part Elevation of Driveway Side of Freight House.



Part of Track Side Elevation.

The office is two stories high and is located at the end of the house on the east side of the entrance driveway. Wagon scales are provided in the driveway, which can be read from the office. The main part of the house, which is 41 ft. wide, is divided up into three sections by 12-in. concrete fire walls extending up to the roof. The floor is 4-in. yellow pine laid on 6-in. x 6-in. stringers bedded in 12 in. of cinder filling. There are seven floor scales provided and over each scale is a ventilating skylight in the roof. The door openings on both sides of the house are 10 ft. x 10 ft., and they are closed by Cross folding doors made of 3-in. planks covered with galvanized iron.



Cross-Section Through Freight House.

We are indebted to Mr. J. O. Osgood, Chief Engineer, Central Railroad of New Jersey, for the drawings.

New and Old Signaling Problems.*

The serious accidents that have recently occurred have so attracted the attention of the public, there is an evident demand for the Interstate Commerce Commission to take up the subject of railroad operation and compel the adoption of a form of block system by which it is expected that many accidents will be prevented. There are few who will deny that a block system, however weak, would not be of some advantage in reducing the number of accidents; but will the commission, in prescribing rules and regulations, take cognizance of the many unsolved problems in signaling, and say what should be considered good and what bad practice? If all roads are required to install the safest and most complete system possible, the expense will be a heavy burden on many, not only in first cost but for maintenance. On the other hand, should not the commission be held, with the railroads, partly responsible for accidents which occur through defects existing in a system of which the commission has approved? To what extent can the commission consistently approve of or require the observance of certain block signal rules and regulations, without being criticized for having sanctioned a system which does not give complete protection?

The Board of Trade of England has prescribed an elaborate set of rules and regulations regarding signaling, which the roads must live up to; and new roads may not commence operation until the prescribed signal system has been installed and is in working order. The Staff system is prescribed for single-track roads, and while insuring almost complete protection against collision from head-on movements, such delay is caused in the running of fast non-stop trains that few can be run where this system is installed. Double-track lines, with all movements made in the same direction on a given track, are therefore more often the rule than the exception. In this country but a small part of the total mileage has been double-tracked, while on the single-track lines there are many and heavy fast trains run. For many of these roads double-tracking is out of the question from a financial standpoint, and the Staff system, with its limitations on the speed of trains, seems to be equally impossible.

There are many block systems, more or less complete, which may be used for single and double-track lines, and in approving of the use of any system, the points affecting the safe movements of trains should be carefully considered. On many of these points signal engineers do not agree, and definite action has not been taken by the Signal Association. The questions involved are so closely connected with operation, a discussion by those not particularly interested in the details of construction will aid in the determination of the best practice and the necessity of the same being observed by those who may not at the present time be conforming thereto.

Of several of the questions here submitted much might be said, but the purpose of this article will be served if definite recommendations are made by the club for the benefit of those who are interested in signaling; and to this end possible conclusions to the several questions have been suggested.

1. The question, "Shall a distinctive color be used for the 'clear' night-signal indication, or shall the white light be continued in use?" is one with which all are familiar. The possibility of a glass breaking and a wrong indication being given is so great, and the chance that a white street or house-light might be mistaken for the signal-light has increased to such an extent with the introduction of electric lights, a change to a colored light for the "clear" night indication seems to be necessary, if reasonably safe operation is to be secured. The Signal Association has recommended that a change be made, and several large roads are using green for the clear night indication. The glass makers have so improved their product, an excellent green can now be had. Although the yellow used for the

*A paper by W. H. Elliott, of the Engineering Department of the New York Central, read before the New England Railroad Club, March 12.

cautionary indication is not all that is desired, it is sufficiently distinguishable from the red on the one hand and the white on the other to answer as a satisfactory cautionary color. In the interest of greater safety in operation it is to be recommended that roads which are now using white should change to green for the clear, and to yellow for the cautionary night-signal indications.

2. Are continuous track circuits necessary for a sure-working block system? Judging from the apparently successful block working of thousands of miles of roads which are not equipped with track circuits, it would appear that a track circuit was not a necessary safeguard. However, an examination of the record shows that on roads that are protected by manually operated block signals, many accidents have occurred which would have been prevented if the working of the signals had been controlled by a track circuit. With the telegraphic block system, accidents have happened from the following causes, which in many cases would have been prevented if a track circuit had been used to control the working of the manually operated signal.

The signal may be allowed to remain at clear after the train has entered the block, and the indication be accepted by a second train.

The signal may be cleared for a train to enter the block when it is occupied.

On single track, trains traveling in opposite directions may be allowed to enter the block at the same time.

Switches in the block may be left wrong, or a switch may be opened and a train run out on the main track ahead of one approaching, or while there is a train in the block.

With the controlled manual system, accidents may happen from any one of the following causes through two trains getting into the block at the same time—a condition that would have been prevented by the use of the track circuit.

The releasing section may be shunted by an uninsulated handcar, a tamping-bar, or by the man cleaning batteries, the lock being thereby released and permitting the clearing of the signal when there was a train in the block.

The unlock may not be taken up when a train enters the block, and it would then be possible for the signalman to improperly clear the signal.

Should, at any time, under permissive card or on account of failure of the system, two trains be permitted to enter the block at the same time, the passage of the first train out of the block would release the instrument and allow the signals to be cleared for the entrance of a third train while the second train was yet in the block.

Should the rear portion of a train be left in the block, the passing out of the head end would release the block instrument, and the signals could be cleared for a train to enter the block that was occupied by a part of a train.

With continuous track circuits installed and thus permitting of the signals being made semi-automatic, the signals would automatically change to the stop position when a train entered the block, and would be held in such position as long as the block was occupied. As this protection is very necessary, and can be secured in no other way than by the use of the track circuit, this apparatus should properly be considered as a necessary part of a sure-working block system.

3. With the wide heads of the heavy rails now in use, is it not advisable to take the detector bars off and depend upon electric locks controlled by track circuits to hold the interlocking levers and prevent a switch being thrown under a train? This is, comparatively speaking, a new problem, and has arisen from the fact that with the 90 and 100-lb. rails the tread of the wheel does not often project over the outside of the head of the rail sufficiently to catch the detector bar and prevent it from going over. This is particularly the case where there is a sharp flanged wheel, or the track is not exactly to gage; and when the bar is allowed to go over, the switch is unlocked and may be thrown under the train should the lever be pulled by the signalman. The size of rails will not be made smaller as engines and cars get heavier, and it is desirable that some more efficient means than the detector bar be provided to prevent the throwing of a switch under a train. The track circuit controlling an electric lock on the switch lever seems to provide the required protection and to be surer working than the detector bar. This is because the shunting of the track circuit is automatic, and once having operated is positive in its action and cannot be forced by a pull on the lever.

The weak point in the arrangement is that the relay may not be shunted; but with a magnet of sufficiently high resistance to make the relay quick acting, and with the ends of the circuit properly located with reference to the position of the switch, the electric lock has been found to be the most reliable and to give the best protection.

4. Do automatic signals give sufficient protection to require their installation as necessary for the safe movement of trains on a single-track road? This is an important question, and more may easily be said upon the subject than can be given here. In the United States the telegraphic block system is the one most generally employed for the protection of trains on single-track lines. Where greater protection is required the automatic is the system usually put in. When installed in the right way, with the signals for opposing movements staggered and also placed on each side of a main-line switch to protect trains entering or leaving the switch, the automatic system furnishes a large degree of protection, although the movement of traffic is assisted in comparatively small proportion for the outlay of money required.

In no instance with which the writer is familiar have distant signals for each home signal been provided for a large installation on a single-track line, and complete protection cannot be obtained without these. It is true in most cases that the distant signals have not been used on account of the complicated wiring required, rather than because of the expense; but to do without the distant signal is to dispense with an important part of a signal system without which it is difficult to require enginemen to obey the indications of the signals. The distant signal gives notice to an engineman when a stop is to be made at a home signal, and without this notice the engineman cannot be expected to come to a stop at the signal unless the signal can be seen from the point at which the brakes should be applied. In bad weather the signal cannot be seen very far away, and if a train is running at high speed and the signal is indicating stop, the train will run by the signal before it can be brought to a stop. Allowing an engineman to constantly pass a signal indicating stop, when he should not, weakens discipline; and the signal is likely to be run by once too often and a collision result.

On single-track lines it is necessary for a train finding a signal indicating stop, to send a flag ahead before proceeding, as the signal may be indicating stop on account of a train approaching from the opposite direction. Great delay is therefore occasioned when the system fails, and traffic is materially interfered with. This the public will say is on the side of safety, but when an important train loses 15 or 20 minutes being flagged through a block on account of a failure of the signal system, the schedules are often so disarranged the chances are increased for a mistake to be made in orders or in meeting points.

The automatic system on single-track lines is of assistance in expediting movements where the trains are moving in the same direction; and where traffic is heavy or the conditions of operation difficult, its installation would seem to be warranted. Where the operating conditions are good and traffic is light, with the possibility of making the blocks of equal length, the necessity for the use of automatic signals is not so apparent. For those roads where the number of trains approaches the maximum it is possible to run, it will sometimes be found a better proposition to double-track the line rather than go to the expense of installing automatic signals; so that, before coming to a decision as to the advisability of installing these signals, it will be well to consider the matter from the standpoint of a possible elimination of, rather than protection against, the dangers due to trains moving in opposite directions on the same track.

5. Where automatic block signals are in use, is it necessary for a man to go back to flag following trains? Mr. Slater, of the Southern Pacific, brought the matter to the attention of the Signal Association, and argued that it was not necessary for a man to go further back than to know that the first signal in the rear of the train was indicating stop; and on leaving torpedoes the man should return to his train. The flagging rule No. 99 is probably more honored in the breach than in its observance, for with many trains, if the rule was fully obeyed, the flagman and then others of the train crew would be left behind until there was no one to flag, or else no one to run the train. The question of when to flag and when not to flag has to be decided by the man on the ground, but in a number of cases this man finds it unnecessary to flag; and often, when he thinks there will not be a train closely following, he remains with his train rather than to go back. In practice, if there are many trains run on a given track, complete flagging protection is not possible; for trains make stops at stations as well as between stations, and an accident is as likely to occur at small stations as at other places, because it is not practicable for a fast train to approach each station prepared to stop. Dependence must therefore be placed on the block signals for protection. Where the blocks are long and the trains are infrequent, the necessity for flagging is more apparent, and the men can be depended upon to more fully observe the rule. If, as seems to be true, there are places where the flagging rule cannot be strictly observed, is it not time to recognize this condition and so change the rule that it will not be held over the flagman's head to convict him when there is an accident, and to be overlooked as long as trains are running satisfactorily? Will not the position of the Superintendent be more consistent and better discipline be secured if, at places where a reliable block system is installed, the flagman is required only to assure himself that the first home signal in the rear is indicating stop, and after doing this and putting down torpedoes should be permitted to return to his train? Will not such practice

cause the engineman to more properly obey the indication of the signal and proceed with caution when entering a block that presumably is occupied, than for him to depend on a flagman being out to stop him in case there is a train in the block?

The automatic is of necessity a permissive signal, and trains coming to a stop at the signal must be allowed to proceed. While an engineman may disobey the rule and run at too high speed, thereby coming into a collision with a train in the block, the fault is certainly the engineman's and shows a lack of discipline; for not only should the train have been run so as to make it possible to stop within the space to be seen ahead, but it should not have been run any faster than would be safe were there a broken rail that might derail the engine. Strict discipline will have to be imposed, but it will probably be found as easy to do this and get satisfactory results as it is to get the men to live up to the requirements of the flagging rule. It would seem, therefore, that where the modern complete system of automatic block signals is installed, the protection afforded by the signals should be recognized and the flagging rule changed to such an extent that the benefits to be had from the use of the signals might be fully taken advantage of.

6. Is the use of approach locking warranted, with its complications, delays to traffic and increased cost of installation and maintenance? The need of an approach lock, by which the route through an interlocking plant is locked when the signal is cleared, and cannot be changed until the train has passed the signal, is most generally shown in the investigations that are made into the causes of derailments or accidents resulting from the home signal being improperly run by. In almost every case of the kind, the train crew apparently at fault will claim that the route was taken away after the signal had been cleared for the train to proceed. In the majority of these cases it is the word of the signalman or men against that of the engineer and fireman, and occasionally also that of the head brakeman and the conductor. The Superintendent is almost always inclined to take the word of the trainmen as against the signalman, and even if such is not the case the mere possibility of the route being changed throws a doubt on the finding of the investigation, unless a device is in use that would prevent the changing of the route in the face of an approaching train. The possibility of the route being changed, either through carelessness, poor judgment or undue excitement on the part of the signalmen, will always exist unless a lock is used to prevent a change being made. As generally applied, the lock takes effect when the home signal is cleared, provided an approaching train is within a certain distance of the distant signal. If a train is not approaching, the signal may be cleared and returned to the stop position at will, as it is the presence of the train that drops the lock and holds the route. The lock becomes effective only when the lever has been reversed, and while the lever may be returned to the normal position at any time, the latch is held by the lock and the route cannot be changed until the head end of the train has passed the home signal and arrived at the point where the route should be released.

Where the approach lock is used it is usual to provide a screw release which will, in case of emergency, allow the route to be changed, provided a certain determined period of time is taken to effect the release. The time required for the release is generally made one and one-half minutes; and as the first turn cannot be given to the screw until the home signal has been put to the stop position, an approaching train would have time to pass the signal and hold the route, or to have come to a stop at the signal before the route could be changed. In view of the many fast trains that are run, the added safety and the better discipline to be obtained through the use of the approach lock, it would appear that the additional maintenance and the delays to traffic resulting are unimportant in comparison, and the use of approach locking is to be recommended.

7. What interlocking signal protection should be provided for a drawbridge to insure that all parts are in proper position, and is it safe for trains to pass over the bridge without stopping? It has usually been considered that sufficient protection was provided when the bridge itself was locked in place before allowing the signal to be cleared, but the several derailments that have occurred have shown that it is as necessary to lock the lift rails in place as it is the points of a facing switch. Safe working can be secured only by providing complete interlocking protection and the elimination of the human element as far as possible. Complete interlocking protection requires that the bridge must be in place and the lift rails locked in position before the signal can be cleared. Also, that the signals must be automatically controlled in addition to the normal control provided by the lever of the interlocking machine. This is necessary, as the locking of the machine might be tampered with, or the indication locks picked and the signal improperly cleared, unless some other control was provided. Automatic control of the signal is obtained by means of a track circuit and circuit controller, the latter being connected to and operated by each lift rail of the track governed by the signal, so that the circuit to the slot on the signal is broken unless the lift rails are in place and the track unoccupied.

8. Has the automatic stop been so perfected that it may be considered sufficiently reliable to warrant its use, and if used would the number of accidents have been materially reduced? It is probable that as many patents have been issued for automatic stop devices as for any other apparatus in use on a railroad. While the stop is successfully used on elevated and protected subway roads, it has not been sufficiently developed to warrant its application to a steam surface railroad. The principal difficulty in perfecting the device is, to transmit to the moving train the impulse or energy required to shut off the propelling power and apply the brakes when the signal has been improperly run by. With a mechanical device snow and ice will either operate or knock the stop out of place, while with apparatus of the electric type it is difficult to make connection between the operating circuit and devices on the engine and the controlling circuit on the track. With either type of apparatus the device has been arranged on the normally open circuit plan, by which a breakage of important parts will cause the giving of a clear indication when the brakes should have been applied by the stop.

The automatic stop appears to be practicable only for those tracks on which trains are run in the same direction. The use of an overlap is also required. To serve the purpose for which it was designed, the stop must bring the train to a stop before it has come into collision with another. There must, therefore, be a clear track in advance of each signal for a space equal to the braking distance, and this the overlap provides. The use of the overlap and the difficulty of so arranging the apparatus that the brakes shall be applied when a train is moving in the direction of traffic, and not be applied when backing up, makes it evident that switching and irregular train movements will be materially interfered with. While it is absolutely necessary that trains should be moved as safely as the state of the art will permit, it is as necessary that trains shall be allowed to run and make schedule time when there are no other trains in the way. That this is so is evidenced by the frequent complaints made by passengers.

It is not to be denied that several of the collisions occurring during the last year would have been prevented had a sure-working stop been used, and it is probable that if a stop should be developed to the extent of being reasonably reliable, it would be used for certain classes of traffic. On the other hand, the use of the stop may have the effect of reducing the attention engineers pay to signals, in which case it would be better to go without the stop than to use it. It is also probable that the use of a stop would transfer in a large measure the responsibility for the observance of the indication of a signal, from the engineman, who is usually an educated man and well paid, to the repairman, who is comparatively speaking not as good a man, and could not be held to the same degree of responsibility. In so far as the responsibility of the engineman is reduced, to that extent it is objectionable to use the stop.

9. Is it advisable to use an overlap and insure a clear section of track ahead of a home signal, equal in length to the braking distance, in which an engineman may be given a chance to stop after passing a home signal and before coming into collision with a train that may be on the track ahead? Without an overlap an engineman must act on the indication of the distant signal to insure against colliding with another train. With an overlap, it is possible for the engineman to stop his train before hitting another train, although the brakes were applied only when the train passed the home signal. The engineman is therefore given two chances in which to bring the train safely to a stop. If the indication of the distant signal with its yellow or green light is overlooked, the probabilities are that the red, which is a more distinctive light, will be observed. Conservative railroading evidently calls for the use of the overlap, as it does that a derail [at a crossing] should be placed far enough back from the fouling point for the derailed train to be brought to a stop before reaching the line it was desired to protect. Men are fallible, and mistakes are made through carelessness or errors in judgment; and unless a certain space is provided in which a train may be stopped after reaching the signal, the chances are that a slight running by of a signal through an error in judgment will result in an accident that would not have occurred if the overlap had been used.

10. Of what length should the blocks be made when a road is signaled for a maximum traffic? This is an important question, in view of the necessity of operating trains safely in the crowded terminals of our large cities. A train may be safely run at a given speed, other conditions permitting, when the engineman is given warning at a point far enough away to enable him to bring the train to a stop before passing the stopping point. The distant signal is the warning point and the home signal the stopping point. Unless there are to be two distant signals for each home signal, a practice that is not to be recommended, the space between the distant signal and the home signal is therefore the shortest length of block that may safely be used. The space to be provided between the distant and the home signal is a matter of the speed of the train, the braking power and the grade of the track; and when

the signals are arranged to suit the conditions existing at a given point, the blocks will be as short as it is safe to make them, and the maximum traffic will be provided for.

11. In arranging signals to indicate the speeds that may be safely run, are the principles of route signaling, as understood at the present time, to be ignored? Speed signaling, as recommended by a committee of the Signal Association, calls for three arms to be provided on all interlocking home signal poles, of which the upper arm will govern for train movements to be made on an unlimited speed route, the second arm to the limited speed route and the third and lowest arm to the diverging, slow-speed and all other routes. The three arms are to be provided on all home signals, although it may be possible that only one or two of the arms may be used. By arranging the signals as proposed, the speed that may be safely run will be indicated; and the engineman will not have to remember the particular route a given signal stands for or the speed that may be run. That such an arrangement of signaling has much to commend it has been shown by the many places where it is used. On the other hand, it is often desirable and important for an engineman to be informed of the particular route set. If it is the main-line route that is set, long practice has required that the upper arm be used to indicate this route, irrespective of whether or not it was the one on which the highest speed might be made. The main route may be one on which there is a sharp curve requiring reduced speed, while the diverging route might be the straight track, so that in certain situations the arm used for the main-line route with speed signaling will not be the same as when signaling for a particular route. The use of the upper arm for the main-line route has shown that it is safe to require the engineman to recognize the location and govern the speed accordingly, and where there is more than one route on which high speed can be made, additional arms may be used for such tracks and practically the same results secured as for high-speed signaling. This is particularly the case at terminals where the speeds are slow, and it is important to indicate to an engineman when the route is set for the straight track or a particular route, thereby making use of all of the arms on a pole, rather than not to be able to clear the top arm because there was no unlimited speed route. The more extensive trial of speed signaling now being made will probably show that it is more important to signal for the route set, and where the two arrangements do not conflict the signals may be understood as indicating the possible speed and the route set.

12. Are electric roads to be allowed to cross steam roads at grade without providing sufficient power return conductor to keep the current from flowing along the rails of the steam roads? It is not desirable to retard or stop the growth of electric roads, but the safe operation desired by the steam road requires that crossings of the two roads at grade should not be permitted. If, however, a crossing is to be made at grade, it is reasonable to require an electric road desiring the crossing to so equip its line that the safe operation of the steam road will not be interfered with. Where automatic signals are in use they are usually controlled by a track circuit operated from a battery of low potential, to avoid excessive leakage and consequent failures. Where the rails of the electric line are used for the return of current to the power house, pressure or voltage is required to cause the current to flow. The pressure required to cause a certain flow is proportional to the resistance; the higher the resistance, the greater the pressure necessary to return a given current to the power house. If there are other paths than the rails of the electric line for the current to take on its return to the power house, the current flowing through these will be proportional to the resistance through these paths and the resistance in the rail return of the electric line. Consequently, if the resistance of the return on the electric line is not kept at a low point in proportion to possible other paths, current enough to interfere with track circuit relays controlling the automatic signals will flow along the rails of the steam road. The safe operation of the steam road depends upon the automatic signals working properly and not giving a wrong indication, and it is necessary that no current from the electric line be allowed to flow along the rails of the steam road. As this may be prevented only by providing sufficient return conductor capacity, the electric line might reasonably and properly be required to put in sufficient conductor to protect from foreign current interference the working of the signals on the steam road.

13. When a steam road is electrified and the rails are used for return of propulsion current to the power house, what special form of track circuit is it necessary to use in order that these circuits will not be affected by the current used to move trains? The use of the track rails for the return of propulsion current makes it necessary to provide a continuous return path from the train to the power house, and it is not possible to divide the track into unconnected sections as is done when automatic signals are installed on a steam road. When direct current is used for propulsion, alternating current is made use of to operate the track circuit, the various sections of track being separated one from the other with the ordinary form of insulated joint. To permit the propulsion current to pass from one track section to the next, a reactance bond or coil is used to connect the ends of adjoining sections. While permitting the direct current to flow with no other than the ohmic resistance of the bond and its connections, which is about the same as that of a piece of rail of equal length, an appreciable resistance is offered by the bond to the flow of alternating current, owing to the reactance of one turn upon the other of the coil which is made around an iron core. By making the copper wire of the bond large enough to carry without injurious heating the heaviest current the power house may furnish, the direct current will be allowed to pass uninterruptedly while the alternating current will be limited to the track circuit section, causing it to operate the track relay and control the signal in the same manner as on a steam road.

Where alternating current is used to move trains, this same kind of current must also be used for the track circuit, and a reactance bond of the same general type as is required for the direct current propulsion system must be used to connect the rails of adjoining sections together. The alternating current generally used for propulsion purposes has a frequency of 25 cycles per second. The track circuit relay must therefore not be worked by the 25-cycle current, and a current of different frequency has to be used, with the relay so adjusted that it will be operated only by this current of different frequency. With a frequency of 60 or 160 cycles per second the rotative impulses or pull on the relay armature caused by the 25 and the 60-cycle current occur at such varying intervals of time that the relay will respond only to the higher frequency, and with the relay working properly the other parts of the signal system are made the same as for a steam road. It is probable the relay for the A. C. propulsion system will be more sensitive than for the D. C. system, owing to the propulsion current having a certain effect on the armature; but the trials which have been made of this relay show it to be reliable in its working, and it is possible to install a satisfactory automatic signal system on a road where an alternating current is the power used to move trains.

Suspension of Freight Transportation on the Hungarian Railroads.

On January 10, the management of the Hungarian railroads issued an order that affected the whole commerce of the country. Starting from that date all transportation into Budapest with the exception of that of live stock, salt, coal and firewood, was suspended. No freight destined for Budapest was to be received, while that en route thither was stopped and placed at the order of the shipper. The order did not affect goods shipped from Budapest. The management stated that this order was necessitated by the enormous accumulation of merchandise at all of the stations; accumulations that have resulted from the delays to traffic that have occurred since Christmas. The decision for this action was taken suddenly on account of the congestion that threatened Budapest. The transportation of freight into Budapest has increased very greatly since autumn. The last order of this kind was issued in 1893. The transportation of passengers was not affected. The order naturally created some excitement in commercial circles, especially in view of a threatened strike by the railroad employees; and it was regarded as an attempt, on the part of the management, to retain the mastery of the situation.

A Bulletin of Traffic News for Shippers.

Arrangements have been made for publication in Chicago of a weekly bulletin intended to give manufacturers, shippers and others concise, reliable information regarding traffic affairs of the country —primarily information of freight tariff changes and other data taken from the records of the Interstate Commerce Commission. The new rate bill requires all tariffs to be filed with the Interstate Commerce Commission 30 days before going in effect. The object of the bulletin is to publish information about these new tariffs and place it in the hands of the shipper not later than seven days after filing, and therefore 23 days before becoming effective. This information will include the name of the road, the commodities, the territories affected, and when effective. The scheme, of course, requires the support and co-operation of the Interstate Commerce Commission. This has been obtained, and permission given for desk space in the Commission's offices in order that all tariffs filed may be examined readily. The plan further embraces the establishment of a rate bureau in Washington, which will be in charge of an expert traffic man, with competent assistants. In addition to examination of the freight tariffs, all complaints lodged with the Commission, and all decisions of the latter, will be digested for publication in the bulletin. For subscribers desiring immediate notification regarding rate changes, etc., there will be two additional services maintained, namely, telegraphic and mail.

The bulletin will also give news of railroad freight traffic associations, concerning their dockets, proposed changes in rates, clas-

sifications or routings, and the complaints or hearings before these associations. Another department will be devoted to shippers' and commercial association news, giving the subjects before such associations, the plans they have affecting transportation interests, and other information of value to shippers at large. Correspondents in the capitals of all states having railroad commissions will report the doings of each. Court decisions affecting traffic matters, changes in traffic officers on railroads, and in short all available information of interest on traffic matters is included in the plan for the bulletin. The publication will be 8 x 11, the size of a tariff sheet, for convenience of filing with the latter, and will be issued on Saturday of each week. It will contain the news of the week up to Friday. The Washington bureau will also be at the service of subscribers to obtain any information desired from the files of the Interstate Commerce Commission at a nominal cost.

The scheme is said to have the indorsement of such organizations as the Chicago Commercial Association, Illinois Manufacturers' Association, Chicago Board of Trade, and similar organizations in other large western centers such as Kansas City, Omaha, Milwaukee, Minneapolis, etc. The first number of the publication is expected to appear the last week in March under the name of the *Weekly Rate Bulletin*. The subscription price is $10 a year and the headquarters are in the Monadnock Building, Chicago.

So important is regarded the introduction of locomotives using superheated steam that the Prussian Ministry of Public Works has detailed Robert Garke, one of its high officers, to experiment with and report upon the performance of such engines; and that officer has recently published a large volume, which, after discussing the leading types of locomotives of recent construction in all countries, is largely devoted to the results of his experience with superheaters continued for ten years. The book says that last October there were in use or already ordered 1,516 locomotives with Schmidt superheaters, of which 875 were in Germany.

Reinforced Concrete Bridge Over the Cumberland River.

BY WARD BALDWIN.*

The Kentucky & Tennessee Railway runs from Stearns, Ky., on the Cincinnati, New Orleans & Texas Pacific southwest about 10 miles through extensive coal and timber lands controlled by the railroad company. The country is rough and some heavy construction work was necessary, the most important piece of engineering



Reinforced Concrete Arch Bridge over the Big South Fork of the Cumberland River, Sept. 11, 1906.

being the crossing of the Big South Fork of the Cumberland river, where a reinforced concrete arch bridge of five spans was built.

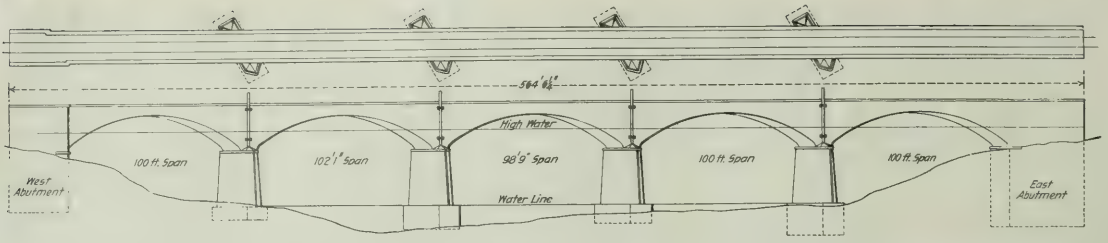
The arches have a span of 100 ft. c. to c. of piers and a rise of 18 ft. with a clear height at low water level of 48.8 ft. They are parabolic with circular intrados and extrados and have a skew of 30 deg. A trainload equivalent to Cooper's E-40 was used in designing them. The reinforcement is twisted steel bars of the sizes and locations shown on the accompanying drawings. A mixture of 1:2:4 concrete was used for the arch rings and spandrel walls. Expansion joints are provided in the spandrel walls at the abutments, but the walls are continuous over the piers where the shear rods of the arch rings are extended into them.

The west abutment was built hollow and filled with rock. It was designed on the supposition that solid rock which outcropped on the ground surface near the site of the abutment would be found at a small depth. Solid rock was not found, however, until El. 713 was reached and to avoid the cost of extending the abutment so that

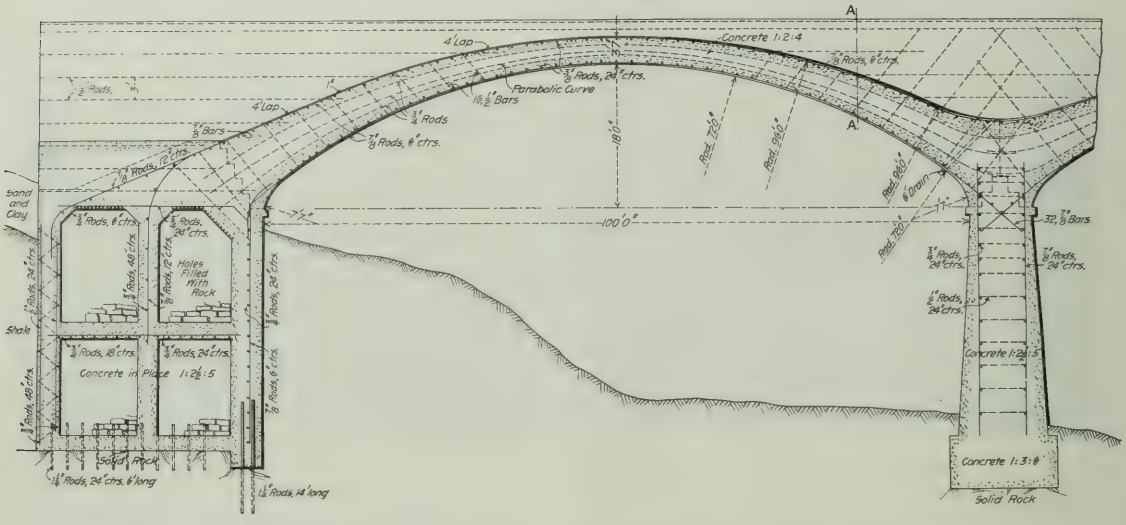
*Consulting Engineer, 528 Walnut street, Cincinnati, Ohio.



Reinforced Concrete Arch Bridge over the Big South Fork of the Cumberland River, Feb. 1, 1907.



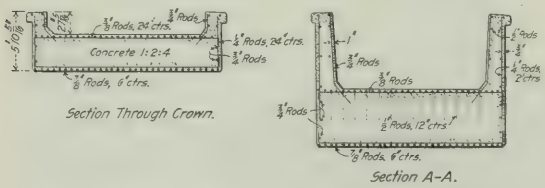
Plan and Elevation of Reinforced Concrete Arch Bridge Over the Cumberland River.



Longitudinal Section Through West Abutment and Arch Showing Reinforcement.

its weight would make it stable against the thrust of the arch, anchor were cemented into the rock foundation for a depth of 6 ft. along the front edge of the abutment. In building the west abutment it was found that the cost of the form work was greater than the saving in concrete and the contractor preferred to build the east abutment solid. This change in the plans was made and much of the steel reinforcement was omitted. The foundation of the east abutment is hard shale.

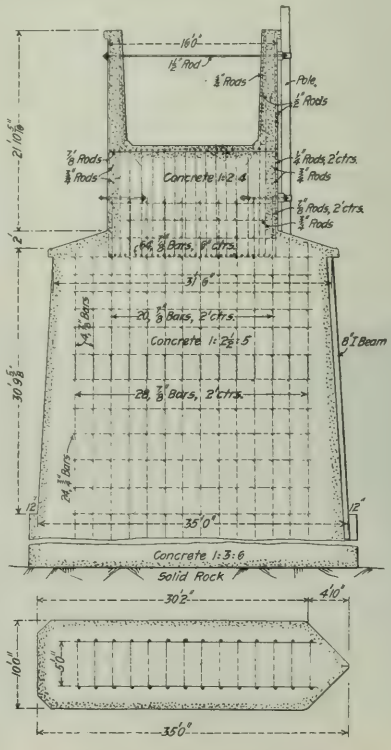
The piers contain some steel reinforcements and the nosings on the up-stream side are protected by steel I-beams set flush in the concrete. A 1:3:6 mixture of concrete was used in the footings and a 1:2½:5 mixture for the body. The foundations for the piers were sunk to bedrock inside of cofferdams made of a single timber box banked with earth on the outside. The site of the bridge is



Cross-Sections Through Arch; Cumberland River Bridge.

just above a riffle where the water has only a slight current at ordinary stages and no trouble was experienced with these cofferdams except in the case of the channel pier, where the water is about 14 ft. deep. The earth bank was washed away from this cofferdam a number of times during high water. The material for the piers and abutments was handled with skips running on a cableway and the material for the arches was handled by small dump cars run on a trestle supported by the arch centering. The entire structure contains 6,470 cu. yds. of concrete and 120 tons of steel reinforcement. Work was begun on the bridge in November, 1905, and the bridge was completed and opened for traffic in February, 1907.

The contractor for the bridge was the Collier Bridge Co., Indianapolis, Ind., but the contract was sublet to Samuel Dingle, who subsequently completed the work as the principal contractor. The



Details of Reinforcement in Piers.

general design was submitted by the Collier Bridge Co. with its proposal, but the details were developed in the writer's office by R. G. Walter.

Mr. Harriman on the Present Railroad Situation.

The following is an abstract of an interview with the President of the Union Pacific, published in the *New York Times*, in which Mr. Harriman discusses various features of the present railroad situation:

"There has got to be co-operation on the part of the railroads on the one hand and the public and the government on the other. We have tried the other methods. We have left it to our lawyers to take care of legislation by whatever means might be the most effective and to our subordinates to explain things to the general public. It won't do. We have produced a flood of legislation throughout the country, some of it of doubtful purpose and some the result of misdirected zeal inspired by the National administration, and if we are ever going to extricate the railroads we have got to come out in the open and tell the people the railroads' side of the matter.

"Take the situation when this Interstate Commerce Commission inquiry started. There were pending arrangements between several large corporations and foreign capitalists running into the tens of millions. These arrangements were on very favorable terms. As soon as the foreigners heard that the Interstate Commerce Commission was going after the Union Pacific they came to the conclusion that American corporations in general were in a pretty bad way, and negotiations were broken off. Now, if those arrangements had been completed it would have established a standard of credit for all good American enterprises that wanted to raise funds abroad. Moreover, the importation of the gold would have added four times its amount to the banking credits of the country. All that was stopped, for the time being, by the timidity of foreign capital, produced by the institution of the inquiry.

"Unquestionably the railroads are now facing a new era in their development, as distinct from that which has gone before as was the period of reorganization from that of rapid expansion which preceded it, or that of tremendous traffic development which has followed in the last seven or eight years. And that is the very reason why I believe it essential that the railroads and the public should reach a common understanding. If the railroads are unable to meet the further development of the country, they become fetters for the country's business interests. We can see the causes of this situation if we go back 15 or 20 years in railroad development.

"Back of 1893 for a decade there had been a period of rapid construction, the great period of railroad expansion as the country began to recover from the effects of the civil war. The railroads in that era unquestionably built beyond the ability of the country to support them. When a reversion of business came in the early nineties, as such things do come from time to time, here was all this railroad construction for which there was no corresponding demand. The receivership period was the logical result.

"Then we had the period of receiverships and reorganizations which was practically contemporaneous with the recovery of the country from the depression of 1893. But in that period practically nothing was done by the railroads to anticipate the future development of the country. They had all they could do holding their own and making ends meet after what had gone before. Now suddenly the country emerges from the years of business depression into six or eight years of the greatest development it has ever known. The railroads have been obliged to crowd into this period all the new work of providing new facilities that should have been distributed through as many years more preceding. And at the same time they have had to anticipate, so far as possible, future development of the country.

"They have been obliged to crowd into the last six or eight years a task of providing facilities that should have been spread over ten years preceding. The result is that they have fairly overlapped the facilities of the country to bring to them, with economy either to shipper or railroad, the goods which are to be carried. This is the all-important point for co-operation between the railroads and the public, for the failure to handle the business economically on the part of the shipper has generally been charged up against the railroads, while the railroads' inability to handle it economically has meant less effective service and a tendency to higher rates.

"Take an example: The other week I went up to Groton, Mass. I lived in my car while I was there, and I couldn't help noticing conditions in the station yard. There were three coal cars and one box car on a siding, and unloading the three coal cars were two single-horse carts. At one of the cars they were actually screening the coal as they unloaded it. Now, right on the other side of those cars there was a coal shed. If that coal had been unloaded into the shed instead of into the carts, the cars might have been moved out on the road again to carry somebody else's coal. But no, they had to unload it, a car at a time, and to tie up three cars for about three times as long as was necessary. On that basis the service of two cars was lost for the entire time that the three cars were allowed to remain at Groton.

"If you multiply that sort of thing by the number of sidings in all the towns and villages of the country you will see what I mean by saying that the facilities provided by the railroads have overlapped the facilities provided by the shippers. Yet it is put up to the railroads to increase their facilities so as to eliminate the congestion. That is what we are trying to do, but you will not get any correct conception of the magnitude of the task until you consider just for a little while the problem of terminal facilities. That is where we have got to have the co-operation of the public more than anywhere else, for we have reached the limit of providing terminal facilities as the present development goes.

"The ability of the railroads to render service is absolutely dependent upon the matter of terminal facilities. And those are conditioned, not upon the length of the yards, but the number of tracks and the capacity of the cars. For instance, if you have 100 cars on a limited number of tracks and you want to pick out any 20 cars to move out somewhere, it is necessary, in practice, to move virtually the entire 100. But if you have the total amount of freight distributed among fewer cars of larger capacity, or have the 100 cars distributed over a greater number of tracks, there is a proportionate reduction of the number of cars that will have to be moved in order to pick out the 20.

"You come now against the flat limitations in this matter of terminal facilities. There is only a given amount of space available on all the island of Manhattan that you can cover with tracks, and we have practically reached the limit of carloads on the existing gage. Right here the question of motive power comes in. The freight car is like a bridge. The trucks are the piers and the body is the roadway. Now, in measure as you lengthen the body to take on more load, you have got to increase the dead weight of the car to be able to carry it, and every such increase in dead weight means a decrease in earning capacity for the car or for the train, when a given motive power is applied to move it. It is a matter of practical experience that if we could go on increasing the width of the cars up to a standard that would be permissible on a 6-ft. gage, or even a 5-ft. gage, we would be able to get a great deal more car capacity for a given increase in dead weight. Furthermore, we would gain in loading and unloading. If, for instance, by increased car capacity, you put into 20 cars freight which had previously taken up 30 cars, you require less terminal trackage for the handling of the freight, you are able to get it on and off with greater speed, and you have the other 10 cars out on the line earning something in the meantime.

"But right here we come up against the matter of motive power, and in that we have reached the limit of development under steam, so long as the present gage is employed. You will see why this is when you remember that there are three ways in which an engine can grow to get more tractive power. It must either be lengthened, be broadened, or be made higher. And in all three directions we have made our engines grow as far as they can on the present standard gage of 4 ft. 8 in. Did you ever ride in the cab of one of the modern freight locomotives. Well, you probably noticed the swaying back and forth that accompanied the drive of the pistons. That meant that the center of gravity had crept up just about as high as it could go without having the engine topple over when it got into action. It told you that we had gone as far as we could in building engines up into the air. Now, if you will think a minute you will see that there is obviously a limit in length of firebox beyond which it is impossible to fire an engine. And we have reached that limit as well. So there you are. If we increase our car capacity, we increase the unproductive dead weight that is to be drawn disproportionately to the increase of the load, and in so doing we are making demands upon tractive power that has already reached the limit of its development under present conditions. The obvious relief then would be by widening the gage to 6 ft., and I am not sure that the railroads will not come to that in the end. If the country after the civil war had adopted the 6-ft. gage that some of the railroads in the South then employed, or even a 5-ft. gage, we would be in much better shape to-day, for we could increase the height and breadth of our locomotives to get greater tractive power per engine, and could increase the capacity of our cars without disproportionately increasing the dead weight that has to be drawn in moving a given trainload. But perhaps it is chimerical to think now of rebuilding the railroads of the entire country and of replacing the entire railroad equipment. If so, what is the next best thing?

"Obviously electricity. And I believe that the railroads will have to come to that, not only to get a larger unit of motive power and of distributing it over the trainload, but on account of fuel. That brings up another phase of the existing conditions. We have to use up fuel to carry our fuel, and there are certain limitations here just as much as there are in car capacity or motive power, particularly when you consider the distribution of the coal producing regions with respect to the major avenues of traffic. The great

saving resulting from the use of electricity is apparent, quite aside from the matter of increasing the tractive power and the trainload, but there is this additional consideration, that when you are operating by electricity you are not losing money when you stop your train. That must not be lost sight of. The train makes money when it is going somewhere, when it is carrying something that somebody wants. When it stops it ceases to make money and becomes a losing proposition because it goes right on burning up coal without doing any work. Your electric train when it stops isn't using up any power, and the only fuel waste is that incidental to the maintenance of the system.

"I have gone into these things in detail to show you, first that the railroads in handling the increased volume of traffic under present conditions, or anything approximating them, must do it at an ever increasing ratio of expense that will tend some day to become prohibitive if present rates are to be maintained or fair returns realized for their shareholders, and, second, that the only relief which can be obtained through economies of physical operation must come through the outlay of enormous amounts of money such as would be involved in a general electrification or a change in gage.

"The railroads are new developing their facilities just as fast as conditions allow. The necessity of double-tracking the transcontinental lines is recognized universally, and we are all lengthening our sidings and our spur tracks in anticipation of the day when we can joint up the sections and have two-track roads across the country. But, do the best they will, the railroads are face to face with physical conditions, such as I have described, which make it impossible to handle a larger traffic without a constantly increasing ratio of expense. It is up to them and to the people whom they serve to devise some means of more economical operation if returns are to be continued to their shareholders, or rates even maintained on their present basis.

"But before we go on to that, there is one other factor of increased cost that the railroads cannot escape, whatever their economies, and that is the cost of labor, not only directly employed by them, but entering into every item of their new construction, their equipment, or their improved terminal facilities. It is a common saying that a railroad tie costs nothing; it is only the labor that the tie represents that costs money. The same thing might be said for the steel rail without stretching the truth, and relatively it is true of every article that goes into railroad construction or equipment. These increases are continuing ones and enter even into the very undertakings by which the railroads seek to obtain greater economies of operation. They have to be considered in the financing of railroad extension as well as in daily operation, and our economies, whatever they are, have got to be sufficient to offset them before we can figure on any actual reduction in the cost of handling the traffic.

"It is proper to consider here the general question of distribution of traffic during the year. We have been going on the basis of moving the great crops of the country in three or four months out of the twelve, with the expectation that the railroads will have ample equipment available for handling the cotton and the corn and the wheat from October, say, until the middle of January, and then will be able to employ all this equipment during the other eight or nine months of the year, so as to make it continuously productive. I don't suppose that idea will ever get entirely out of people's minds, but it is at least one important thing upon which there should be co-operation between the railroads and the shippers, if the roads are going to render the best service possible at the lowest rates, and have any care as well for the interests of their stockholders. You can find example in the coal troubles out on our lines, which would have been almost entirely eliminated if the users of coal had only allowed us to carry it for them in the summer when we have an opportunity to handle it expeditiously. But no, although we make substantial inducements to them to move their coal in the summer, they don't want to move it then. They want to wait until the busy season comes, and then want their coal in a hurry. You see there are two sides to that question."

Asked what specific enactment by the National government would help the railroads, Mr. Harriman's answer came quickly:

"Recognize by Federal statute the making of enforceable agreements between railroads for a distribution of traffic, and have such agreements binding for a given period of years."

"Would you have the enactment go far enough to permit pooling under proper supervision?" he was asked.

"No," he replied. "I don't believe in pooling. The railroads never accomplished anything by it when it was legal. If you will go back over the history of all the railroad pools that were ever attempted, you will find that there was always somebody who broke the agreement and made things worse than they were before, or else that when the railroads had arranged to pool the business at a certain point some outsider came along with a proposition to build a line in there, and wanted either a part of the business or a quid pro quo.

"The agreements that I have in mind would apply to the distribution of traffic so that it could be handled economically. As I have said in the last few days, the President started the movement for it on the part of the Government in his message last December, when he declared that railroads should be allowed to make agreements under certain conditions. I believe that he realizes the necessity for something of this kind, if the railroads are going to practice anything like the economies that the present situation demands, and it is right here that the railroads need the co-operation of the Government.

"Suppose we had such a law in operation and could arrange for the distribution of the transcontinental traffic between the various lines according to the possibilities of each, then the road with a low grade and small curvature could relieve the high-grade winding road of the excess of traffic that it could not carry profitably. Similarly, a distribution of classes of freight could be accomplished—which is absolutely impossible under present operating conditions—with resultant economies that are apparent when you consider what I have said.

"You can't make competition by law. The conditions which make certain points competitive or non-competitive are not to be fixed by statute. The thing that both the railroad and the shipper are anxious to get is the best possible service on the most economical basis, and it frequently happens that the very competition existing between various railroads in a given territory is wasteful and expensive. Take, for instance, the situation we had in Northern California, where both the Atchison and the Union Pacific were planning to build an important feeder line. By combining we are able to work harmoniously to develop that territory, whereas, if both lines had been built, each would have wasted facilities that might have been offered elsewhere to advantage."

The question was raised as to the effect of such agreements on the transcontinental traffic which is competitive, and the construction of the Western Pacific was mentioned as an example.

"If we had been allowed to make agreements with the Denver & Rio Grande and the Missouri Pacific," said Mr. Harriman, "the occasion for the construction of the Western Pacific wouldn't have arisen, and the traffic would have been better handled. We could have distributed it so that the Missouri Pacific and its allied lines would have got all they could handle profitably, and the remainder would have gone where it could be best taken care of.

"One thing that I think ought to be done is to allow the railroads to vary their freight schedules, so that the man who wants extra quick service, which can only be rendered at an increased operating cost, could be allowed to pay for it and get it, just as a man who wants to go to Chicago in 18 hours is allowed to pay for the extra service he receives, and does not have to take a 24-hour train just because there is only one rate.

"Of course, in all this there must be supervision by the Government. The railroads must recognize the necessity for that if they are going to get from the Government the relief they need."

The effect of agreements for distribution of traffic on railroad consolidations was the next question put to Mr. Harriman.

"It would stop them right away," he replied quickly. "I don't mind saying that if we could have made an advantageous agreement with the Central Pacific in 1901, whereby we could have developed that property and at the same time could have obtained the outlet that it afforded to the coast, the Union Pacific would never have acquired the Southern Pacific. It would never have been acquired if we could have made a permanent agreement, or one for a long term of years, whereby we could have developed the property and used it for an outlet.

"The same may be said of the Northern Pacific acquisition. We went into that because it appeared that the Burlington acquisition in the interest of the Northern Pacific and Great Northern was going to shut us out of important territory where we needed to be. We thought we had worked out a solution to the situation in the Northern Securities Co. whereby the rights of all parties would be conserved, but that couldn't be. Then came the redistribution of the stocks, which left the Union Pacific with a lot of Northern Pacific stock which the Supreme Court had said it couldn't keep. It was necessary for the Union Pacific to divest itself of this stock, and in the reinvestment of the proceeds of its Northern Pacific and Great Northern it looked to two things, first to secure a greater income return, and, second, to acquire holdings that would be beneficial to the road. So it turned to connecting lines and lines where its influence would operate to bring it business. I mention this because it shows the way in which the Union Pacific's position has developed by virtue, primarily, of the fact that it was unable in 1901 to make such agreements with other railroads as would have enabled it and them to reap a mutual advantage by an economical division of traffic."

Pacific Locomotive for National of Mexico.

In the description of the details of the Pacific locomotive for the National Railroad of Mexico published on March 1, it was stated that the connecting rod was a steel casting. This was an error, as the rods are made of forged steel of 80,000 lbs. tensile strength.



Colonel W. C. Gorgas.



John F. Stevens.



Lieutenant Colonel G. W. Goethals.

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Major D. DuB. Gaillard.

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Four Members of the Isthmian Canal Commission.

Comparative Effects of Steam and Electric Locomotives on a 3-deg. Curve.

The following calculations of the stresses developed in curved track by steam and electric locomotives were made by the engineers of the New York Central following the derailment of an electric train on a 3 deg. 5 min. curve near Woodlawn on the Harlem Division on February 16, 1907. The track at this point has a superelevation of 4½ in. and a gage of 4 ft. 8¾ in. The wheel spacing and loads of the two types of locomotives considered are shown on the accompanying diagrams.

There are three fundamentals of "mechanics of curve resistance":

(1) Component of slipping in the direction of the radius, due to curvature.

(2) Component of slipping in the direction of the tangent of track, due to unequal rail lengths inside and outside.

(3) Net effect of centrifugal force (superelevation of outer rail considered).

The locomotive in rounding a curve must be revolved against these forces, Nos. 1 and 2, and such a pressure applied as will cause the locomotive to follow the curve. The point about which the locomotive revolves may be determined mathematically and the stresses resulting from these two effects can be determined by calculation. Due consideration should be given to the action of the rigid wheel base on the curve in question, taking into account the clearance in the gage and the clearance between the main drivers and the rigid frame.

The radial slip on the front outside driver when rounding the curve is self-contained and of itself does not tend to displace the rail; the radial slip on the inside front driver does tend to displace the outer rail acting through the front axle to the outer front driver.

If the clearance between the driving wheel hubs and the locomotive frame is more than the departure of the curve at the second axle, the second axle will run to the outer rail until the flange of the outer second driver bears against the rail and thus the frame of the locomotive does not have to carry the stresses necessary to produce radial slippage of the second set of wheels.

The centrifugal effect and superelevation of the outer rail are readily calculated and need no explanation.

Considering first, the condition where the second driving axle bears against the locomotive frame and so transmits the radial thrust of the second axle to the outer front driver, a comparison of the New York Central electric locomotive with the Atlantic type steam locomotive on a three-degree curve with a 4½-in. superelevation shows that the pressure of the steam locomotive driver against the rail is greater at all corresponding speeds. The resultant shear on the spikes, however, allowing for the friction of the rail on the tie plate, is less with the steam locomotive than with the electric locomotive up to about 60 miles an hour.

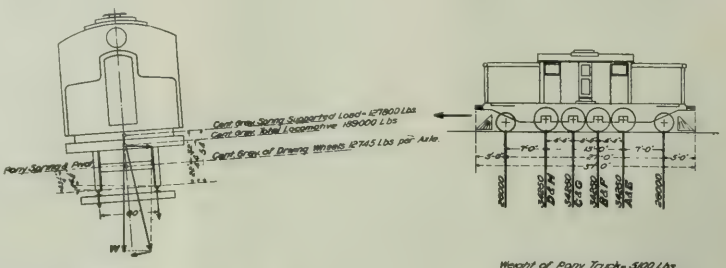
The difference between the pressure against the rail and the shear on the spikes is affected, so far as the drivers are concerned, by the height of the center of gravity under the influence of centrifugal force increasing the vertical pressure on the outer rail. The greater effect for the higher center of gravity of the steam locomotive disappears, however, at the higher speeds by reason of the increasing preponderance of the horizontal force due to centrifugal action.

At about 90 miles an hour the shear on the spikes for the steam locomotive would be approximately the same as that of the electric locomotive, but at this speed the steam locomotive would be in danger of overturning.

The maximum shear on the spikes is not necessarily caused, however, by the driving wheels of the locomotives, but at certain speeds may exist at the leading wheel of the guiding truck. Although the pressure of the guiding truck wheel against the rail may be actually less than that of the driver, the weight upon the rail of the guiding wheel is so much less that the resultant shear on the spikes is consequently greater. On the electric locomotive the shear on the spikes, due to the guiding truck, is in excess of that due to the drivers up to about 40 miles an hour. On the steam locomotive the shear on the spikes due to the guiding truck is in excess of that due to the drivers up to about 65 miles an hour, and this shear exceeds that of either the driving or truck wheel of the electric locomotive up to about 57 miles per hour.

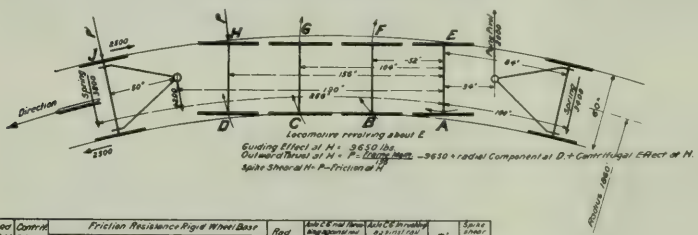
Considering second the condition where the second driving axle clears the locomotive frame by reason of the end play and so bears directly against the outer rail without transmitting to the leading driver the thrust due to its radial slip.

The pressure against the rail of the leading steam locomotive driver as before is greater at all corresponding speeds. The resultant shear on the spikes is less, however, with the steam locomo-



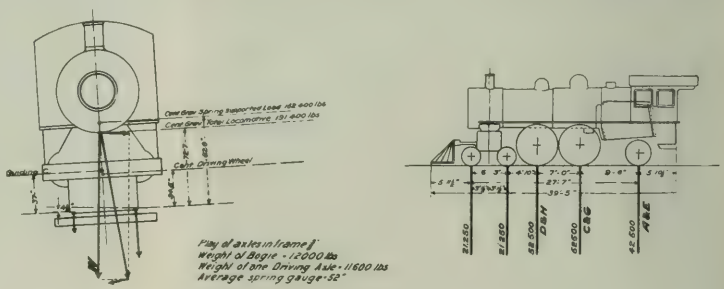
Speed M.P.H.	Weights on Rigid Wheel Base.						
	A	B	C	D	F	G	H
40	14325	20570	18500	12300	13125	15795	15750
50	13775	19875	17100	10600	14275	17140	17450
60	13125	19300	15945	15645	14945	18300	18603
70	12485	18500	14900	14300	15745	19355	19950
80	11425	17800	13770	12770	16630	20470	21480

Fig. 1—Wheel Loads Under Electric Locomotives.



Speed M.P.H.	Centrif. effect at M	Friction Resistance Rigid Wheel Base							Rad. Component at D	Axle C.G. Inside of Rail		Axle C.G. Outside of Rail		P'	Spike Shear at M
	P	A	B	C	D	F	G	H		P	Position at M	P	Position at M		
40	1590	3600	5150	4620	4380	3940	3920	4180	4080	4740	560	3860	—	6410	2410
50	1920	3430	4980	4300	4200	3560	4280	4320	3930	7400	3040	4120	—	6600	2570
60	4080	3300	4900	3980	3900	3740	4560	4650	3640	10470	5820	4480	—	6830	2780
70	9050	3130	4620	3720	3580	3940	4830	5000	3350	14130	9130	7960	2480	7100	3020
80	13790	2900	4400	3430	3200	4150	5100	5360	2970	18360	13000	11000	5640	7400	3300

Fig. 2—Diagram of Track Stresses Under Electric Locomotive.



Speed in M.P.H.	Weights on Rigid Wheel Base.				
	A	C	D	G	H
40	22180	27085	27085	25165	25465
50	20640	25365	25365	24085	24685
60	18590	23245	19545	23006	32705
70	16590	21055	16535	31195	37695
80	13640	17945	7245	34305	45005

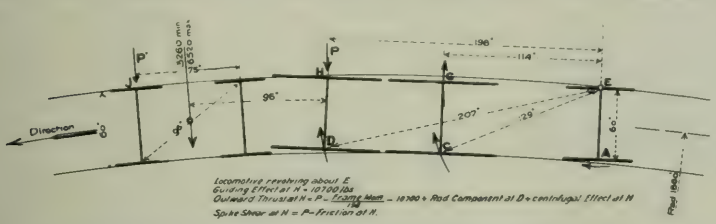
Fig. 3—Wheel Loads Under Atlantic Type Steam Locomotives.

tive due to the effect of its higher center of gravity. Under this second condition with the electric locomotive the shear on the spikes due to the guiding truck is in excess of that due to the drivers up to about 75 miles an hour. On the steam locomotive the shear on the spikes due to the guiding truck is in excess of that due to the drivers at all speeds and this shear exceeds that of either the driving or truck wheels of the electric locomotive up to 75 miles an hour.

Regarding the stress on the outer spikes of the outside rail, it will be seen from the tables accompanying the diagrams that for a speed of, say 60 miles an hour, on a 3-deg. curve with a superelevation of 4½ in., the maximum shear on the spikes with the forward driver only bearing against the outer rail, is 5,820 lbs. as compared with 4,830 lbs. for the steam locomotive, or a difference of about 19 per cent.; but on the other hand, if the comparison is made on the basis of the two forward drivers bearing against the outer rail of the electric locomotive, the unbalanced pressure is 2,780 lbs., as compared with 4,890 lbs. on the steam locomotive, a difference in favor of the electric locomotive of 43 per cent.

The ultimate shearing resistance of the standard spikes used on the curve in question ranges from 14,440 pounds to 17,060 pounds. Assuming a factor of safety of 4, the permissible shear per spike is 3,810 pounds to 4,265 pounds.

The 100-pound rail in use on the curve acts as a continuous girder distributing the stresses over several spikes, but to be conservative, two spikes may be taken as resisting the unbalanced outward thrust. Consequently at 60 miles per hour we have actual



Speed M P H	Centrifugal at H	Friction Resistance Rigid Wheel Base A	C	D	G	H	Rail Creep at D	Rail Shear Resistance at D P	Rail Shear Resistance at D Bending	Rail Shear Resistance at H P	Rail Shear Resistance at H Bending	P'	Resistance at J
40	-380	5530	6770	6770	6280	6280	6280	6120	——	6260	——	7830	6630
50	1970	5130	6340	6340	6720	6720	8080	7450	730	6220	——	7950	6740
60	7450	4680	5810	4690	7250	8170	4680	11230	3060	5460	——	8130	6890
70	13090	4150	5260	3640	7900	9420	3500	15390	5970	7570	——	8170	6840
80	21050	3410	4480	1810	8580	11250	1730	21160	9910	13020	1820	8200	6770

Fig. 4—Diagram of Track Stresses Under Atlantic Type Steam Locomotives.

maximum shears with either steam or electric locomotives ranging from 2,780 pounds to 5,820 pounds borne by two spikes, which with a factor of safety of 4, are proper for shears of 7,620 pounds to 8,530 pounds. In other words, the actual factor of safety is approximately 6.

In conclusion, it appears that on the basis of the forward driver only bearing against the outer rail, the electric locomotive imposes slightly greater unbalanced stresses than the steam locomotive, whereas, on the basis of the two forward drivers bearing against the outer rail, the steam locomotive imposes considerably greater unbalanced stresses. Therefore the shearing force on spikes, one on the outside of the outer rail in each tie, with tie plates, is far within the limits of safety for speeds in excess of the so-called "equilibrium speed" of 46½ miles per hour to which the superelevation of 4½ in. corresponds.

As proof of this contention the results of many experimental runs made on the six mile test track west of Schenectady can be cited.

The electric locomotive was purposely driven at speeds of 75 miles an hour around a curve that was elevated for but 60 miles an hour, so as to bring out any tendency that might exist with the locomotive to spread the gage. This high speed developed a centrifugal force sufficient to move the ties in the gravel ballast, but there was no widening of the gage under such extreme conditions, thus demonstrating that even such excessive speeds around insufficiently elevated curves, producing a centrifugal force sufficiently great to shift the track in the ballast and distort the curvature, would still not cause a widening of the gage on this inferior track. In other words, it was demonstrated that the method of spiking curves in ordinary practice was sufficient to meet even abnormal conditions.

Electric Night at the New York Railroad Club.

The meeting of the New York Railroad Club on March 15 was held in its new quarters at the Engineering Society's building. A general discussion of heavy electric traction which resolved itself in the beginning into a defense of the New York Central's electric locomotives was participated in by a number of prominent engineers and railroad officers.

Mr. W. J. Wilgus, Vice-President of the New York Central, undertook to defend the electric commission, of which he was the chairman, against the attacks which had been made from various sources on the safety of the electric locomotives and other features of the New York Central electrification scheme. He briefly reviewed the exhaustive tests which were made on the experimental tracks west of Schenectady in the precautions taken in instructing engine-men and thoroughly trying out the new locomotives and motor cars for a number of months between High Bridge and King's Bridge before they were put into actual service. He pointed out that during the searching investigations by the railroad company and by the coroner's jury nothing had developed which showed that the electric installation was in any way responsible for the derailment at Williamsbridge. The current in the third rail was automatically cut off almost instantly after the accident happened, and none of the passengers, or those who came to their relief, were injured by coming in contact with it.

Mr. Frank J. Sprague reviewed the preliminary work of the electrical commission of which he was a member and read a somewhat lengthy comparative description of the electrical locomotives as finally approved and built and other designs of locomotives submitted at the time bids were asked for. The type finally adopted was unanimously considered the most suitable for the work to be done. He reviewed the circumstances leading up to the wreck and the conditions obtaining at the time so far as they have been definitely brought out in the inquiries made by the State Railroad Commission and the coroner's jury. The testimony brought out no single fact which would lead to a definite conclusion that the electric locomotives were themselves responsible for the derailment or that the casualties resulting therefrom were greater than if a similar accident had occurred where electricity was not in use. He read a list of 12 derailments due to broken rails or other causes which had occurred within a period of approximately two weeks, and pointed out the injustice of coupling the wreck on the New York Central with the electric system as a cause.

Mr. George Gibbs, Chief Engineer of Electric Traction on the Pennsylvania, New York & Long Island, discussed the problem of heavy electric traction in a general way. He uttered a word of caution regarding many of the published estimates of the cost of installing electric traction on a steam railroad. His experience led him to believe that under average conditions the cost of electric

Table of Comparative Shear on Spikes at Leading Truck Wheel and at Driver Wheels for Electric Locomotives and Central-Atlantic Type Steam Locomotives, on Three-Degree Curve, Super-Elevation, 4½ Ins.

	Rail thrust leading truck wheel.	Friction bet. rail and tie plate leading truck wheel.	Shear on spikes by leading truck wheel.	Rail thrust leading driver		Friction bet. rail and tie plate leading driver.	Shear on spikes by leading driver	
				2d driver not against rail.	2d driver against rail.		2d driver not against rail.	2d driver against rail.
				Electric locomotive.				
40 miles per hour.....	6,410	4,000	2,410	4,740	3,860	4,180	560	.....
50 " " "	6,600	4,030	2,570	7,400	4,120	4,360	3,040	.....
60 " " "	6,830	4,050	2,780	10,470	4,480	4,650	5,820	.....
70 " " "	7,100	4,080	3,020	14,130	7,460	5,000	9,130	2,460
80 " " "	7,400	4,100	3,300	18,360	11,000	5,360	13,000	5,640
				Steam locomotive (Atlantic).				
40 miles per hour.....	7,830	3,200	4,630	6,120	6,260	6,280	.....	.....
50 " " "	7,950	3,210	4,740	7,450	6,220	6,720	730	.....
60 " " "	8,130	3,240	4,890	11,230	5,460	8,170	3,060	.....
70 " " "	8,170	3,330	4,840	15,390	7,570	9,420	5,970	.....
80 " " "	8,200	3,430	4,770	21,160	13,020	11,250	9,910	1,820

Note.—Figures underlined represent maximum shear by either leading truck wheel or driving wheel under worst possible conditions.

equipment was only about one-half of the total cost involved. For average trunk line work he did not believe that electric operation, in the present state of the art, could be made to effect enough saving in operating expenses to offset the additional capital charges. In large terminals where reduction of switching will increase capacity, where safety and cleanliness in tunnels and cities are controlling features and for heavy mountain grade operation, where cheap fuel or water power can be utilized, he thought electrification might well be introduced, not to save money but to make money. He did not believe that the steam locomotive was doomed for many years to come. He also had a word of warning regarding excessive speeds which are the aim of promoters of every electric road. The high average speed of electric traction is made possible by equipping each car with motors or by putting an excess of power at the head of the train. This excess of power enables rapid acceleration, and where numerous stops are made, an appreciable shortening of the running time can be secured. It is possible, however, to carry the matter of high speed too far, that is, to a point where unless safety is sacrificed the trains are required to be kept such great distances apart that the capacity of the line is greatly reduced.

Mr. W. B. Potter, Chief Engineer of the Railway Department of the General Electric Company, reiterated the statements of Mr. Wilgus and Mr. Sprague regarding the thoroughness of the tests made on the New York Central locomotives before they were put in operation. Referring to the question of high speed on electric roads he said that he had been interested in investigating a proposition to operate an electric road at schedule speeds of 200 miles an hour. He had made some comparisons regarding the number of passengers that could be carried between two points at that rate of speed and he came to the conclusion that the greatest number of passengers that could be carried between two points could be handled better on a moving sidewalk. With such enormously high speeds the headway between trains, necessary for safety, becomes so great that there is no gain in carrying capacity but rather a loss. He felt, however, that speeds of up to 100 miles an hour were quite possible in the future.

Mr. S. M. Vauclain, of the Baldwin Locomotive Works, was the next speaker. He referred to his long experience in building steam locomotives, and said that he thought we were going ahead a little faster than we ought to in building electric locomotives. Steam locomotive designers have learned along what lines to build the running gear for maximum safety and efficiency. He felt that if the designers of electric locomotives would follow the fundamental principles that underlie the construction of high speed steam locomotives there would be no difficulty in operating electric locomotives at speeds up to 100 miles an hour. But electric motors have not yet been built which have enough power to maintain that speed. High speed steam locomotives have the driving wheels proportioned to the speed desired, roughly 1 in. diameter for each mile per hour speed. This does away with high rotating speeds and increases the height of the center of gravity. Increasing the height of the center of gravity greatly decreases the destructive effect of a locomotive by nosing when running at high speed. Another feature which assists in relieving the track of severe stresses is the fact that by far the greater part of the weight of a steam locomotive is supported on springs and is free to roll independently of the driving wheels. In the present designs of electric locomotives the axles of the driving wheels carry a large dead load without the interposition of springs. His experience led him to believe that the successful electric locomotive of the future would be built with the motors set on the frames and connected with the driving wheels by a system of driving rods substantially the same as are now used on steam locomotives. The reason this has not been done is because the manufacturers of the electric apparatus have so far been unable to produce motors sufficiently powerful and compact to mount on the frames, but instead have followed the early practice in street car work and have confined themselves to efforts in the direction of building motors directly geared or mounted on the driving axles.

Foreign Railroad Notes.

According to consular reports, there were in Brazil on January 1, 1906, 10,427 miles of railroad, an average of one mile of railroad for each 313 square miles of country.

On the Victorian Railroads foot warmers have been provided for the cars in use on many of the country trains, thus adding to the comfort of passengers, especially those traveling during the winter on trains starting in the early morning.

Through mail service, but for letters and postal cards only, from Western Europe to Eastern Asia (by way of Vladivostok), which was suspended by the Japanese war, was resumed only last February. The time from Moscow to Vladivostok is 12 days and 7 hours; from Berlin to Vladivostok, 14 days.

Track Deformations and Their Prevention.*†

II.

BY G. CUENOT,
Chief Engineer of Bridges and Ways for the Board of Control of the Paris, Lyons & Mediterranean Railway.

PRINCIPAL MOVEMENTS TO WHICH THE TRACK IS SUBJECTED.

The tracks, made as has been explained, have permitted the study of the principal movements to which they are subjected, and which cause their deformations; they are produced in a longitudinal direction, in the direction of the travel of the trains, and in the transverse direction.

It is important to analyze them with care, in order to seek the means for remedying them.

LONGITUDINAL MOVEMENT.

The weight on the wheel is distributed over a certain number of cross ties, and imposes on them a vertical movement, directed at first from low to high, then from high to low, when the load is brought near.

Mr. Coüard has recorded these facts by means of the apparatus of Marey, and has derived from the experiments which he performed in June, 1903, between Melun and Bois-le-Roi, the following conclusions:

When the first wheel of the engine is at 6 meters (19.68 ft.), the movement of the cross tie, from low to high, begins.

When the first wheel of the engine is at 3 meters (9.84 ft.), the displacement is maximum.

When the first wheel of the engine is at 2 meters (6.56 ft.), the movement from high to low below the initial position begins.

When the wheel is on the cross tie the depression of the tie reaches its maximum.

But these figures are only averages, and the mean distance of 2 meters (6.56 ft.), from which place the depression of the cross tie in the ballast commences, goes on increasing from the advance to the following end. It follows that the bending rail in its first half, over shorter length, ought to curve more in that part.

Mr. Ast, Director of Ways and Cross Ties (Austria-Hungary), by the use of instantaneous photography has confirmed the results and shown, afterwards, that the ballast was compressible and underwent movements analogous to those of the cross tie, although less.

It was our desire to verify the results given by those engineers,

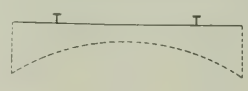


Fig. 1.

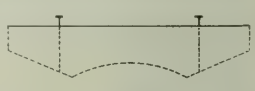


Fig. 2.

and to observe the influence of more rigid cross ties on the vertical movement. We had at our disposal, aside from the wood cross ties in use on the Paris, Lyons & Mediterranean System, the composite cross ties laid as described in one of the main tracks of the line from Mouchard to Bourg. The experiment was made by an engine with three axles coupled weighing 32 tonnes (35.27 net tons) in working order, a tender of 24 tonnes (26.46 net tons), and a car.

This train was moved on a bay provided with ordinary wood cross ties, then on another bay with composite cross ties, each of these bays being comprised between two successive joints. The wood cross ties supported P. L. M.-A. rails, the composite cross ties P. M. rails, having a greater weight and rigidity.

The first axle of the engine was brought as near as possible to the cross tie to be tested. There were marked off, by a special rule and a gage, of which a description will be given further along, when we study the flexure, points on the rail at each cross tie; these same points were retaken at each stoppage of the train, that is to say, each time it advanced a length corresponding to the spacing of the cross ties. The points thus marked off on each rail were joined, for each position of the train, by a full line where it refers to the movement on the track composed of ordinary cross ties, and by a dotted line where it refers to the track with composite cross ties. Each of these lines, represented on Plates 4 and 5, give the undulatory movement of the track in each of the positions of the train, when the latter is stopped successively right at each of the cross ties. This movement is quite like that which has been described by Mr. Coüard; when the first wheel of the engine is found at a certain distance (about 6 m.) (19.68 ft.) from a cross tie, the movement from low to high commences; the latter is maximum at 3 meters (9.84 ft.), then it reverses and the cross tie sinks, the maximum corresponding with the passage of the first axle.

The part of the track, in which the composite cross ties were placed, was much worse, as has been explained above, than that where the ordinary cross ties were located. The roadbed was less hard and above all the ballast was more moist, more muddy; the consequence of this was that the composite cross ties were not

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†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines, Southwest System.

perhaps buried more at certain points than the wood cross ties placed under more favorable conditions; but, as a whole, the profile with composite cross ties is much less accentuated than that with wood cross ties. The rise is much less marked, that is to say, the track as a whole being more rigid, the oscillatory movement is diminished. The ramps, which the train has to surmount, are less, that is to say, the traction is better and exerts a smaller effort. The joint which is induced from low to high, by the oscillatory movement of the track, and which by this fact is disorganized, as will be seen further along, is not so to speak more affected, when the track is provided with composite cross ties.

The table herewith exhibits the results:

Designation of position first axle of engine.	Ascents to overcome — Ordinary cross ties — 100ths of millim.	100ths of an inch.	Composite cross ties — 100ths of millim.	100ths of an inch.	Movement of the joint. — Ordinary cross ties.	Composite cross ties.
1	16	6	17	7	1	0
2	18	7	17	7	0	4
3	26	10	20	8	2	4
4	33	13	25	10	1	2
5	43	17	17	7	3	1
6	34	14	14	5	2	0
7	23	9	11	4	2	0
8	17	7	10	4	4	1
9	14	5	17	7	2	3
10	11	4	16	6	0	4
11	6	2	14	5	16	9
12	8	3	6	2	11	11
13	15	6	20	8	0	1
14	16	6	20	8	2	3
15	18	7	19	8	2	2
16	23	9	14	5	3	0
17	23	9	11	4	6	0
18	27	11	8	3	5	0
19	24	10	14	5	6	0
20	14	5	11	4	6	1
21	13	5	7	3	5	3
22	14	5	14	5	6	3
23	1	..	15	6	8	3
24	8	3	7	3	18	13
Total.....	445	..	324	..	106	65
Mean.....	445/24 = 18	7	324/24 = 13	5	106/24 = 4.4	65/24 = 2.7

Note.—The positions from 1 to 12 correspond to the track on the long radius; those from 13 to 24 to the track on the short radius.

In recapitulation, the use of rigid cross ties has diminished the effort of traction in the proportion 13 to 18, that is to say, that the tractive effort on rigid ties is about 30 per cent. less than on the ordinary cross ties. The movement of the joint is reduced by about one-half. The result was indeed what one could expect. It demonstrates the importance of the longitudinal movement, and the advantage of diminishing it by using rigid tracks.

It can be objected that the comparison made is not perhaps entirely exact, since the P. L. M.-A. track, laid with ordinary cross ties, is less rigid than the P. M. track with composite cross ties, and that everything in the case in hand was combined to obtain a more favorable result. That objection ought to be dismissed, for the influence of the subsoil and of the ballast counterbalanced, and more, the rigidity of the rail.

TRANSVERSE MOVEMENT.

The transverse movement of the track is of still greater importance than the longitudinal movement, and produces more important effects. It arises from this that the cross tie is not only buried in the ballast, but it bends; each of its points seems then to be buried in the ballast by unequal quantities, and this unequal sinking results in the greatest deformations of the track.

Mr. Coüard has studied the question with all desirable care, but his measuring instruments, doubtless imperfect, have not permitted him to draw from his study all the conclusions which should have been derived. The form of the curve of deformation which he has found (*Revue des Chemins de Fer*, July, 1897,) is such that it does not permit the deduction of a general law from the phenomena observed. However, that engineer has found that the vertical displacements of cross ties hardly reach 3 millimeters (⅛ in.), and that they are not proportional to the weights supported. He has concluded from it "that the cross ties fixed to the rail remain, at certain points, suspended above the ballast, and that right at the rail there is formed, under even the best tamped cross ties, some depressions of ballast on the edges of which the cross tie is supported; that under the passage of a wheel even lightly loaded, the cross ties come in contact with the ballast and deflect to the depth of the depressions; that from this moment only the importance of the bending is proportional to the load." Basing their study on the theoretical researches of Winckler, some notable engineers, Shwedler, Hoffmann, Lehwald, Riese and Zimmermann, have studied the manner in which cross ties behave when resting on an elastic foundation. They have determined the deformations which they experienced under the effect of a load in repose, and estimated the magnitude of the tensions of flexure which result from it.

If the cross ties were completely rigid there would result a uniform distribution of the pressure on the ballast. But it is not so; the cross tie is unequally buried in the ballast, in such a way that the pressure is no longer uniform, but is greater right at the rails.

The cross tie should, then, be considered as a continuous beam resting on an elastic base unsolved for continuity, and supporting a vertical load at two points. The German engineers designate by *load on rail* the pressure which the rail exercises on the cross tie, and that pressure depends as much on the transverse section of the rail as on that of the cross ties, as well as on their spacing and on their bedding. They admit, also, that the deformations and the strains experienced by the cross tie vary with the length and nature of the tamped bed.

Starting from these premises, they have found that the elastic curve of a cross tie was represented by Figure 1 or by Figure 2,

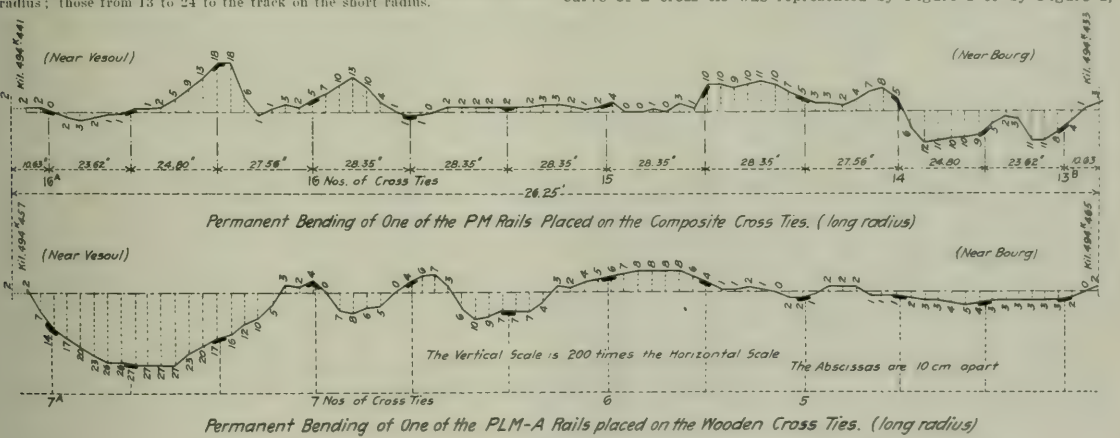


Fig. 3—Permanent Bending of the Two Types of Rails on Long Radius Ties.

according as the cross tie was 2 m 40 (7 ft. 10.4 in.) or 2 m 70 (8 ft. 10.3 in.) long.

The cross tie of 2 m 40 (7 ft. 10.4 in.) would be deformed then according to a convex curve; the maximum of the sinking would be produced at the extremities and would continue diminishing toward the middle. But, with a cross tie 2 m 70 (8 ft. 10.3 in.) long, the maximum sinking would be produced nearly under the rail, and the permanent compression of the ballast would be diminished from this point nearly uniformly on both sides, in such a way that even a deeper sinking would not have as a consequence a change in the inclination of the rails, nor in the spreading of the track.

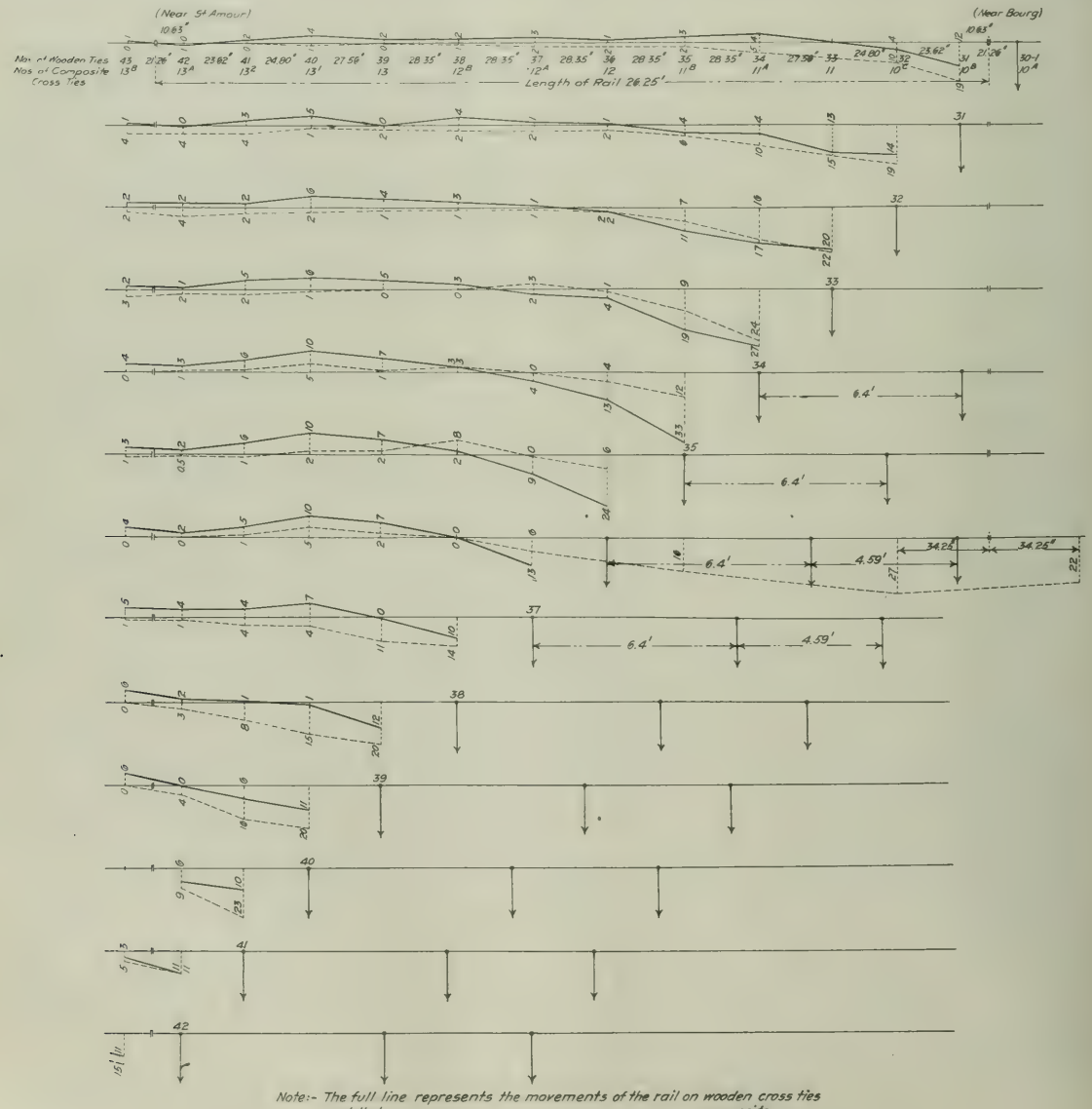
The theory assumes an absolutely homogeneous cross tie with a tamped bed continuous and uniform over its entire length. The German engineers think indeed that this hypothesis is not realized in practice; they recognize also that short cross ties present in reality a curve of deformation similar to that of long cross ties; but they explain this difference between theory and practice by the stronger tamping of the heads of the cross ties.

The incomplete results given by Mr. Coüard, the very ingenious theory of the German engineers, rendered necessary the study of the deformation of a cross tie under a load, of the manner in which the ballast behaves under the cross tie, of its more or less

extent of compressibility, of its more or less extent of elasticity. The experiments which have been carried on during nearly two years have had this object as their principal end.

CURVES OF DEFORMATION OF CROSS TIES.

They have taken place under the most different conditions of temperature and humidity, in such a way as to have the terms of comparison numerous, to be able to compare them and to determine an aggregation of facts which may not be controvertible. They have been carried on at three different periods; from the 4th to the 15th of May, during a rainy period, after a prolonged season of rain; from the 19th to the 30th of June, after a drier season, and finally at the end of the month of July, 1903, at a time when the rains had just returned. (I do not give an account of the last experiments, which only confirm the results of those which are given.) In all the tests the ballast, composed as has been pointed out above of rough gravel agglomerated with argillaceous sand, was particularly moist, and consequently muddy. This state of moisture was so great that it was maintained even in the period of heat in the months of June and July. The drying of the ballast was not completed, by reason of the position on a curve, and of the inclination toward the interior of the track, which is the consequence of it (0 m 083) (3"/32 in.), the loads were carried on the rail on the side of the short radius. The ballast was therefore more compressed on that side than on the other; its permanent sinking was consequently more pronounced, and it preserved, after the passage of vehicles, the form of a plane slightly inclined toward the center of the curve. The cross tie rested thus toward the extremity of the inclined plane on the side of the long radius; the water accumulated in the lowest part of this inclined plane, that is to say on the side of the short radius. The ballast was therefore particularly wet on that side; it was possible, by making a trench right at the cross ties, to let the water flow off, which rendered the support very elastic. The drop of the vehicles from the advance-rail to the following-rail rendered this effect still more sensible right at the cross ties of the following end of the even-joint; the hammering of the ballast by the shocks of the wheels augmented the depression between the bottom of the cross tie and the upper part of the support, a depression in which the water accumulated. Also, at the passage of vehicles, the water was projected vertically; the cross tie and the rail bore traces of these ejections. This fact was not isolated and peculiar to the part of the track which we studied. Wherever the ballast is but little permeable, and can form a cake more or less firm, the same phenomenon is observed, which shows above all right at the cross ties of the even-



Note:- The full line represents the movements of the rail on wooden cross ties
dotted " " " " " " composite "

Fig. 4—Rail Deformation Under the Action of a Static Load (Long Radius).

joint (of whatever nature they may be) by the projection of mud on the rail. The hammering of the ballast produces a void under the point of application of the load; this void is filled little by little with the materials of the roadway, which are slowly displaced, falling into the inter-track space or on the outside space, and flowing between the two rails. The ballast is as though screened by the vibration of the cross tie of the following end of the even-joint; the finest materials pass under the rail and cause the coarser materials to ascend in the inter-rail space. In this part of the track it is also remarked that the screw spikes of the cross tie of the following end of the even-joint are subjected to a wrenching, because they support at their lower extremity a hydraulic pressure which expels them from their holes, and that the more rapidly as the insufficiently creosoted wood is submitted to the alternations of dryness and wetness and deteriorates in consequence of the oxidation of the screw spike. In order to have a good track it is very important to select a gravelly ballast purged from earth and above all from clay.

The experiments thus executed in a mediocre ballast, resting on a compressible bed, have then taken place under unfavorable conditions, the results obtained, and the information which will be derived from them will have a bearing which we should not slight.

The most numerous experiments have been carried on in a static state, because it resulted from similar tests made by Mr. Ferry, Sub-Engineer at Bourg, that the flexures in the dynamic state are not superior to those which are realized in a static state. The curve of deformation of cross ties can be modified in its general form, but its parts preserve the same relation between themselves, maintaining the same flexure as in the static state. This fact has been verified on the wood cross ties provided with P. L. M.-A. rails.

The determination of the curves of deformation of cross ties has been made with extreme care, taking all desirable precautions.

MEASURING APPARATUS FOR EXPERIMENTS IN THE STATIC STATE.

There were first placed in the surface of the wood cross ties screws with square heads distributed over their whole length and giving 15 or 16 fixed points, which were to serve as bench marks for the determination of the deformation. A rigid steel rule in the form of a T (Fig. 6) presented, right at the points, whose spacing was the same for all cross ties, vertical rods terminated by a notch, in which was brought, while resting on the screw with square head, a gage in the form of an inclined plane, whose divisions were calculated in a manner to correspond with a tenth of

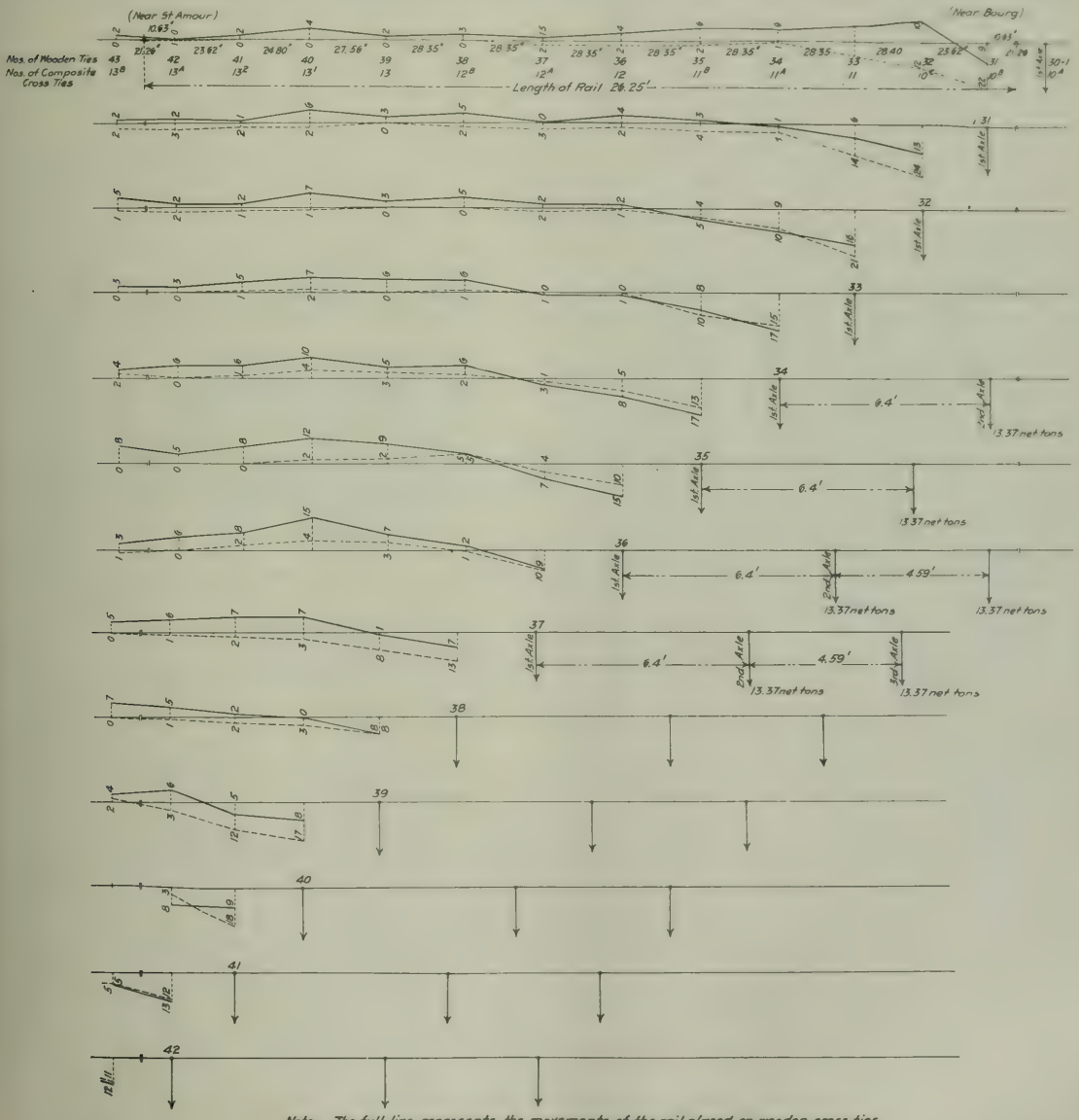


Fig. 5—Longitudinal Deformation of the Rails Under the Action of a Static Load (Short Radius).

a millimeter. The inclination of the inclined plane had been so chosen that the interval between two divisions was at least of 2 centimeters ($^{20}/_{100}$ in.), which allowed estimating the tenth of a millimeter with exactness. The rule was fixed in an unchangeable manner to two stakes of strong dimensions, buried in the embankment about 1 m 10 (3.61 ft.), in order to eliminate the influence of the load on the supports of the rule. When the rule was in place, an observer introduced the wedge-shaped gage in the notch, while maintaining it horizontally on the head of the screw, and stopped it at the moment when it commenced to become wedged; he then made a first reading on all the points of reference, proceeding, for example, from left to right, then a second, proceeding in the reverse direction, from right to left. The readings made were recorded by the employees of the Board of Control and those of the P. L. M. Co., and the mean of them was taken, which thus gave the actual position of the cross tie.

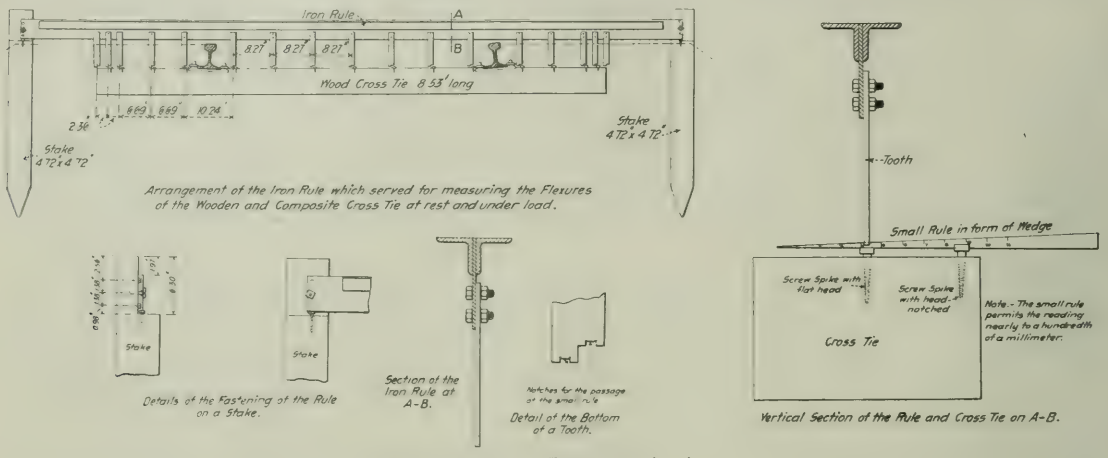


Fig. 6—Flexure of Ties Under Load.

The vehicle, which served to load the cross tie considered, was brought up, always taking care to place the same wheels at the same spot, with reference to the piece submitted to the test; it was allowed to remain during about 10 minutes, and the readings were recommenced, which caused some difficulties, since the head observer was obliged to pass under the frame of the engine and to operate stretched out to his full length. In like manner two successive readings were made, and the mean of them was taken, as has been recited above; the difference between the inscribed means gave the deformation of a cross tie under the load considered. It was necessary to count on an hour at least for the aggregate of the readings, and the necessary delays during the passage of trains made the operation require a very long time.

The preparation of the working place and the establishment of the measuring apparatus has been made by Mr. Ferry, Sub-Engineer of the P. L. M. Co., who has carried on experiments of this kind for more than 20 years, and who allies with a consummate experience a sagacity truly remarkable.

MEASURING APPARATUS FOR THE EXPERIMENTS IN THE DYNAMIC STATE.

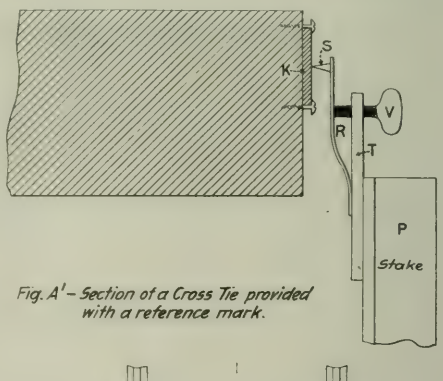
Mr. Ferry employed for the experiments in a dynamic state a measuring apparatus which had previously served for studying the deformation of cross ties in a static state as well as in a dynamic state. It is extremely simple and strong; it presents then from this point of view an incontestable superiority over the apparatus employed for the same object, which would give perhaps more precise results, but whose indications require corrections always difficult to make, by reason of the greater delicateness of the measurements (apparatus of Marey). If these corrections are incomplete, the indications given conduce to results which cannot be utilized.

The measuring apparatus (see Fig. 7) was essentially composed of a stylus arranged in a stable manner at the face of a plate of smoked glass and fixed on the points of the cross tie under observation. The black smoke deposited on the glass plate, which was displaced at the same time and by the same amount as the points, was removed by the point of the stylus; the height of the part removed gave the value of the deflection, or of the raising of a cross tie at the points considered. The reading of this height was made by means of a magnifying glass nearly to the tenth of a millimeter.

The stylus, with flat point of tempered steel, was mounted on a very flexible spring, which could be approached to or removed from the glass plate at will, with the aid of a thumb screw. The glass plate was fixed by screws on one of the faces of a cross tie, then smoked in the flame of a candle at the moment when it was desired to put it in service. The thumb screw passed through an iron rod and simply rested on the spring which, left free, moved back and forth on the rod fixed by means of two bolts on a stake deeply buried in the soil.

In order to make an observation, the screw is pressed against the spring until the point of the stylus comes in contact with the blackened plate. In this position a light blow is given to it, which makes it oscillate and defines a horizontal trace of 2 or 3 millimeters ($^{8}/_{100}$ to $^{12}/_{100}$ in.) length on the black smoke, a trace which forms the reference mark.

At this moment one can either place the vehicle on the cross tie, or allow trains at speed to pass over it. The height of the part of the glass plate rubbed off by the point of the stylus gives,



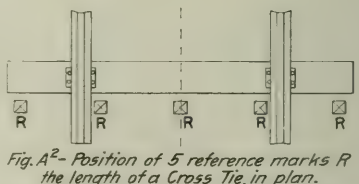


Fig. 7—Flexure of Ties Under Load, Shown by Reference Marks.

above the reference mark, the values of the depression, and below, the uplift, of the cross tie. The latter is always inferior to the former; for the flexure is important in comparison with the movement of uplift of this piece under the influence of loads at a distance. The successive influence of each of the axles cannot be noted, but it is solely a maximum indication which is produced.

Mr. Ferry, before providing himself with the rule which we have described above for the study of the deformations in a static state, employed the registering apparatus just above, and determined with exactness the form of that deformation by placing five of these apparatus on different points of the cross tie. He was then able, by comparing the results obtained with the rule and the wedge on the one hand, and the stylus on the other, to appreciate the precision of measurements given by one or the other of these apparatus.

(To be continued.)

GENERAL NEWS SECTION

NOTES.

The Government of Manitoba is to build 1,000 miles of telegraph line and, according to press despatches, contracts for some of the material have already been given in Chicago.

The Railroad Commission of Canada has ordered the Canadian Pacific and the Grand Trunk to reduce passenger fares to 3 cents a mile on all lines east of Edmonton, the change to go into effect May 19.

The number of emigrants going from England to Canada is now very large; but the demands for laborers on the new railroads and other works in western Canada is still unsatisfied. Over 60,000 laborers are wanted.

The Connecticut State Board of Railroad Commissioners has decided that a street railroad whose electric current damages underground pipes by electrolysis must pay for the damage, the amount to be determined by some court of competent jurisdiction.

The President of the Delaware & Hudson announces that in the past 12 years, during which time that road has carried 75,000,000 passengers, there has been only one train accident which was fatal to passengers. In this accident three passengers were killed.

At Prince Rupert, the western terminus of the proposed Grand Trunk Pacific Railway, the 300 men at work on improvements go to bed every night at 9:30, and the place is termed a "model colony." The explanation is that no intoxicants are allowed to be brought in.

F. M. Crump, President of the Memphis Cotton Exchange, reports to the Interstate Commerce Commission the existence of a serious congestion of cotton at Memphis, and the commission proposes to investigate the matter. Mr. Crump says that the railroads now have in that city 23,000 bales of cotton for which they cannot find cars.

The Canadian Pacific has just distributed to station agents and track foremen 35,000 packages of flower seeds. These seeds, with 150,000 bulbs sent out last fall, are expected soon to produce scenes of beauty at hundreds of stations of the company. The flower department of the Canadian Pacific was started ten years ago by N. S. Dunlop, who still remains at the head of it.

The Interstate Commerce Commission announces that in consequence of the large volume of business now coming before it, hearings will no longer be held by the commission, except in Washington. When it is found necessary to take testimony in other cities special agents will be sent out for the purpose; and the arguments will be heard subsequently in Washington.

On account of the unfavorable weather and other obstacles, the Canadian Pacific will not run a "seed special" this year. It is said, however, that the pure seed distributed by the railroad in former years has proved a great benefit to the farmers of the Canadian West. Some years 10 per cent. of the wheat crop is a total loss on account of noxious weeds, and the weeds are increasing.

Mr. T. P. Shonts, President of the Interborough-Metropolitan Street Railroads in New York City, has requested representatives from 50 business and civic associations to appoint delegates to act as an advisory committee to confer with him concerning the transportation needs of the city. Mr. Shonts is considering favorably the adoption, for the subway, of cars with side doors, like those in use on the Illinois Central.

The Railroad Commission of Canada has issued a statement of accidents on the railroads of the Dominion from February 1, 1904, to March 31, 1906, two years and two months. Total number of persons killed, 402; injured, 144. Of the killed, 109 were trespassers. The report says that the commission intends to station inspectors at different places in Canada to investigate accidents, and also to examine cars and engines and to report generally on the conditions of railroad operation.

According to an interview with an officer of the San Pedro, Los Angeles & Salt Lake, printed in a Western paper, the legislature of Nevada has passed a law limiting freight rates to 7½ cents per ton-mile, a rate which, says this officer, will compel the roads to raise to that figure the prices on all classes of goods, in order to make up for the loss on high class goods. Hitherto the roads have been charging 20 cents per ton-mile on first class freight, though at the same time they are carrying some cheaper goods at 1 cent per ton per mile.

On Monday last a decision was announced by the Interstate Commerce Commission in the case of the American Livestock Association and the Texas Cattle Raisers' Association against the Texas & Pacific. The commission holds that the public interest requires the establishment of the through routes and joint rates formerly provided for in joint tariffs. In the case of the Birmingham Packing Company against the Texas & Pacific the commission ordered that a through route and joint rate thereover of not exceeding 50 cents per 100 lbs. be established and maintained for the transportation of cattle in carloads from Fort Worth to Birmingham.

President Roosevelt has decided to appoint an Inland Waterways Commission, with Congressman T. E. Burton, of Ohio, as chairman. The duty of the commission will be to report on a plan for the improvement and control of the rivers of the country. The President says that the railroads are unable to move the agricultural and other products of the country, and that water transportation must therefore be provided. Other men asked to serve on the commission are: Senator Francis G. Newlands, Senator William Warner, John H. Bankhead, General Alexander Mackenzie, Dr. W. J. McGee, Mr. F. H. Newell, Mr. Gifford Pinchot and Mr. Herbert Knox Smith.

Judge Trieber, of the United States District Court in the Eastern District of Arkansas, has handed down a decision sustaining the constitutionality of the Employers' Liability act. It is in the case of Splain against the St. Louis & San Francisco. Judge Trieber agrees with Judge Hanford, in the Western District of Washington, in holding that the enactment was within the powers of Congress. On the other hand, Judges Evans and McCall recently decided that the law was unconstitutional. The government therefore has taken steps to have the question reviewed by the Supreme Court, and, at the request of Attorney-General Bonaparte, who will argue for the constitutionality of the statute, the Supreme Court has advanced the cases on the calendar, and they will be heard on April 8.

According to Chicago papers, the railroads centering in that city intend to protest against the reduction of about 14 per cent. in the pay for mail transportation which must result from the recent order of the postmaster-general to change the basis on which the average daily weight of mail is computed. Heretofore the total quantity of mail carried in a week has been divided by six to give the average daily quantity; under the new order the total is to be divided by seven. The Chicago roads point out, however, that under the new rule it will be to the interest of a railroad to carry no mails on Sunday, which would be a serious inconvenience to the public. But some of the roads are likely to accept the new ruling without protest, so that those who wish to complain are doubtful about the expediency of doing so.

Mr. Albert H. Harris, general counsel of the New York Central, has mailed to Governor Hughes and the members of the New York Legislature a printed letter asking that more money be appropriated by the state to aid in eliminating grade crossings. Mr. Harris complains that the state has so far appropriated a very inadequate sum to meet its share in the abolition of these crying evils. Especially does he urge appropriations by the state for the abolition of the crossings in Ossining, Tarrytown, Irvington, Hastings, Yonkers, White Plains, Scarsdale, Tuckahoe, Bronxville and Mount Vernon, toward which, Mr. Harris says, these municipalities and the railroads are willing to pay their respective shares. Massachusetts has appropriated $7,109,892 up to November 30, 1906, and only about half as many people out of every million have been killed at grade crossings, while New York has appropriated only $1,067,606.

One of the new tracks of the elevated line of the Philadelphia, Baltimore & Washington at Wilmington, Del., has been put in use, and within a few weeks the other will be in service. In the plans for this track elevation a special effort has been made to reduce noise as much as possible, thus reducing to a minimum the annoyance to persons living or doing business near the tracks. There are 24 bridges in all, carrying the main tracks over the street and railroad crossings. The floors of the bridges are solid trough construction. The steel is covered with concrete, which is waterproofed with five layers of felt and asphalt compound. This in turn is covered with a layer of protecting bricks laid in sand and grouted. Upon the bricks is laid the stone ballast, carrying the wooden ties and the rails forming the roadbed. The elevated line is about three miles long. When the improvements are completed they will probably result in the saving of several minutes in the running time between Philadelphia and Baltimore—marking another step, says the press agent of the road, in the accomplishment of the purpose of the Pennsylvania eventually to reduce its running time between New York and Washington to four hours.

Mechanical and Electrical Engineering Courses at Rensselaer.

The trustees of the Rensselaer Polytechnic Institute have decided to establish courses in mechanical and electrical engineering. The recent gift of $1,000,000 from Mrs. Sage and other recent gifts through which they have been able to increase the value of their plant for the purposes of instruction, enables them to do this.

These courses will be as general as the civil engineering course now given at the Institute.



Waiting.
Chicago *Daily Tribune.*

Prosecution of the Lackawanna for Rebating.

In the United States Circuit Court at New York City last week the suit of the government against the Delaware, Lackawanna & Western for making illegal payments to L. M. Palmer, proprietor of the Palmer docks and lighters in New York harbor, came to an end by a disagreement of the jury; and the newspapers say that the government probably will not ask for a second trial, the purpose of the suit having been, not so much to punish the railroad as to secure a judicial construction of certain clauses of the law.

The road was charged with having granted rebates to the American Sugar Refining Company under the guise of lighterage charges to Mr. Palmer, and the prosecution evidently believed that the acts of the railroad had been similar to those of the New York Central, under trial last autumn, in which it was found that payments made by the road to Mr. Palmer were really for the shipper. In the Lackawanna case, however, Mr. Palmer testified that none of the money went to the sugar company. Officers of the road testified that the money was paid to Mr. Palmer because of the loss in traffic sustained by him in consequence of the giving of the Lackawanna lighterage to Starin & Company.

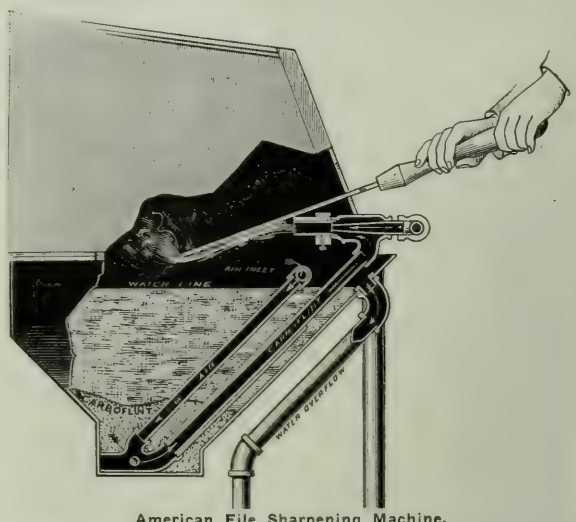
The trunk lines had an agreement for dividing the westbound sugar traffic from New York and Philadelphia, and in 1898 the Lackawanna was to have 4 per cent. of the total from both cities. All the lines except the Pennsylvania and the Lackawanna received their New York sugar at or through the Palmer docks, Brooklyn, but the Lackawanna had an independent dock of its own. Mr. Palmer had close relations with the New York refinery, and the owner of the refinery was interested with him in the ownership of the Palmer docks. An arrangement appears to have been made with the railroads whereby the whole of the 4 per cent. allotted to the Lackawanna was shipped from Philadelphia and none from New York. This did not suit the Lackawanna because it had to divide the revenue with the Reading, and finally the other roads were induced to agree that the Lackawanna should get its percentage (now raised to six) at New York. This was in 1901. Mr. Palmer intimated that it was hard on him to thus voluntarily divert traffic from his own docks and vessels, and the Lackawanna thereupon agreed to do business at his docks; but there was no room, and finally the road agreed to allow him 2 cents per 100 lbs., which was a little less than half of the usual lighterage charge received by him from the other roads. The Lackawanna paid Starin & Company 2½ cents and allowed Mr. Palmer a "cartage" charge of about 2 cents. Vice-President Caldwell, of the Lackawanna, testified that when these allowances were made he did not know that Mr. Palmer was the director of the sugar company. It does not appear that Mr. Palmer performed any service in connection with the Lackawanna shipments.

A Lightning Calculator.

According to a press despatch from Austin, Tex., the General Attorney of a railroad in that state, who has examined the 125 bills affecting railroads which have been introduced this year in the legislature, finds that they would reduce the revenues of the railroads ten millions a year and increase their expenses five millions.

The American File Sharpener.

The accompanying illustration shows a sectional view of an apparatus, made by the American File Sharpener Company, New York, for restoring the cutting edges of worn or dull files. The operating principle of the machine is to force a siphon blast, carrying an abrasive material called "carbo-flynt" which is impelled by a jet of steam or steam and compressed air, at high velocity, against



American File Sharpening Machine.

the dulled file, striking the teeth at an angle of from 15 deg. to 30 deg. The file during the process of being resharpened is drawn forward and backward over the ejector nozzle, inside of which is a reducing jet so adjusted that the carbo-flynt strikes the teeth of the file from the back, thus restoring the sharpness and at the same time preserving the original angle of the teeth. After im-



File Teeth Before Sharpening. File Teeth After Sharpening.

pinging against the file the carbo-flynt settles at the bottom of the machine and is used over and over again until it is cut up into fine particles and carried away in solution by the overflow outlet. The machine occupies a floor space 6 ft. x 6 ft., weighs 450 lbs., and is operated by from 80 lbs. to 150 lbs. steam pressure. It is claimed that files sharpened with the device do as good or better work than new files, and that they can be resharpened from four to six times before being discarded. The process being simple an expensive mechanic is not required to operate it, so that the cost of resharpening is small. From 200 to 400 files is given as the daily capacity per machine, according to the condition of the files to be resharpened. Prominent manufacturers and railroad companies now using this device include the Niles-Bement-Pond Company, the Westinghouse Electric & Manufacturing Company, the Illinois Central, the Chicago, Rock Island & Pacific, the Chicago, Burlington & Quincy, and the St. Louis & San Francisco.

Possible Clash Between Federal and State Laws.

The interstate commerce act forbids unjust discriminations, and charges the commission with the duty of enforcing that provision as well as all other provisions. There have been many cases where railroads have been charged with discrimination in the distribution of their available cars in favor of one shipper and against another. The commission has enforced the law in a number of such cases where no question of state legislation was involved. It may be said with some force that the case would be different where a railroad does this under the compulsion of a state law. But would it be different in principle? The federal law is, of course, paramount. It permits unjust discriminations on no grounds whatever. Will it then permit a state law to interfere with interstate traffic? The commission cannot sit idle while interstate traffic is interfered with and in some cases interrupted by the operation of such state enactments. "If interstate carriers are forced by state laws to side track interstate commerce, and if such laws result in putting

all the available cars at the disposition of state shippers, to the prejudice of interstate shippers, it is a clear interference with interstate traffic." When the cars are not sufficient to take all traffic offered, and terminals overcrowded, and when all the loaded cars cannot be moved at the average rate provided by the state laws, what is more natural than the side-tracking of the cars containing the merchandise of interstate shippers, for whose benefit the state penalties are not imposed? This, as we are informed, is being done." —*Commissioner Harlan* (Interview).

Wood Rolling Roundhouse Doors.

Steel rolling doors for roundhouses, freight houses and similar buildings have many advantages, but one serious disadvantage accompanying their use in roundhouses is that steel is readily attacked by the chemical action of the sulphurous fumes due to the smoke. The accompanying illustrations show a rolling shutter door for roundhouses made out of materials which are least affected by acid

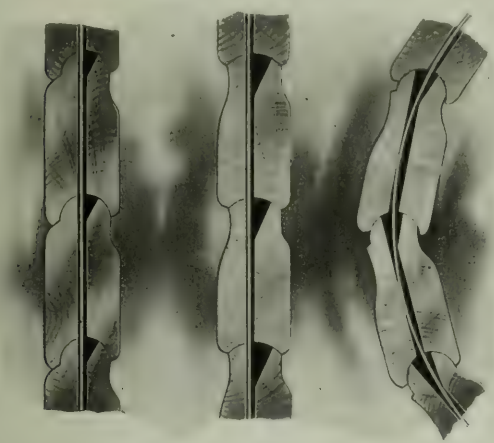


Fig. 1—Forms of Wooden Slats for Rolling Door.

gas, namely, wood, copper and cast iron. These wood rolling doors have all of the advantages of simplicity, compactness and ease of manipulation that characterize steel doors of the same construction. They have been especially designed for roundhouses, and the end clearance is so small that the usual steel post construction between stalls affords ample space on which to mount the grooves in which

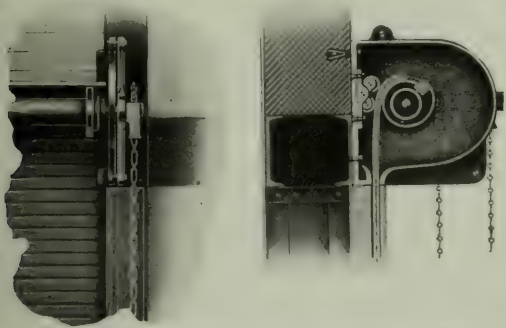


Fig. 2—Kinnear Wood Rolling Lift Door Mechanism.

the doors travel. The curtain is made up of wooden slats mounted on phosphor-bronze ribbons threaded through slots placed about 2½ ft. apart. These slots are accurately designed and cut to such shape that the flexure of the slats when passing around the barrel does not change the relative length of the slats and the suspending ribbons. The metal ribbons are never exposed.

The curtain is suspended and rolls on a barrel made of boiler tube of sufficient diameter to afford the necessary stiffness and large enough to contain within it the helical springs used to counterbalance the weight of the curtain. The ends of this tube are closed by cast iron plugs, thus protecting the springs. Mounted on the barrel are spiral cast iron rings to which the suspending curtain ribbons are attached, so that after the first turn of the slats around the shaft the roll is always a true spiral. Two methods of suspending the barrel and hoisting gears are shown in the illustrations. Fig. 2 shows the barrel and hoisting gears mounted on a horizontal bar which is suspended at its inner end by a link and carried at its outer end by a similar link, the adjustment being such that the curtain hangs vertically in the grooves. Back of the curtain is a pivoted cradle carrying two rollers which bear against the curtain as it is wound up. As the door is raised the curtain is wound on the barrel, and the rollers on the pivoted cradle keep forcing the barrel farther

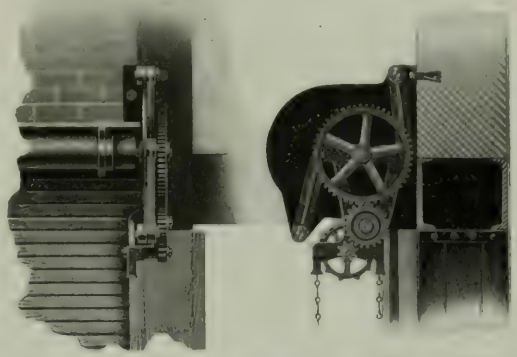


Fig. 3—Mechanism for Use With Limited End Clearance.

and farther out as the diameter of the roll increases, but the curtain is maintained in a vertical position at all times. Fig. 3 shows a modification of this arrangement, in which the horizontal bar link is replaced by a heavy frame extending downward and carrying the chain hoist under and in front of the bracket. This arrangement economizes end clearance and the doors may be placed closer together than with the arrangement shown in Fig. 2. The slats or doors are treated in the shop with a waterproofing compound, but they should be painted after erection. One of these doors, 13 ft. wide and 17 ft. high, has been operated over 1,800 times without showing any appreciable wear. The time required to operate the door is 30 seconds. The Kinnear Manufacturing Company, Columbus, Ohio, are the makers.

Thirteen Passengers Killed in South Africa.

Press despatches of March 13 report the derailment of a night passenger train at Alkmaar on the railroad to Delagoa Bay, in consequence of running into a washout; and that 13 persons were killed and many injured.

Respectfully Referred to Hapgoods.

[Press despatch from Topeka.]

"The Kansas State Board of Railroad Commissioners will hire a rate expert, at $10,000 a year if necessary. Two big undertakings confront the board. First, to examine into freight rates; second, to determine the actual value of all the railroad property in the State. The legislature has placed at the disposal of the board the sum of $25,000. If the right man can be found in Chicago or New York his services will be secured." Why exclude Topeka, London, St. Petersburg, Altoona, St. Paul, Chattanooga and Washington? In passing out $10,000 plums a spirit of fairness should prevail. God Almighty did not exhaust the rate-making stock when he created a few New Yorkers, etc.

No More Coal Scoops at Denholm.

The Pennsylvania has built new coal "wharves" at Denholm, Pa., on the Middle division, and at Thorndale on the Philadelphia division, which will save much time in coaling and watering locomotives. The two plants have the same general features. Each runs across 12 tracks, like a bridge, and 12 locomotives underneath can be supplied with coal from the wharf and water from stand pipes at the same time.

Approaching the Denholm wharf the four main tracks branch out into 12. Not the least of its valuable features is that it makes train crews hurry as they never hurried before. The engineman and conductor of a train dislike, above everything else, to have another train overtake and pass them. At Denholm it is easily possible for one locomotive to pull in behind another, supply itself with coal, water and sand and then move away before its rival.

The first time a train crew were "scooped" at Denholm the men were angry. According to the old way, when one train was stopped it blocked all the other trains behind. Inevitably this led to a complacency among crews not conducive to great haste, and it was not unusual for a train to stay half an hour. Not long after the new wharf was finished recently a locomotive came under it

and the crew began to "coal up" in leisurely manner. But the men on the engine that arrived three minutes later hustled with all their might, and before the crew of the first realized what was happening they saw the second train pull out ahead.

One day not long ago the wharf was put to a severe test. Owing to a delay east of Denholm several westbound trains had become "bunched." When the cause of the trouble had been remedied they all began to press forward. Nineteen trains passed the wharf in 80 minutes. There was but one detention on account of waiting for room. The average stay of a locomotive at the wharf was between 12 and 13 minutes.

The wharf is 210 ft. long. From end to end runs the coal bin lined with solid concrete, with chutes underneath it. Along the top of the wharf is a track for the cars which bring coal from the west. Near one end is a sand tower. Little cars, running on a narrow gage track beside the coal car track, carry the sand out over one side of the wharf to sand bins. From these it passes through chutes to the sandboxes of the locomotives, while the tenders are being loaded with coal.

Below the point where the locomotive stops, and running underneath the 12 tracks, are two arched tunnels. Into one of these opens a chute for ashes from the firebox. An endless chain of ash conveyors runs through each tunnel under the chutes, and on it the ashes and sparks are carried out and dumped into a bin from which they are taken by regular ash cars. There is a power house 100 ft. long and 40 ft. wide, with boilers, dynamos and pumps. In the cellar of the house is an oil storage room, where the various grades of lubricating oil used on a train are kept in steel tanks and forced up from them by air pressure.

Union Switch & Signal Company.

The annual meeting was held at Pittsburg on March 12. The officers and directors were re-elected as follows: George Westinghouse, President and Director; H. G. Prout, Vice-President and Director, and George C. Smith, William McConway, John B. Jackson, Thomas Rodd and Robert Pitcairn, Directors. The annual statement showed a gross business for the calendar year 1906 of $5,065,676, an increase of more than 70 per cent. over the preceding year. The net profits for the year were 45 per cent. on the outstanding capital stock. The dividends were at the rate of 12 per cent. Five thousand shares, $50 each, of new stock was offered to the stockholders at the rate of $80 per share, and all of it was subscribed for. The company has at the present time $2,000,000 worth of unfinished orders in its shops and the prospect for the continuance of orders is such that it has become necessary to provide additional manufacturing facilities. For this purpose the company has recently bought 34 acres of land immediately adjoining its present holding. This land has a frontage on the Pennsylvania Railroad which will enable it to put in switching tracks to great advantage. A new foundry and blacksmith shop, and probably a power house, will be erected at once. Galleries will be built in the existing foundry and blacksmith shop and so add convenient and well lighted floor space for the general manufacturing business. The present floor space in the plant is 355,000 sq. ft. The new building and the galleries in the old building will furnish 140,000 additional sq. ft. Colonel Prout's estimate is that these additional facilities will answer the company's purposes for another year, and he does not now contemplate any building other than the new foundry and smith shop.

The Bigness of Norfolk.

An absolutely unmistakable sign that Norfolk has come to be an important city is the establishment by the Pullman Company of a District Superintendent's office here. There is no more sentiment in the Pullman Company than there is in a corncob, and therefore the recognition of Norfolk as an important point is dictated by business considerations. It is well, too, that sentiment should have nothing to do with this matter. It has no place in such enterprises. Norfolk does not wish to be considered sentimentally. She has been too long treated by the railroads as a way station, or jumping off place.—*Norfolk Correspondent Richmond Despatch.*

TRADE CATALOGUES.

Wallace-Coates Engineering Co.—This Chicago company has a little pamphlet giving the organization and scope of the work of the company. The executive committee is composed of H. U. Wallace, formerly Chief Engineer of the Illinois Central, and Third Vice-President of J. G. White & Co., New York; Frank R. Coates, formerly Chief Engineer of the Chicago Great Western, and Vice-President of Thos. Phee & Co., general contractors; J. F. Wallace, President of the Electric Properties Co., New York, formerly General Manager of the Illinois Central and Chief Engineer of the Panama Canal; T. W. Snow, President of the Otto Gas Engine Co., and Pliny B. Smith, Attorney at Law, Chicago. The officers are: H. U. Wallace, President; F. R. Coates, Vice-President; J. F. Wallace, Treasurer, and M. E. Shire, Secretary.

Crucibles.—The Joseph Dixon Crucible Co., Jersey City, N. J., has published a pamphlet on graphite crucibles by John A. Walker, Vice-President and General Manager of the company. The point is made that most crucibles are perfect when they reach the user, and most of their failures are due to bad usage; accordingly it gives rules for their treatment, telling how to put the metal in, how to put the crucible in the fire, what sort of fuel to use, the proper tongs and how they should be handled, etc. It describes specific troubles and tells how to avoid them. In addition, the pamphlet contains tables showing the make-up of the principal alloys, the freezing, fusing and boiling points of certain materials, and some general information and tables useful in foundry work.

Sanding Devices.—The 1907 catalogue of the American Locomotive Sander Co., Philadelphia, Pa., describes Leach and "She" sanders and Sherburne's arrangement for automatic sanding. Different types and fittings of the Leach sanders are shown, suited to different wheel arrangements; the double sander feeding in front of the leading drivers and behind the rear drivers, and the triple sander fitting also between the wheels. The illustrations are unusually attractive, most of them being transparencies; they show the arrangements in the sand-box, the piping, the valves and other parts.

Car Barn Doors.—The Kinnear Manufacturing Co., Columbus, Ohio, sends an illustrated pamphlet describing Kinnear steel rolling doors for car barns. These doors are made of horizontal steel slats hinged together along their entire length. They roll up at the top of the barn opening on a barrel counterbalanced by helical springs. The slats are corrugated to prevent buckling, and the door runs in vertical grooves. They are usually worked by hand through sprocket wheels and gears, but the company has lately worked out a system for operating them with electric motors.

University of Illinois Railroad Courses.—Information concerning the School of Railway Engineering and Administration of the University of Illinois, which was established a year ago, was given in these columns at that time. The university has just issued a little pamphlet which gives concise information concerning these courses, the equipment for same, etc. More detailed information can be obtained from the registrar of the university. A bulletin giving full detailed information is soon to be issued. It will be for general distribution.

Gasolene and Oil Storage Outfits.—A pamphlet sent by S. F. Bowser & Co., Ft. Wayne, Ind., illustrates and describes their gasolene storage outfits for automobiles, and their oil cabinets especially suited to this service.

Machine Tools.—The March number of the *Progress Reporter*, published by the Niles-Bement-Pond Co., New York, has some excellent illustrations of heavy machine tools, including lathes, planers, drills and presses.

Manufacturing and Business.

William C. McMillan, President of the Michigan Malleable Iron Company, died at his home in Detroit on February 21, at the age of 45.

J. H. Burwell, Fisher Building, Chicago, Ill., has been made sales agent in the middle west for the Automatic Ventilator Company, New York.

The Independent Pneumatic Tool Company, Chicago, has received a large order for Thor piston air drills and pneumatic hammers from the Wisconsin Engine Company, Corliss, Wis.

The Pressed Steel Car Company has moved its western office, in charge of J. H. Mitchell, Manager of Sales of the Western district, from the Fisher Building to the Old Colony Building, Chicago.

The Power Specialty Co., New York, reports recent orders for Foster superheaters aggregating many thousand horse-power from several companies, including the Illinois Central, the Bucyrus Company and the Philadelphia Electric Company.

W. J. Dolan, formerly with the Remington Typewriter Co., and more recently with L. P. Smith Bros., of Syracuse, N. Y., has been appointed to a position in the sales department of the Dayton Pneumatic Tool Company, with office at Pittsburg, Pa.

Walter D. La Parle has opened an office at 1513 Manhattan Building, Chicago, and will represent the following companies: J. W. Faessler Mfg. Co., Moberly, Mo.; U. S. Nut Lock Mfg. Co., Ft. Worth, Tex.; Truss & Cable Fence Co., Cleveland, Ohio; Western Tool & Mfg. Co., Springfield, Ohio; Minimax Supply Co., Chicago, and Lincoln-Williams Co., Taunton, Mass.

The Standard Asphalt & Rubber Co., Chicago, announces the following appointments: H. T. Snell, formerly General Manager of the Eastern division of the Standard Oil Co., Vice-President; Samuel McRoberts, formerly Treasurer of Armour & Co., Chicago, Vice-President; W. H. Lawrence, formerly General Inspector of Bridges of the Chicago & North-Western, as Engineer; W. H. Lonsdale, formerly General Superintendent and Hydrocarbon Expert of the American Asphalt & Rubber Co., Chicago, Representative.

J. F. W. Bunsen has gone to Muralt & Co., Engineers and Contractors, New York, in charge of the company's southern office in Charleston, S. C. Mr. Bunsen, who is a nephew of the late Prof. Bunsen, the inventor of the burner which bears his name, has for some years been designing and erecting important engineering works. At the time of the Galveston flood, when he was Mechanical Superintendent of the Southern district of the American Cotton Co., he prepared designs and plans for a system of breakwaters for Galveston, and the present breakwater system was built nearly in accordance with them.

The offices of the Safety Car Heating & Lighting Company and the Pintsch Compressing Company, New York, have been removed to the seventeenth floor of the United States Express Building, Trinity place and Rector street. The management of the Prussian State Railways has decided to change the equipment of all cars to incandescent gas lighting before the end of the year 1909; and after that date they will make only Pintsch gas and not Pintsch gas enriched with acetylene. Acetylene has been found to be much more expensive in Germany than oil gas. All new cars, about 3,800, to be built during 1907 will be equipped with mantle lamps. The Saxony Imperial State Railways have adopted the same method of lighting.

Iron and Steel.

The Texas Traction Co. has ordered 9,000 tons of rails.

The Illinois Central has ordered 6,000 tons of bridge steel.

The Norfolk & Southern will soon let contracts for a bridge over Albemarle Sound.

Contracts are reported let for various electric lines aggregating about 4,000 tons of rails to the Carnegie Steel Company, and for 3,000 for the Lehigh Valley to the Lackawanna Steel Company.

The contract for the general construction work on the Brooklyn approach to the Manhattan bridge, New York, has been let to the F. W. Carlin Company, of Brooklyn. Contracts for about 800 tons of steel to carry out the work will be let shortly.

The American Bridge Company, during the second week of March received orders for 11,000 tons of fabricated steel, including 1,000 tons for the American Sheet & Steel Plate Company, and an additional order of between 700 and 800 tons for the power house at the Gary plant.

The Illinois Central, it is said, has ordered 6,000 tons of steel for bridges from the American Bridge Company. The Great Northern is negotiating for 6,500 tons and between 4,000 and 5,000 are pending for the Lehigh Valley, the Erie, the Tidewater and the Pittsburg & Lake Erie.

OBITUARY NOTICES.

Henry T. Jaeger, General Agent of the Erie at Buffalo, N. Y., died in Buffalo on March 19, a week after he had been operated on for appendicitis. Mr. Jaeger was 46 years old and had been in the service of the Erie for 25 years.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Civil Engineers.

At the meeting of this society on March 20, a paper on "Lower Colorado and the Salton Basin" by C. E. Grusky was presented for discussion. This paper was printed in the *Proceedings* for February, 1907.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Erie.—George N. Orcutt, General Claim Attorney, has been appointed General Attorney, with office at New York City, and his former position has been abolished. Mr. Orcutt will have charge of the claim department together with his new duties.

Missouri Pacific.—Stuyvesant Fish, who was recently elected a Director, has been made also a member of the Executive Committee.

Texas & Pacific.—Robert C. Clowry and Benjamin Nicoll have been elected Directors, succeeding, respectively, James H. Hyde and Louis Fitzgerald. A. C. Bird, Vice-President, has resigned.

Western Maryland.—B. F. Bush, President of the Consolidated Coal Company and the Western Coal Company, has been elected President of the Western Maryland, succeeding Winslow S. Pierce, resigned. F. S. Landstreet, Vice-President of the Western Maryland, has resigned.

Operating Officers.

Buffalo, Rochester & Pittsburg.—E. J. Devans has been appointed Superintendent of the Buffalo and Rochester divisions, with office at Rochester, N. Y., John McGarvey having been granted leave of absence because of ill health.

Great Northern.—H. A. Kennedy, Assistant General Superintendent at Spokane, Wash., has been appointed Assistant General Manager, succeeding to the duties of George T. Slade, General Superintendent, who recently resigned to go to another company. The four offices of Assistant General Superintendent have been abolished. F. S. Forest, heretofore Assistant General Superintendent at Minot, N. Dak., has been appointed General Superintendent at Spokane, Wash., succeeding to the duties of Mr. Kennedy. R. W. Bryan, General Superintendent of Transportation, has been appointed General Superintendent at Minot, succeeding to the duties of Mr. Forest. W. C. Watrous, formerly Superintendent of Transportation of the Missouri Pacific, succeeds Mr. Bryan. E. L. Brown, Assistant General Superintendent at St. Paul, has been appointed General Superintendent at that place. D. M. Philbin, Assistant General Superintendent at Superior, Wis., has been appointed General Superintendent at that place.

Lehigh & New England.—R. G. Kenly, Trainmaster of the Lehigh Valley at Easton, Pa., has been appointed General Superintendent of the Lehigh & New England, succeeding to the duties of J. R. Whitney, General Manager, resigned on account of ill health.

Lehigh Valley.—C. S. O'Neill has been appointed Trainmaster at Easton, Pa., succeeding R. G. Kenly. See Lehigh & New England.

Mexican Central.—H. D. Myers, Trainmaster at Guadalajara, Jalisco, has been appointed Acting Superintendent at that place, E. S. Banks having been granted leave of absence.

Missouri, Kansas & Texas.—J. L. Walsh, Assistant Superintendent at Parsons, Kan., has been appointed Acting Superintendent at that place, succeeding J. W. Walton, Superintendent, resigned to go to the St. Louis & San Francisco.

New York Central & Hudson River.—J. P. Bradfield, Assistant General Manager, has been given leave of absence on account of ill health. P. E. Crowley, General Superintendent of the Western district, has been appointed Assistant General Manager, with office at New York City. J. H. Hustis, Superintendent of the Hudson and Putnam divisions, succeeds Mr. Crowley, with office at Syracuse, N. Y. F. T. Slack, Assistant Superintendent of the Hudson and Putnam divisions, succeeds Mr. Hustis, with office at Grand Central Station, New York.

Miles Bronson, who was recently appointed Superintendent of the River division, was born on May 8, 1875, in the village of Gauhati, Province of Assan, British India. He began railroad work in 1890 in the law department of the Grand Trunk at Detroit, Mich. After five years he was made secretary to S. R. Callaway, President of the New York, Chicago & St. Louis. In 1897 he was appointed Superintendent of the Buffalo Terminal, which was then under construction; before the road was opened, however, Mr. Callaway went to New York to succeed C. M. Depew as President of the New York Central & Hudson River, and Mr. Bronson went with him as his secretary. He was later appointed Assistant to the President. In November, 1900, he was appointed Superintendent of the Har-



Miles Bronson.

lem division, where he remained until he was transferred to the River division early this month.

George Van Tassel, recently appointed Superintendent of the Harlem division, has had 34 years continuous service on the New York Central. He was born on January 11, 1856, at North Salem, N. Y. He was educated at North Salem Academy, and began railroad work in the spring of 1872 as an operator at Croton Falls, on the Harlem division of the New York Central; he was transferred to different stations during the next few years, and was made despatcher at Dover Plains, N. Y., in 1880. In 1889 he was appointed chief despatcher at White Plains, N. Y., and in 1900 was made Trainmaster of the Harlem division, where he remained until his recent promotion.



George Van Tassel.

Frederick T. Slack, the new Superintendent of the Hudson and Putnam divisions, was born on July 27, 1849, at Stonington, Conn. He was educated at the common schools and Academy at Mystic, Conn., and began railroad work in 1868 as a brakeman on the New York Central. He worked on the Eastern division for several years, and then on the Harlem division, being made baggageman and then conductor. In 1886 he was transferred to the Hudson division, where, in 1889, he was made conductor of the first Chicago Limited. In 1892 he was appointed station master at Grand Central Station, New York City, and in 1895 was appointed Passenger Trainmaster of the Hudson division. In 1906 he was appointed Assistant Superintendent of this division, where he remained until his recent promotion.



Frederick T. Slack.

Southern.—M. M. Richey, General Superintendent of the Middle district, has been appointed to the new office of Manager of the Middle and Western districts, with office at Atlanta, Ga. J. N. Seale, Manager of Transportation, has been appointed to the new office of Manager of the Northern and Eastern districts, with office at Washington, D. C., and the office of Manager of Transportation has been abolished.

Traffic Officers.

Durham & Southern.—See Seaboard Air Line.

Rutland Railroad.—See New York Central & Hudson River.

Seaboard Air Line.—R. I. Cheatham, Traffic Manager of the Durham & Southern, has been appointed Assistant General Freight Agent of the Seaboard Air Line at Norfolk, Va., effective April 1.

Engineering and Rolling Stock Officers.

Chicago, Burlington & Quincy.—J. C. Sesser has been appointed Engineer of Maintenance of Way at St. Louis, succeeding L. F. Goodale, resigned to go to the Philippines. R. W. Willis has been appointed Engineer of the Missouri district, with office at St. Louis, succeeding A. W. Newton, promoted.

Northern Pacific.—W. C. Taylor has been appointed Acting Division Engineer in charge of the lines east of Mandan, with office at St. Paul, Minn.

South & Western.—A. W. Jones, Division Engineer at Clinchport, Va., has been appointed Assistant Chief Engineer, with office at Johnson City, Tenn. C. L. Ruffin succeeds Mr. Jones.

LOCOMOTIVE BUILDING.

The Temiskaming & Northern Ontario has ordered six locomotives from the Locomotive & Machine Company of Montreal.

The Cumberland River & Nashville, Louisville, Ky., which is about to build a 20-mile line, is in the market for second-hand locomotives.

CAR BUILDING.

The Intercolonial is figuring on ordering one passenger coach from the Pullman Co.

The Norfolk & Western has ordered 243 40-ton flat cars from its Roanoke, Va., shops.

The O. F. Jordan Co. has ordered five flat cars from the Hicks Locomotive & Car Works.

The New York Central & Hudson River has ordered 35 passenger coaches from the Pullman Co.

The Canadian Northern has ordered one cafe car to be built in the United States for delivery this summer.

The George Palmer Lumber Co., La Grande, Ore., it is reported, has ordered 300 yard cars from the La Grande Iron Works.

The Seaboard Air Line has ordered 50 36-ft. Hart convertible cars of 80,000 lbs. capacity from the Rodger Ballast Car Co.

The Cumberland River & Nashville, Louisville, Ky., which is about to build a 20-mile line, is in the market for second-hand cars.

The Cedar Rapids Refrigerator Express, Cedar Rapids, Iowa, as reported in the *Railroad Gazette* of January 25, has ordered 35 refrigerator cars from the American Car & Foundry Co.

The Norfolk & Western, as reported in the *Railroad Gazette* of March 8, has ordered 1,000 drop bottom gondola cars of 50 tons capacity from the Western Steel Car & Foundry Company, for June delivery. These cars will weigh 38,100 lbs., and will measure 38 ft. 2½ in. long, 8 ft. 11½ in. wide and 4 ft. high, inside measurements, and 40 ft. long, 9 ft. 11 in. wide and 7 ft. 11½ in. high, over all. Bodies will be of wood and underframes of steel. The special equipment includes:

Bolsters	Sectional, plates and angles
Brake-beams	N. & W. standard deck beam
Brakes	Westinghouse
Brasses	Ajax plastic bronze
Draft rigging	Butler
Dust guards	Wood
Springs	Union Spring Mfg. Co. and Pittsburg Steel & Spring Co.
Trucks	Barber

The Louisiana & Arkansas, as reported in the *Railroad Gazette* of March 15, has ordered 300 box cars of 60,000 lbs. capacity from Barney & Smith, for April and May delivery. These cars will be 36 ft. long, 8 ft. 6 in. wide and 7 ft. 2 in. high, inside measurements. The special equipment is as follows:

Axles	Carnegie steel
Bolsters	American Steel Foundries
Brake-beams	Simplex
Brake-shoes	American Brake-shoe & Foundry Co.
Brakes	Westinghouse
Brasses	More-Jones Brass & Metal Co.
Couplers	Tower
Door fastenings	Jones
Draft rigging	Miner
Journal boxes	Barney & Smith
Paint	M. B. Sydam Co.
Roofs	Murphy
Springs	Railway Steel Spring Co.
Trucks	Arch bar
Wheels	Barney & Smith

The Terminal Railroad Association, St. Louis, Mo., as reported in the *Railroad Gazette* of March 8, has ordered 10 six-wheel switching locomotives from the Baldwin Locomotive Works for July and August delivery. The specifications are as follows:

General Dimensions.

Total weight	138,000 lbs.
Diameter drivers	51 in.
Diameter cylinders	20 x 26 "
Type boiler	Straight-top, radial stay
Boiler, working steam pressure	200 lbs.
Tubes, number	323
" material	Charcoal iron
" diameter	2 in.
" length	10 ft. 5 "
Firebox, length	9 ft. 5/16 "
Firebox, width	3 ft. 6⅝ "
Grate area	31½ sq. ft.
Heating surface, total	1,914 "
Tank capacity	5,000 gals.
Coal capacity	9 tons

Special Equipment.

Air brakes	Westinghouse
Boiler lagging	Magnesia
Brake-shoes	Perfecto
Couplers	Climax
Injector	Simplex
Safety valve	Ashland
Sanding devices	Leach
Sight-feed lubricators	Nathan
Steam gages	Ashcroft
Tires, driving wheels	Midvale

RAILROAD STRUCTURES.

ALTOONA, PA.—The Pennsylvania, it is said, has given a contract to Armstrong & Latta, of Philadelphia, for a new freight

station, with two transfer sheds, the work to be completed by the middle of July next.

AMHERST, N. S.—Bids are wanted March 29, by D. Pottinger, General Manager of the Intercolonial, for a passenger station at this place.

KENORA, ONT.—Contract has been given to Kelly Bros. & Co., for putting up a large roundhouse here for the Canadian Pacific.

LANCASTER, PA.—The Pennsylvania, it is said, is replacing the bridge at Mulberry street with a new structure.

LITTLE ROCK, ARK.—A permit has been granted by the Building Department to put up a new union passenger station at a cost of about $183,000.

MACON, GA.—The new shops which the Central of Georgia is planning to build at this place will cost $1,400,000.

MATTOON, ILL.—The Cleveland, Cincinnati, Chicago & St. Louis, it is reported, will put up a 40-stall roundhouse here.

MEMPHIS, TENN.—The railroads interested, which for a long time have had under consideration the question of building a union passenger station, have organized a company to carry out this work.

NORFOLK, VA.—The Norfolk & Western Railroad and the Tidewater Railway have plans ready for putting up a joint station at the east end of Main street. The Norfolk & Southern may also use the proposed structure.

OTTAWA, ONT.—The Transcontinental Railroad Commission is asking bids for putting up six steel bridges on the Grand Trunk Pacific.

PRINCE RUPERT, B. C.—The Grand Trunk Pacific, it is said, will at once build a wharf at Porpoise Bay, near this place.

SHAWNEE, OKLA.—The Chicago, Rock Island & Pacific, it is reported, will build a new station and yards to cost $100,000.

SPRINGFIELD, OHIO.—Plans are under way by the Pennsylvania for putting up a new passenger station, also a freight house here.

SUPERIOR, WIS.—The Philadelphia & Reading Coal & Iron Company has given a contract to the Duluth & Superior Dredging Company for the dredging work for its new dock on Superior Bay, which is to cost about $500,000.

TOPEKA, KAN.—The Union Pacific, it is said, will build a 30-stall roundhouse in North Topeka, to cost $64,000.

WINNIPEG, MAN.—The Canadian Pacific has plans for improvements to roundhouses at Moose Jaw and Souris; also at Swift Current, Lethbridge, Strathcone and Cranbrook. N. E. Brooks, Division Engineer of Calgary, Alb., will have charge of the work.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ARIZONA, NEW MEXICO & COLORADO.—Organized in New Mexico, with a capital of $1,000,000, to build a line from a point on the Southern Pacific in Arizona northeast to Farmington, N. Mex., which is on the Denver & Rio Grande. H. B. Cerveny is President, F. McLaughlin, Secretary and Treasurer; C. B. Davis, Chief Engineer, and F. W. Kinne, General Manager, all of Fort Worth, Tex.

BANGOR & AROOSTOOK.—A charter has been granted this company to build an extension from Seboeis, Me., north 140 miles, via Chesuncook Lake over the Allaguash river and St. John divide down the Allaguash river valley past Allaguash Falls to St Francis. The plans for this extension were opposed by the Somerset Railway, that company having planned to build into the same territory from its present northern terminus at Birch Point, on the west shore of Moosehead Lake. The matter was compromised, the Bangor & Aroostook having been granted permission to build on the east bank of the Allaguash river, and the Somerset agreeing not to build within ten miles of that river. A charter has been granted the Somerset to build an extension under these conditions; also for an extension from Birch Point west toward the St. Francis branch of the Quebec Central.

CHANDLER & SHAWNEE.—Incorporated in Oklahoma with $600,000 capital, with office at Chandler, to build from Chandler, Okla., south to Shawnee, 30 miles. W. R. Gulick, F. S. Dimon, J. F. Collar, M. D. Owen, F. P. Hoyt, G. B. Rittenhouse, H. G. Stettmund and W. G. Schlegel, of Chandler, incorporators.

CHICAGO, LAKE SHORE & SOUTH BEND (ELECTRIC).—President Hanna, of this company, which is building 71 miles of road from South Bend, Ind., west to Chicago, Ill., has grading completed for 25 miles and 15 miles of track laid. The company is also putting up a central power house at Michigan City. (Mar. 15, p. 381.)

ELK VALLEY & ONEIDA.—Incorporated in Tennessee with $50,000 capital to build from Elk Valley, Campbell County, on the Southern west to Oneida in Scott County, 15 miles. H. C. Lindsay, C. H. Smith, R. N. Kesterson, R. S. Young and J. O. Smith, incorporators.

INTERNATIONAL TRACTION.—President Pierce is quoted as saying that this company will build during the next 18 months a new double-track line over the right-of-way now owned by the company, between Buffalo and Niagara Falls, connecting at Tonawanda with the Lockport division. Some additional tracks are to be laid in the city of Buffalo to relieve the present congestion.

MEMPHIS RAILROAD TERMINAL.—Incorporated in Tennessee, with $100,000 capital, to build a union station and terminals in Memphis. The estimated cost of the station is $3,000,000 and of the grounds and connections about $2,000,000. A. W. Sullivan, of the St. Louis, Iron Mountain & Southern; S. T. Fulton, of the Chicago, Rock Island & Pacific; C. R. Gay and F. H. Britton, of the St. Louis & San Francisco; J. L. Lancaster, of the Union Railway of Memphis; W. S. King, of the Yazoo & Mississippi Valley; W. J. Harahan, of the Illinois Central; G. E. Evans, of the Louisville & Nashville; C. H. Ackert, of the Southern; J. W. Thomas, of the Nashville, Chattanooga & St. Louis, and John H. Watkins, of the Bank of Commerce & Trust Company of Memphis, are directors.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—Contract has been given to Foley Bros., of St. Paul, and work is to be started at once on a branch line from Brooten, Minn., northeast via Freeport, Royalton and Superior to Duluth, about 200 miles. The proposed line with terminals at Duluth is to cost about $8,000,000.

MISSISSIPPI ROADS.—Application has been made by a company in Mississippi to build a line from Gulfport, Miss., north to West Point, 250 miles, where connections can be made with the Southern; the Canton, Aberdeen & Nashville, and the Mobile & Ohio. This is supposed to be a Frisco project.

NASHVILLE & COLUMBIA (ELECTRIC).—Surveys are being made by this company to build from Nashville, Tenn., southwest to Mount Pleasant, 50 miles. Contract for the work has been let to Patrick Hirsch, of New York.

NEW YORK & PITTSBURG AIR LINE.—This company, formerly the Pittsburg, Johnstown, Ebensburg & Eastern, is selling bonds to secure funds for extending its road. The line is now in operation for about 13 miles, from Philipsburg, Pa., where connection is made with the Beech Creek Railroad at the union station. An extension is projected southwest via Johnstown to Somerset, Pa., where a connection can be made with the Baltimore & Ohio.

NEW YORK CENTRAL & HUDSON RIVER.—A bill is being framed to be introduced in the state legislature, to secure the removal of this company's tracks from the surface at Eleventh avenue in New York City. This line is used mostly for freight. It provides for a side track subway between 30th and 62d streets. From 146th to Spuyten Duyvil the right of way is to be walled up at the expense of the railroad and covered at the expense of the city. Between 122d and 146th streets the railroad will run on an elevated structure. Below 30th street, the bill provides that within eight months after it becomes a law, the railroad company shall submit a plan for improvements, other than an elevated structure, which is prohibited. The railroad company is to have three months from the passing of the law in which to file its plans and make terms under which the improvements are to be carried out, and must complete the work within four years.

NEW YORK, NEW HAVEN & HARTFORD.—Plans to elevate the main line of this company in Meriden, Conn., at a cost of between $2,000,000 and $3,000,000 have been submitted to the local authorities. The work includes two new freight houses, extensive alterations to the passenger station, elevated sidings to factories, and concrete bridges in place of the existing grade crossings.

NORFOLK & SOUTHERN.—The Raleigh branch, between Raleigh, N. C., and Zebulon, 24 miles, will be opened for business March 25.

The Columbia branch, between Mackey's Ferry, N. C., and Creswell, 13 miles, was opened for business on March 18.

NORTH DAKOTA.—Organized in North Dakota with $200,000 capital to build from Olga Township to Edenburg, 21 miles, where connection is to be made with the Great Northern.

NORTH LOUISIANA.—Organized in Arkansas with $150,000 capital to build from Cleora, La., on the St. Louis, Iron Mountain & Southern, east to Lake Providence, 40 miles. W. E. Farrell, of Cleora, President; R. E. Farrell, Vice-President; H. Kahn, Secretary and Treasurer, all of Little Rock, Ark.

OKLAHOMA, TEXAS & WESTERN.—Contract let to Donald Fitzgerald for the entire construction and equipment of this proposed line from Clinton, Okla., to Canadian, Texas, 108 miles.

PENNSYLVANIA.—Bids are wanted April 22 at the office of the Pennsylvania, New York & Long Island Railroad, 85 Cedar street, New York City, for work on the East river division, including the construction of tunnels and approaches and bridge superstructures between points near East avenue and points near Thomson avenue in Long Island City. Specifications and other particulars may be obtained from the Chief Engineer at 1 West 34th street, New York City.

Pennsylvania, New York & Long Island.—See Pennsylvania.

Pennsylvania System.—The record of the mileage of the road on December 31, 1906, shows that the total length of main line on the lines east of Pittsburg and Erie is 5,251 miles, with 1,772 miles of second track, 566 miles of third track, 457 miles of fourth track, and 4,136 miles of company's sidings; a total of 12,182 miles. There was an increase during 1906 of 65 miles of first track, 161 miles of second, third and fourth tracks, and 248 miles of company's sidings; a total increase of 474 miles. On the Pennsylvania Lines West of Pittsburg and Erie, the mileage is 2,865 miles of first track, 1,165 miles of second track, 137 miles of third track, 81 miles of fourth track, and 2,220 miles of company's sidings; a total mileage of 6,468 miles. During the year there was a decrease of one mile of first track, and an increase of 87 miles of second track, third and fourth tracks, and 101 miles of company's sidings; a total increase of 187 miles. The mileage of the Vandalia Railroad is: First track, 923 miles; second track, 65 miles; sidings, 613 miles; a total of 1,601 miles. During the year there was a decrease of five miles of first track, and an increase of 18 miles of sidings, making a total increase of 13 miles. The grand total of all lines, including those operated by and associated in interest with the Pennsylvania Railroad, is 10,978 miles of first track, 3,186 miles of second track, 722 miles of third track, 548 miles of fourth track, and 7,675 miles of sidings; a total of 23,109 miles. Of this 6,110 miles of first track are east and 4,868 miles are west of Pittsburg and Erie.

Philadelphia Rapid Transit.—This company has opened the Market street elevated road from Schuylkill river, Philadelphia, west to the upper Darby terminal station, and cars now run through from Fifteenth and Market streets, four miles, to Darby, using the subway to the Schuylkill river.

Pittsburg, Johnstown, Ebensburg & Eastern.—See New York & Pittsburg Air Line.

Portage Bay & Cobalt.—A syndicate composed of men from Haileyburg and New Liskeard, Ont., is planning to build, under this name, an electric line from Haileyburg, Ont., to New Liskeard, 27 miles.

Quebec & Lake Champlain.—Application made to the Quebec Legislature by J. C. Langelier, of Quebec, the attorney for the company, for permission to build from Quebec to Lake Champlain.

St. Paul Terminal.—Under this name a company is being formed to build a line from St. Paul, Minn., to the stock yards in South St. Paul. The plans include the laying of about 50 miles of new track. The company proposes to put up a roundhouse in South St. Paul. William Mavigny, of Sioux City, Iowa, is President, and Joseph Strawhorn, of St. Paul, General Manager.

Somerset.—See Bangor & Aroostook.

South & Western.—Contracts are said to be let to Carpenter & Moxley, of Knoxville, Tenn., for work on this road from Hill's Station, Scott County, Va., to Guest river in Wise County, 40 miles.

Texas State.—The road from Rusk, Tex., west, in operation for 10 miles, which is owned by the state, is to be extended west 18 miles further to a connection with the International & Great Northern, at Palestine; also from the eastern terminus at Rusk east six miles to a connection with the Southern Pacific.

Texas Traction.—A mortgage has been given by this company to secure funds for construction. The line is under construction from Dallas, Tex., to Sherman, 63 miles. Entrance into Dallas is to be made over the tracks of the Dallas Consolidated Electric Street Railway. The company will build a power house at McKinney, midway between Dallas and Sherman. J. F. Strucklan is President; J. P. Griffin, Secretary, and O. Goodwin, Treasurer. Office at Dallas.

Tidewater Development Company (Electric).—Contracts are soon to be let by this company to build its proposed line from Gadsden, Ala., via Birmingham southwest to Tuscaloosa, 125 miles. (March 15, p. 393.)

Toledo & Defiance.—Incorporated in Ohio with $10,000 capital to build through Lucas, Fulton, Henry and Defiance counties in Ohio. The project is backed by Toledo capitalists.

Walsenburg & Western.—Incorporated in Colorado with $100,000 capital to build from Walsenburg, Colo., northwest via Tolpa and Gardner to Westcliffe, in Custer County, 40 miles, with a branch north to St. Mary in Huerfano County; also another branch through Mosca Pass via the San Luis Valley to Costilla and Saguache counties. E. W. Griffith, F. E. Guy, G. C. Barnard, L. E. Rowland and F. J. Jackson are incorporators.

Wiscasset, Waterville & Farmington.—This company, which operates a narrow gage line from Wiscasset, Me., north to Winslow, 43 miles, has applied for charter renewals of the Maine Light & Power Company, organized to control the development of electrical power along the Sheepscott river from Wiscasset north to Palermo, 30 miles. It also asks for a renewal of the bridge charter to cross the Kennebec river from the present terminal in Winslow to Waterville, which is four miles from the Somerset's southern terminal and junction with the Maine Central.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—This company is said to have bought the branch of the Chicago, Rock Island & Pacific running from North Enid, Okla. T., to Billings, 20 miles. The Atchison is building a connecting line from Tonkawa southwest to Billings.

Bennettsville & Cheraw.—This road, which runs from Bennettsville, S. C., to Kollock, 14 miles, and has been operated by the Chesterfield & Lancaster, has, it is reported, been sold to Pennsylvania capitalists. It is to be extended from Bennettsville to Seller, where it will connect with other lumber lines.

Chesterfield & Lancaster.—See Bennettsville & Cheraw.

Chicago Great Western.—The stockholders have authorized an issue of $3,873,000 additional 4 per cent. debenture stock, making the total outstanding $30,000,000. (Feb. 15, p. 228.)

Chicago, Rock Island & Pacific.—See Atchison, Topeka & Santa Fe.

Chicago Terminal Transfer.—The foreclosure sale has been set for April 25, with $15,140,000 as the upset price. (Mar. 1, p. 290.)

Delaware & Hudson.—This company is arranging for a new entrance into Montreal, Que., through its control of the Quebec, Montreal & Southern. The last named road runs from Noyan Junction, Que., near the New York state line, north to Robert's Junction, which is northeast of Montreal, and near the St. Lawrence river. It also has a line from St. Lambert, opposite Montreal, down the St. Lawrence to Pierreville; its total length is 145 miles. The Napierville Junction is building a line for the Delaware & Hudson from Rouse's Point, N. Y., the present northern terminus of the D. & H., northwest to St. Constant, 27 miles, and negotiations are under way for trackage rights over the Grand Trunk from St. Constant to St. Lambert, and across the river into Montreal, including the use of terminal facilities in that city. Trackage rights are also to be arranged for over the Grand Trunk from Rouse's Point to Noyan Junction. It is expected that during the present year, the Quebec, Montreal & Southern will be extended from Pierreville, 49 miles toward Quebec, and that by the time the Quebec bridge is finished, the road will be further extended, 43 miles to the bridge. When all these plans are carried out, the Delaware & Hudson will have a direct line to Montreal, another to Quebec, and a connecting line along the St. Lawrence river.

This company has acquired $175,000 of the $225,000 capital stock of the Greenwich & Johnsonville, which owns 21 miles of road from Johnsonville, N. Y., via Greenwich to Schuylersville, and is building a branch from Greenwich northeast to a connection with the Rutland & Washington branch of the D. & H. at a point near Salem.

Greenwich & Johnsonville.—See Delaware & Hudson.

Missouri, Kansas & Texas.—Gross earnings for January were $2,293,266, an increase of $600,172; net earnings $741,392, an increase of $360,747.

Napiersville Junction.—See Delaware & Hudson.

New England Railroad.—See New York, New Haven & Hartford.

New York, New Haven & Hartford.—The Massachusetts State Railroad Commission has given this company permission to absorb the New England Railroad, which the New Haven controls and leases. The New England Railroad owns 359 miles of road, including lines from Boston to Hopewell Junction, N. Y.; from Providence, R. I., to Willimantic, Conn., and from East Hartford, Conn., to Springfield, Mass.

Quebec, Montreal & Southern.—See Delaware & Hudson.

Rockland, South Thomaston & Owl's Head (Electric).—The Rockland, South Thomaston & Owl's Head Street Railway was sold by receivers on March 8 to Moses Weil & Sons of Philadelphia for $13,825.

St. Louis & San Francisco.—According to the *Commercial and Financial Chronicle*, this company is to make an issue of equipment notes to pay for 4,500 freight cars recently ordered from the American Car & Foundry Company. The cars are to cost about $5,500,000, and the car-building company will dispose of the notes among the makers of the special equipment for the cars.

Toledo, St. Louis & Western.—An initial semi-annual dividend of 2 per cent. on the $9,952,600 outstanding 4 per cent. non-cumulative preferred stock has been declared payable April 15 to holders of record on March 30.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- A Curious Economic Situation 429
- The Tie Problem Again 429
- Legislative Campaigns Against Railroads 430
- An Increase in Freight Rates 431
- New Railroad Laws in Vermont 432
- The Section Foreman's Work 432
- Difficulties in the 30-day Limit on Tariffs 433
- New Publications 433

ILLUSTRATED:
- Grade Separation in Cleveland on the Cleveland & Pittsburg 440
- The Engineering and Maintenance of Way Association Convention 442
- The Flatbush Avenue Terminal of the Long Island 448
- Ganz Steam Motor Car for the Rock Island 451
- Track Deformations and Their Prevention 453
- Southern Pacific R.R. Building in Sonora. 458

CONTRIBUTIONS:
- Are American Railroads Overcapitalized? 434
- Prevention of Collisions on Prairies 435
- The Profitable Weight and Speed of Freight Trains 435
- The Necessity for Increasing Rates 436

MISCELLANEOUS:
- Freight Traffic on the Great Northern and the Northern Pacific 437
- Uniformity in Specifications for Railroad Construction 437
- The Work of the United States Forest Service on Timber Preservation 446
- Location Surveys for the Eastern Half of the Grand Trunk Pacific 446
- The Orenburg & Tashkend Railroad 448
- Oldest Railroad Junction in the World .. 450
- Grover Cleveland on Attacks against the Railroads 450
- Exhibits at the Maintenance of Way Convention 452
- Buhrer Concrete Ties 459
- Anti-Railroad Legislation 459
- German Comment on American Signaling 460
- Foreign Railroad Notes:
  - Automatic Couplers in Russia 440
  - Italian Traffic Troubles 451
  - Pooling in Switzerland 460

GENERAL NEWS SECTION:
- Notes 461
- Trade Catalogues 463
- Obituary 464
- Meetings and Announcements 464
- Elections and Appointments 464
- Locomotive Building 465
- Car Building 465
- Railroad Structures 466
- Railroad Construction 466
- Railroad Corporation News 468

VOL. XLII., No. 13. FRIDAY, MARCH 29, 1907.

It has been computed on authority that the total shrinkage in market values of the shares of American railroads during a period of 68 days ending with March 14, inclusive, amounted to the stupendous sum of $2,097,000,000, not including shrinkage of bonds. But facts even more striking are annexed to the amazing sum total. The contraction has not been attended with a single failure save one or two of the most trifling character; not a single railroad has defaulted on its bonds in connection with the downward movement; no railroad property has gone into a receivership; and yet the tremendous shrinkage has been resisted by no such quick combinations of individual capitalists, including the great banks, as in late years have been looked for in times of panic and crisis, while the aid against stress of money rates rendered by the federal treasury has been slight, transitory and incidental. Financial history in the annals of nations may be challenged for such an experience and, in its strange but cheering lights, it almost seems as if theories of crises and panics rooted in political economy would have to be re-written. Explanations of the anomaly have naturally been many and varied. It has been said that the shrinkage has been a Wall Street contraction, a statement which has its measure of truth but imperfectly explains the absence of failures. It has been said that the railroad securities have been in "strong hands," a welcome fact if it refers to holders that are conservative, disquieting if it means holders who are speculative. More substantial is the reasoning that sets against the downward perturbations of the market, the commercial and industrial prosperity of the land and some recent warnings of financial craft nearing the rocks to reef sail and change tack. But when all these elements have been reckoned up there remains behind us a twelvemonth in railroads of amazing paradox. Disquietude of investors has been bracketed with national prosperity. Vast financial outlays of the railroads to promote public necessity and convenience have been met by legislative attack on the revenues which make such improvements possible. Railroad stocks have fallen in the face of dividends increased, and rights to new stock have connoted such a fall of the old stock, so that the more rights a shareholder has possessed the poorer he has been. Intrinsic value, usually so potential a force, has yielded to strange and fantastic workings of the law of supply and demand. The end is not yet, the major prophets are confused and the minor augurs cannot read the financial viscera. But whatever the outcome of the medley of prosperity-at-large and Wall Street adversity, of railroad regulation and railroad expansion, and of sharp fiscal contraction without disaster, the final round-up, when it comes, will close an epoch rich in strange phenomena for the analysis of historian and economist.

THE TIE PROBLEM AGAIN.

The report of the committee on ties of the American Railway Engineering and Maintenance of Way Association, which was presented at the annual meeting last week, says in the beginning: "In view of the present condition of the tie supply and the possible future supply, it does not seem wise to adopt as standard large-sized ties (7 in. x 8 in. x 8 ft. and 7 in. x 9 in. x 8½ ft.), and the committee recommends smaller sizes, beginning with 7 in. x 8 in. x 8½ ft., for first-class track and running down to 6 in. x 8 in. x 8 ft. for third-class track." This is proof enough of the difficulty of obtaining large ties. Had the committee recommended what, in their own minds, they must have believed to be the most suitable sizes, considered from an engineering standpoint, they would have increased the proposed sizes rather than decreased them, but apparently they were compelled to adopt, not what they wanted, but what they could get. In another paper presented at the same meeting, Mr. O. E. Selby recommended 20 ties to a 33-ft. rail, each tie to measure 7 in. x 9 in. x 8½ ft. He based this recommendation on a study of the stresses in track superstructure under the loads of present practice. The contrast between these two recommendations, presented at the same meeting, is food for thought.

The committee was also directed to report on the design and use of concrete and steel ties. Only a partial report was made, however, covering the subject of concrete ties. The information presented is instructive, but not encouraging. A record is given of 19 different types of plain concrete and reinforced concrete ties which have been tried in track in the United States and Europe during the last eight or ten years. Almost without exception they have been complete failures wherever they have been tried under reasonably

severe conditions. The causes of failure have all been the same—namely, the lack of elasticity of concrete. Most of the ties broke or crumbled under the rail or in the center of the track, while others were completely destroyed after derailments. This lack of one essential element of a cross tie is inherent with concrete as a material of construction. Various methods have been tried to overcome it, but wood cushion blocks, tie plates and other expedients have all failed alike.

While the report does not include any data regarding steel ties the knowledge gathered piecemeal from other sources is hardly more encouraging than the results summarized for concrete ties. In one or two instances a large number of steel ties have been put in track, and have, apparently, given the best of satisfaction, but the steel tie of to-day is far from being an ideal substitute for the wooden tie.

So far, three serious objections have been raised to most of the existing designs of steel ties: First, the method of fastening the rail to the tie is crude. To this may be largely attributed the decision of the engineers of the Pennsylvania Railroad to take out the steel ties near Mineral Point, Pa., following the derailment of the 18-hour train on February 22. When the wheels were derailed and dropped down on the ties they cut and sheared all, or nearly all, of the fastenings and, in the estimation of the engineers, the damage to track and rolling stock was much greater than had wooden ties been used. As was pointed out last week by Mr. Shand, this decision on the part of the Pennsylvania was in no way a condemnation of the principle of the steel tie.

Second, such steel ties as have been tried have generally proved to be either too weak or too stiff, and have either failed themselves by crushing, or have resulted in broken rails. On the Bessemer & Lake Erie they have had comparatively little trouble with broken rails, but on the New York Central, where some ties of the same design were tried, the rail breakages were enormous. The need for further experimenting along this line is obvious.

Third, metal ties introduce the serious problem of insulation where automatic block signals are installed. This last, while perhaps it is a serious objection at the present time, is not necessarily a permanent or a prohibitive objection. If the time comes when steel ties are uniformly acknowledged to be the only feasible substitute for wood ties and wood ties can no longer be obtained in any quantities, the problem of insulation, if it cannot be solved directly, will have to be overcome by the skill of the signal engineer in devising some system of signaling which will not require one rail to be insulated from the other. The art of signaling is in its infancy, and what has already been accomplished can be far surpassed if the necessity arises. On this score, therefore, the steel tie need not be condemned.

THE LEGISLATIVE CAMPAIGNS AGAINST RAILROADS.

The owner of railroad securities, were he to look merely at the volume of railroad measures pending now before our state legislatures, might well be appalled and tremble for his dividends. In almost every large state of the Union the bills swell into multitudes, and they are as varied as they are voluminous. "Crank" bills crude and undigested, jostle measures painfully wrought out by wiser heads or organizations of heads. Rates, layouts, taxes, passes, stations, construction, demurrage, hours of labor, commission powers—dozens of other subjects, large or trivial in their range, load the tables of legislative railroad committees who, in these times, if faithful to duty, must be inclined to envy the lot of a juryman in the Thaw trial. Nor is the number of these measures which become positive law contemptible. Take the Kansas legislature which has just adjourned, as an example though perhaps a superlative one. It had 73 railroad bills before it and passed 10 which, inclusively, reduced rates and the hours of railroad labor, regulated speed of freight trains, prohibited free passes, provided for reciprocal demurrage and enlarged the powers of the state commission. And, in some other states, the gross product of new railroad statutes promises to be as large as in Kansas.

The state of Kansas, somewhat famed for drastic experimentalism in other directions than railroads, must not be passed by without reference to another of its new railroad statutes. The text is not at hand. But its description as a law "to authorize the state board of railroad commissioners to intervene in interstate commerce cases" is rich in suggestion. It outlines a situation which day by day grows more striking, namely, the clash of the powers and jurisdiction of the interstate commission and of state authority. Theoretically interstate and intrastate commerce seem clearly enough separated; practically they are not so and, at points, they fall into a vague and more or less undefined region of state and federal authority. Just at the present time both federal and state restriction of railroads is being pushed fast and far and collision of the two is inevitable. Indeed it begins to look as though the long and indeterminate conflict of reserved rights of states as against centralized federal power would have, in the regulation of railroads, one of its most interesting and significant readjustments. From such a conflict the real equities may emerge and federal authority thus be a haven of safety for corporation craft distressed by the winds and waves of state legislation.

But, quite apart from the federal beacon light of hope, toward which some of the railroad corporations have begun to turn, there are other grounds of assurance that the legislative campaign against the railroads is not to end in disaster. It takes now a mature man whose mental eye was observant in the early seventies to recall the frenzy of the granger movement of that time against the western railroad corporations. The movement did not include many states, it did not include railroad problems so complex as they are now, and it was not "up against" interstate federal statute as distinguished from the federal constitution, but its violence far surpassed the present anti-railroad campaign which, temper alone considered, must be classed relatively as sobriety. "The western prairies are on fire set by a locomotive spark" is remembered as a lurid newspaper headline of the time that aptly described the legislative and popular outbreak. But the movement ran quickly to seed. Three years sufficed for its undoing. The "Potter law" went down after working but minor and transitory ills; and all this came to pass with granger assent and before the granger organization had lost much of its popular strength. Yet then, as now, the railroad investor, beset not only by the granger terror but by the grim realisms of the financial panic of 1873, was loud in his prophecies of enduring calamity.

The sober study of legislative campaigns against certain vested interests, not all of them railroad interests, like the gust of anti-corporation law-making through which the country is now passing, will always bring to light certain reactionary and conservative forces apt to be overlooked. One of them is the underlying desire of the electorate and its legislative representatives alike not to "hurt" the state; and the instant any such hurt becomes apparent the conservative reaction sets in. Let any attack on honest capital go beyond a certain limited bound and the hurt is sure to reveal itself in contracted enterprise and the slackened industry that constituencies see and feel and are quick to remedy if they can. The principle works out more slowly in the scattered agricultural communities of the west than in the factory and mercantile communities of the east, but it works out just the same; and, in the present period, it is the more likely to work out the quicker because general prosperity is apt to be sensitive to its own interests. If the granger movement beginning in 1873 could so soon die out notwithstanding the sting of industrial depression, even shorter life may be inferred for any really unjust anti-railroad law conceived during the prosperities of 1907. Philosophy may carry the idea further and count amid many evils of our national mania of materialisms one good at least, that is to say, the tendency to resist too radical attack on material interests.

Besides the foregoing principle of comfort bed-rocked in American experience there are minor elements of cheer to be descried in the pervasive anti-railroad campaign of the state legislators. Of the new laws not a few are levelled at actual evils. Some of them—like the anti-free pass statutes—positively benefit the railroads financially. Other new statutes are hybrid in their character varying with their local application. For instance new two-cent fare laws that will work hardship to railroads of the far west and northwest may prove fiscal angels in disguise to lines of the central west and east of higher passenger density. Some betterment of the intelligence of state railroad commissions may also be looked for from their new burden of responsibility involving, as it does, liability to judicial review. Finally and from the higher viewpoint it may be said that the anti-railroad legislative drift, in so many states, besides its warning to high finance to stop going wrong and to begin going right has, with all its possible evils, other possibilities of rational readjustment of relations of railroad and state. The new laws bring the two into closer touch and even if the contact is, at first, one of controversy, out of such controversy searched by practical experience come ultimate compromise and peace.

AN INCREASE IN FREIGHT RATES.

At the present time, in the face of a complex railroad situation, with gross earnings showing a tendency to increase, but not to increase rapidly, and with operating expenses showing a tendency to increase very rapidly indeed, while railroads everywhere are being made the object of political attack, the question whether or not there should be a general increase in freight rates—and, if so, how it should be brought about—is of great and pressing importance. Briefly summarized, the reasons why freight rates should be increased may be stated as follows: There has been a general increase in wage cost, amounting to about 30 per cent. in the last five years. There has been an increase in the cost of materials, amounting to fully 30 per cent., as compared with the schedule five years ago. There is great need for terminal extension at the larger points, but the cost of real estate at these points has increased greatly in the past few years, the increase varying in different localities to such an extent that it cannot readily be expressed by an average figure. There has been a widespread and heavy increase in the burdens placed on the railroads by the communities and commonwealths which they traverse in the form of materially higher taxes. In short, within the past few years, there has been a radical increase in practically everything the railroad has to buy, excepting, possibly, fuel, which has remained more or less stationary, while the transportation which the railroad sells has tended downward, although not quite uniformly.

As against these facts, the objections to an increase in freight rates may be summarized by saying that, in general, the companies are afraid to take any step which may aggravate the hostility of the state legislatures, while a few roads can be cited, like the Lackawanna and the New Haven, the first with its anthracite, the second with its l. c. l. tonnage, which enjoy a better average rate than their neighbors, and are not only able but willing to do business on the present basis. In other specific instances it is probably true that present rates on many commodities are too high, and that the owners and managers are in position to gain rather than lose by a reduction, and would lose rather than gain by an increase. It is of interest to study these outline specifications more in detail with a view to determining, so far as possible, what the necessary and just policy of the railroads should be, although it by no means follows that they will be able to carry out the policy which is just, both from their own standpoint and from that of their patrons, in the face of two-score hostile state legislatures.

President Oscar G. Murray, of the Baltimore & Ohio, points out, as first in importance, a fact in this connection, the moral of which is perhaps not fully appreciated or at least clearly formulated in people's minds. The abnormal volume of traffic which has been brought about by the unparalleled wave of prosperity which has swept over the country has been too great for existing facilities, and it has been almost impossible for the railroads to increase their carrying capacity fast enough to handle it with reasonable promptness and satisfaction to shippers and railroad alike. In the effort to do so, increased equipment, trackage and terminal facilities have been required, and have cost far more than they would have cost several years ago. This much, of course, is known to all. The important thing in connection with it is that the cost of providing the additional facilities has been disproportionately high in comparison with the earnings from these facilities. The railroads, as common carriers, are under strong obligations to provide for their traffic, and they have been forced, during the past year or so, to expend sums in excess of any immediate return, while they have been saddled for all time with the high capital cost incident to providing these facilities at a period when wage cost and material cost are at their highest. Besides all this, it must be kept in mind that a railroad cannot buy materials and employ labor without also employing money, and the cost of this money has been driven up to a point where it is now practically out of reach for new construction, especially for new construction by the roads which need it most, simply because the great facilities needed to handle the great traffic have created a demand for money exceeding the supply. It is scarcely necessary to point out that new issues of railroad bonds are all but unsalable at present, and issues of new stock would entail so great a sacrifice that they are not even to be thought of. Almost the only device left for procuring capital, however urgently it may be required and however strong the security behind it, is the issue of short-time notes, which will probably cost the railroad company 7 per cent., and which are a source of great hazard when issued in sufficiently large quantities by a great number of companies, because they are a temporary expedient and must be funded at whatever cost, in a few years' time when they fall due.

As regards the increase in costs of material, there are plenty of figures at hand. It has been pointed out by a railroad in the West that the cost of its plate girders has increased nearly 64 per cent. in the last decade; the cost of its pine fencing, 122 per cent.; of pine bridge stringers, 109 per cent.; of oak ties, 65 per cent.; of spikes, 18 per cent.; of rails, 55 per cent.; of cast-iron pipe, 63 per cent.; of car wheels, 53 per cent. In the East the President of the Norfolk & Western writes that the prices of all staple supplies required by his railroad have increased very materially in the last five years, and that in a number of important items the increase has been 50 per cent. or more. The President of the Chicago & Alton writes that within the last ten years the average increase in the cost of material entering into the operation of his railroad is about 54 per cent.

As regards labor, Mr. Felton reports an increase ranging between 15 and 30 per cent. within the past decade. Mr. Johnson reports an increase of 10 per cent., 1907 and 1906. Mr. Murray reports that the advance in wages on the Baltimore & Ohio, 1907 over 1906, will amount to approximately $2,500,000 a year, and adds: "The trainmen who had their wages advanced in January haul the same train the same distance and are not any more competent than they were in December; the company, therefore, must look to the traffic handled by the road to reimburse it for this heavy increase of expenses. This must come from earnings in the same way that the head of a household looks around for more money to meet the increased cost of supporting himself and his family."

The increase in the burdens placed upon the roads in the form of taxes does not submit of averaging. It is extremely severe in the Northwest and follows no rule nor fixed principle, but represents a constant piling on, which appears, unfortunately, to be based neither upon valuation nor upon earnings, but upon a frank desire to make the railroads pay more, regardless of where the money is to come from. Even on the Norfolk & Western, running through a part of the country where agitation against railroads is less specific and less severe than it is in many localities, the taxes per mile of road have increased 109 per cent. in the last five years.

As regards real estate costs, specially itemized as an important and often neglected item in considering the general upward tendency of prices, it need only be pointed out that the great terminals of the country are already being worked at the limit of their capacity, or close to it. To quote W. C. Brown, Senior Vice-President of the New York Central: "When you talk about increased terminal space on Manhattan Island you have to figure on covering every piece of real estate you want with gold." To all intents the city is driving out its railroad freight terminal business, and the wholesale business must sooner or later follow. The terminal problem in Chicago, in St. Louis, Cincinnati, St. Paul and a long list of other central points is fortunately not quite as bad as it is at New York City, so far as real estate prices governing expansions are concerned, but it is, nevertheless, a problem of the first magnitude, involving not only charges on the first costs of land, but subsequent taxes on gilt-edge property situated directly under the eyes of the tax commissioners.

If undue space has been given in presenting facts already well known, it is only because these facts have changed so rapidly and taken on an aspect so serious within the past year that they must be considered anew. The cost of everything that the railroad buys and of everything which it employs, including not only men but money, goes up and up, and against all this there is but one source of income in the last analysis—the charge for transportation. Even this source of income is under savage attack at present, so far as passenger rates are concerned, in approximately three-quarters of the states of the Union. The present situation, with practically every state legislature concerned in passing bills limiting passenger rates to 2 cents a mile, is an extraordinary one, and the legislative action in the states reflects no study of economics or of operating costs, but seems to be simply a popular craze, a sort of political slogan. That freight rates have not been so widely tampered with cannot be attributed to the fact that the state legislatures are content with them, but to the fact that they come only partially under local jurisdiction, and are not amenable to the same kind of off-hand treatment. This enforced reduction in passenger rates in the thinly populated parts of the country, coming at the same time with universally increased costs of operation, stands as the final reason why freight rates should be increased. Such increases have been made already in some instances.

At a recent meeting of the officers of roads representing the

Eastern Ohio and Western Pennsylvania Coal and Traffic Associations and the Ohio Coal & Traffic Association, a general increase in the rate of bituminous coal was referred to a committee, of which Joseph Wood, head of the Pennsylvania Company, is chairman, and committees were appointed to discuss reclassification of certain commodity schedules and an increase in the minimum carload. As regards grain traffic, there is to be an increase in the rate from Illinois to the seaboard, averaging 1 cent per hundred pounds, effective April 1, and the old distinction between winter and summer rates will be abolished. It is understood that rates to the Gulf will be advanced proportionately, and that the export basis will be advanced from 10 to 13½ cents. Ore, coke and limestone in the Pittsburg district have also been made subject to a small increase, as have the rates on lumber and various forest products in the extreme Northwest. It will probably be generally agreed that the tendency of the past decade has been that far too great a proportion of total freight has been hauled under the commodity class, especially in trunk line territory, and it seems right and natural that many articles now so apportioned should be redistributed so as to take class rates. With a slight general increase in rates on the commodities having the largest movement, and a better apportionment of general freight into classes, it is probable that satisfactory provision can be made, at least in part, to take up the greatly increased costs of the present period. It is surely important that the railroads mostly concerned should take an active and not a passive attitude in this respect, and should show, in a spirit of all fairness, that their income must at least be adjusted to meet their expenses, and that this cannot be managed if the expenses constantly tend upward and the income constantly tends downward.

New Railroad Laws in Vermont.

In the midst of the multitude of words about radical railroad legislation in the central and western states, the modest and conservative state of Vermont has usually been left entirely out of the account; but a reference to the laws passed by the Green Mountain State in the legislative session which ended last December shows that there is no need of going west of the Alleghanies to find examples of drastic railroad regulation.

From the dozen or more of these acts which affect railroads, we summarize the main points as follows:

The most comprehensive railroad act, No. 122, approved December 7, contains 13 sections, and it empowers the railroad commissioners on their own motion to correct any railroad rate found to be unreasonable and fix a time within which the order shall be complied with. Appeal may be taken to the Supreme Court, but this process shall not stay or vacate the order of the commission, unless the court, for good cause, shall order a stay. In case, after such suspension, a rate reducing order of the commissioners is affirmed, the railroad must refund the overcharges to all who have paid the old rate. Railroads are to be held responsible for shipments through to destination, while in the custody of other companies. Tariffs must not be raised except on 30 days' notice. Passes are forbidden, with the usual exceptions. Among those excepted are the railroad commissioners and their employees. Express, parlor car and sleeping car companies are brought within the law; and the term "transportation" includes all vehicles and all service such as refrigeration, storage, etc. Demurrage must not be collected on freight until after four days. Shippers must be furnished with cars within four days; penalty, $1,000 fine and whatever damage the shipper may have suffered. If a shipper unnecessarily orders or retains a car he shall answer in damages to the road. Where a railroad has complied with an order of the commission to provide additional equipment or rolling stock, it shall not be liable for failure to furnish cars if the failure is occasioned solely by shortage of rolling stock. Both shippers and railroad officers are liable to $1,000 fine for violation of the law, and the penalty for receiving or giving a rebate is $1,000 fine, or imprisonment for one year.

Section 20 of a law approved December 13 requires railroads to interchange traffic at connections and to do this fairly as between rivals, where there are two or more connections. The railroad commission has power to determine the times of connecting passenger trains. A competing road aggrieved by an order of the commission in this matter may petition for a hearing and modifications, and the Chief Judge of the Supreme Court may, upon proper petition, hear an appeal from a decision of the commission. Railroads must establish suitable stations and shall not abandon a station without permission from the board, and after public notice. A conductor or engineman running on the time of another train, without proper authority, is subject to a fine of $1,000. A railroad employing or retaining a conductor, engineman, brakeman, switchman, signalman, train despatcher, train-order operator or motorman who uses intoxicating liquors as a beverage, such fact being known to the President, Superintendent or any Director, shall be fined not more than $3,000 and not less than $300; and any such employee intoxicated on duty is subject to a year in the state prison or a fine of $500.

Act No. 119 empowers the railroad commissioners, when requested in writing by three or more freeholders, to order gates, electric signals or flagmen at railroad grade crossings, and to make suitable regulations for the management of crossings.

Act No. 121 forbids the collection of more than 10 cents excess fare on trains, and the excess must be refunded on demand within 30 days. Act No. 125 provides for the abolition of grade crossings. The commission may act on the petition of the selectmen of a town, or on its own motion. Each railroad must remove at least one grade crossing every year for each 80 miles of its line, unless the commissioners shall exempt it. The exemption must be only for the current year, and be given only after a hearing. Not over one crossing shall be abolished in any one town in the same year without the consent of the town. The commissioners shall designate which crossings shall be removed first. They shall apportion the expense, not over 25 per cent. to the state and 10 per cent. to the town; but where a highway has been laid out since the railroad was built, the town may be assessed 15 per cent. The state shall not be required to pay over $25,000 a year toward abolition of crossings. The act makes suitable provision for appeal to the courts.

A new railroad commission is provided for, and the members are to hold office for six years, one being appointed every two years. The Governor shall biennially designate a member to be chairman. The commission has the power of a court of record, both at law and in equity. Appeals shall be taken to the Supreme Court in the county where the cause arises. The commission has general supervision of all railroads, both steam and electric; and must examine the road, equipment and other property every year. All accidents must be reported by the roads to the commission, and if a passenger is killed or seriously injured by collision or derailment, notice must be given by telegraph. The board shall inquire into the cause of every fatal accident and into others if it sees fit. It shall hold public investigations if deemed necessary. In public investigations persons known to have been injured are to be summoned, and the state's attorney must be notified so that he can investigate the cause, call witnesses and represent the state at the hearing. The railroad must produce the trainmen, etc., free of expense to the state. The board must publish its conclusions.

The board has jurisdiction to hear and determine questions connected with crossings, location of stations, fences, tracks and bridges, time and connections of trains, issues of stocks and bonds to prevent overcapitalization, and the manner of operating railroads generally. It may establish a uniform system of keeping railroad accounts, making the same conform, as far as practicable, to the systems in use in the other New England states, New York and Canada.

For all these multifarious responsibilities the commissioners are to receive salaries of $1,200 each, with an additional $300 for the chairman.

The Section Foreman's Work.

The *North-Western Bulletin* has in its February issue portraits of 15 or 20 veteran Section Foremen of the Chicago & North-Western, mostly old-timers, and it is an interesting and unique exhibit. Every railroad man of experience knows that the work done by these men is at the very foundation of our most elegant and dazzling superstructure—the palatial train, traveling at top speed—but not every one, even in the railroad service, realizes the importance of foundations, or what sturdy mental and moral qualities are to be found in this branch of the service. These pictures serve to recall this point. In some of the groups the physiognomy is as fine as would be found in some groups—perhaps the average group—of artists, business men, clergymen, or town or county officials. A list of about 100 of these track men, on the Wisconsin division, contains the names of ten who have been in the service over 30 years, and 15 more whose record extends over 20 years or more. The effete Easterner who still looks upon "the West" as a new country, is by this list reminded of his error. Henry Flentge, Charles Hofert, J. F. Kahl, F. L. Horn and M. Flaherty have been in the North-Western service 40 years or more. The bulletin has articles by some of the section foremen, from two of which we copy:

A. Smith, Iowa.—I have one man who always does Sunday and holiday track walking. I think it is better to have a trackwalker and hold him strictly responsible for this work. He should start over the track at 7 o'clock in the morning and the foreman should be on hand at that time and see that the trackwalker takes the flag and torpedoes and necessary tools, reporting to the foreman when he returns.

On some sections trackwalkers start over the track at 5 o'clock in the morning and return about 7. This should not be done. Track inspectors should start from the toolhouse and not from their homes, and if the foreman is at the toolhouse when the inspector starts there will be better inspection.

J. Brown, Colorado.—In case of heavy rainfall, track men should

make their inspection right then and not wait until the rain is over, or perhaps to get a meal or possibly a few hours' sleep. I have known men that think because they have made their inspection right after the rainfall that the danger is all over. That is when I think the greatest danger comes in, when the high grades and cuts are soaked with water and a slide is liable to take place at any time. Also in sloughs where muskrats have undermined track, it will settle then if at any time. For at least 24 hours after heavy and long rainfalls track should be inspected frequently. In cold weather track should be inspected first thing in the morning, as broken rails are usually found between the hours of 4 and 9. Of course, in extreme cold weather an inspection in the afternoon should also be made.

I think a regular track inspection should be made during hot weather between the hours of 2 and 6 in the afternoon, as then is when the track is liable to get too tight and kink, and especially on double-track where traffic is all one way.

I usually have one man do my track inspection, as it is easier to make one man familiar with the weak points than a half dozen, and no matter what gang it is, there is always a choice, and I think the brightest man should be used for that purpose. In a period of 18 years' service which I have put in for this company as foreman I have never had a car wheel on the ground caused by condition of the track.

The Interstate Commerce Commission, in a tariff circular issued this week, recognizes that "there is a limit beyond which a freight agent cannot reasonably be expected to know the rates for terminal service at distant points." This is a ray of light. Everybody, including the Commissioners, must know that for every station in the country to bill through to every other station, with all conditions for all kinds of commodities fully set forth on the waybill, would be impossible, or, if possible, utterly absurd and unnecessary; but this is the first time that the fact has been officially recognized. Every congressman and every legislator seems to assume that billing freight and making the prices on it are as easy jobs as mailing a half-ounce letter. The Commission's latest circular also brings to light a number of other difficulties which have developed in the application of the 30-day limit rule in the issuance of tariffs. These circumstances and others like them show the wisdom of the Commission's recently reported decision to appoint agents to represent it at Chicago and other principal cities. To continue the old practice of dealing with all complaints directly would be scarcely less childish than for the Supreme Court at Washington to attempt to act as the trial court in the hundreds of cases that come before it yearly. It is not likely that the local representative scheme will go far toward curing the various administrative troubles connected with the revised law, but it will at least put the rate regulating business on a rational basis. If an agent has to spend most of his time in approving commodity tariffs on special lots of scrap iron, or on carloads of water melons returned to shipper because of a slump in the market, it will at least serve to illustrate the beauties of the Texas idea, and possibly promote a return to sensible practice.

NEW PUBLICATIONS.

The Walschaert Locomotive Valve Gear. By W. W. Wood. New York: The Norman W. Henley Publishing Co. 6 in. x 7½ in.; 193 pages, 38 illustrations in the text, 4 folding plates. Cloth; Price, $1.50.

In his preface the author calls attention to the lack of a book devoted to the analysis of the Walschaert valve gear and announces that this book is intended to supply the deficiency. It is a pity that he did not devote more attention to the analysis that is lacking and answer more fully than has yet been done, how and why the motion is designed as it is. The opening pages are devoted to a rather elaborate and discursive description of the way in which the Walschaert gear could be developed from the simple direct-connected valve motion, but there is nothing to tell clearly and directly in easily remembered words how the device works, and the reader must study this out for himself, aided by the two valuable adjustable diagrams that accompany the book. In the section devoted to the designing of the motion, there is nothing to indicate the proportions to be adopted between the various parts of the combination lever, the proper location of the attachment of the union link to the crosshead, or the location of the eccentric rod pin in the lower end of the link, of the point of suspension of the radius bar or of any of the details of the motion which are of such vital importance to the proper action of the mechanism. The book, however, does give a good deal of information regarding the operation of the motion that will be of value to those who are to use it. In fact, it is quite essential that enginemen should know what the book can teach. But even this could have been improved by making the engravings to a somewhat larger scale. As it is they are so small, for the most part, that it is exceedingly difficult to decipher the details.

There are a few statements regarding the motion that should be corrected, and one is to the effect that American locomotive designers had been casting about to find something to take the place of the Stephenson gear and hit upon the Walschaert; for the inference is that they did not know of it, which is far from the fact, and the men who stand foremost in its introduction are the ones that are most emphatic in their statements that it possesses no advantage in the matter of steam distribution over the Stephenson gear. More than this, it has been in continuous use for many years on at least one American railroad. Also the statement that it has never been explained why Walschaert never rose above the position of foreman on the Belgian roads, needs withdrawal in the next edition, for it is generally known to be because he was not a technically educated man and so was not eligible for promotion. These are minor matters, but are worthy of correction.

The third division of the book takes up the advantages of the Walschaert gear and recites those that are regularly set forth by its advocates and as generally conceded, closing with a catechism on the motion, in which methods of handling and disconnecting are set forth in a way that will be of value to enginemen, and, with the general description of the operation that has preceded, makes the book worth having.

The Design of Steel Mill Buildings. By Milo S. Ketchum, C.E. New York: The *Engineering News* Publishing Co. 480 pages; 6 in. x 9 in.; 212 illustrations. Cloth. Price, $4.00.

To the title given above, there is added inside the covers "The Calculation of Stresses in Framed Structures." It might perhaps be better to consider the work as a valuable treatise on framed structures than to think of it as limited to mill buildings, which indeed it is not. Presupposing enough general information regarding steel frame construction to enable one to read intelligently, this work is complete in itself. Starting with the general classification of mill structures, it deals with the weight of trusses, snow, wind, dead and moving loads, and sets forth the methods that should be pursued to sustain them. The chapter on graphic statics is remarkably clear and complete. Starting in with definitions of the equilibrium of forces, it takes the reader through the successive steps of the polygon of forces and beam reactions to their natural goal, in this case, the stresses set up in framed structures. These are handled graphically as well as mathematically and in a manner of extreme simplicity. The whole second part is occupied with this section of the work and extends through 153 pages. It is not until the third part is reached that we come to the subject matter suggested by the leading title of the book; and, here basing the principles upon what has preceded, the subject is treated exhaustively and in a way to hold the attention and interest of the reader. These principles are too often neglected by those who have to do with mill and shop construction, and it will be well to remember the author's statements that "in railroad shops and factories turning out heavy machinery or a similar product, foundations for the machinery are required and convenience in handling material are the most important" considerations, at the same time, where large numbers of men are employed, "the principal items to be considered in designing are light, heat, ventilation and ease of superintendence." Throughout this part, the whole subject is handled with minute and careful attention to detail that leaves little to be desired. This includes not only the ordinary trusses and columns of the building but its covering and the use of corrugated steel for both roof and side sheathing. The floors, foundations and partitions receive due attention, closing the book proper with a chapter on paints and painting. After this there is a chapter on cost estimation, showing the methods that are to be pursued and the allowances that are to be made. Figures from the cost sheets of various firms for different pieces of work are given, with examples of specific jobs.

Part IV. contains a description of a number of notable and typical buildings, and this is followed by a set of carefully drawn specifications for steel mill buildings; ending in a series of problems in graphic statics and the calculation of stresses.

It will thus be seen that the book will serve very well to supplement, not only the elementary books on stresses but the more elaborate treatises on bridge design, and as such it cannot fail to be a most valuable assistant to the student, the engineer and the architect.

Handbook of Mathematics. By J. Claudel. Translated and Edited by Otis Allen Kenyon. W. New York: McGraw Publishing Co. 708 pages, 6½ in. by 9½ in.; 422 illustrations in the text. Cloth; price, $3.50.

This book is another example of the careful and painstaking work that French and German authors put into their scientific publications. The title page states that the book is intended for engineers and engineering students, but it is primarily a reference book in which there is a resumé of the whole range of mathematical science from the rules and definitions of elementary arithmetic to differential calculus. To do this within the compass of a single volume requires brevity and care and a total avoidance of all repetitions. This has been done, and done not in a cursory way, that leaves matters so at loose ends that the value of the book is in-

jured, but thoroughly and well. It would, perhaps, be saying too much to assert that a person totally ignorant of the first elements of mathematics could, by the aid of this book alone, become an expert, but for one who has once trodden the path, even in part, and learned how to work or to use the principles set forth, it should be all sufficient for a regrounding in those principles. In fact, its principal abbreviation from the ordinary text books lies in the absence of the mass of examples for practice which they usually contain. The section on geometry, for example, is greatly abbreviated as compared with the ordinary text book, in its demonstrations, and yet is quite sufficient to brush up the hazy recollections of the man who has once been over the ground. All through the book there are analyses of operations that are invaluable demonstrations of principles, and in this it is much superior to many of the regular text-books that are too frequently content with the mere statement of a rule without any attempt to explain the reason underlying its formulation; thus leaving the student with mere parrot-like information that rapidly fades from the memory unless it is kept in constant service. For those who have learned mathematics from the surface only, and who need an assistant that will bolster them up and help them over weak places, as well as for those whose knowledge is simply rusty from disuse, this translation of M. Claudel's work will be invaluable.

Annual Report of the Smithsonian Institution for 1905. Washington, D.C. 576 pages; 6 in. x 9 in. Cloth.

The opening pages of the volume contains the report of the secretary, which, with the appendices, gives a full account of the working of the Institution and the National Museum for the year. Few people have an idea of the magnitude of the work that is being done in those quiet buildings on the Mall, and the growth of the museum is more rapid than its facilities. For example, more than 30 carloads of material in the fields of ethnology, mineral technology and other branches of the useful arts have been received from the Louisiana Purchase Exposition, and this is but a fraction of the whole. In the department of ethnology a great deal of work has been accomplished, especially in the field of Indian research. The work of the astrophysical laboratory has continued in its investigation of stellar heat, and it has now become possible to design a bolometer whose action can be calculated in advance, and by which a sensitiveness, hitherto unattainable, can be reached. These are two of the more important lines of research work that is being prosecuted but are far from being all.

The volume concludes, as usual, with a number of articles of scientific interest and value, culled from various American and European sources. In these, as in previous years, the extracts deal, for the most part, with the refinements of pure science, though there is among them an article dealing at length with the development of the Rhodesian railroads.

Mathematical Drawing. By G. M. Minchin and J. B. Dale. London: Edward Arnold. New York: Longmans, Green & Co. 145 pages; 6 in. x 9 in.; 102 illustrations. Cloth.

Most engineers after they have cut their connections from higher mathematics for a time find that there is a haziness that obscures their recollection as to the ways and means to be followed in the quick determination of certain problems that may present themselves. The time required to review past work and brush up on obscure points is sometimes considerable and out of all proportion to the results that are to be obtained. As a guide to a shortening of this time and an assisting in the graphic solution of such problems the book under review will be very valuable. It is not an elementary book and presupposes that a good deal of mathematical theory is within the knowledge of the student. It does not deal at all with the usual problems of dividing straight lines and circles, with which text books abound, but starts in at once with the graphical production of the scale, and the linear representation of it. This is followed by a demonstration of the theory of Amsler's planimeter and the method to be followed in using the instrument for the determination of centers of gravity and moments of inertia. With such an introduction as this, the book swings naturally into the construction of comics by metrical methods, in a way that is simple and clear, provided only there has been a sufficient preliminary training on the part of the student to understand. The construction of the various forms of the cone-section with certain given details is fully explained. Closely allied to this is the work on the catenary curve. Only a few pages are devoted to it, but those few are so well utilized that, with the instructions given, it should be easy for almost anyone to either draw the curve to meet a given set of conditions or calculate deflections and stresses with accuracy. Other forms of curves such as the Cartesian oval, the oval of Cassini and the lemniscate of Bernoulli, are handled with equal clearness. The book is, therefore, not one that will be in popular demand in ordinary work, but it is one that stands by itself in this peculiar method of grouping and handling the problems that sometimes confront the engineer, and whose solution can be effected most satisfactorily by the graphical method.

CONTRIBUTIONS

Are American Railroads Overcapitalized?

New York, March 22, 1907.

To the Editor of the Railroad Gazette:

The General Managers' Association of Chicago has recently issued a pamphlet containing some general data relative to the railroads in the United States and those of the leading European countries. In some instances the figures refer to the operating results of 1904, in others to subsequent years.

However, in the following study the comparisons being compiled in round figures only, they are sufficiently accurate to be used as a basis for argument.

At the outset, it should be noted that the average freight rates on European railroads are 100 per cent. higher than those charged by the American roads.

On the other hand, the average wages received by the railroad employees in the different countries are approximately as follows:

In England they are 50 per cent. lower than in the United States.
In France they are 65 per cent. lower than in the United States.
In Germany they are 50 per cent. lower than in the United States.

It should be remembered that in England, a "free trade" country, the cost of living should be lower than in countries where "tariff protection" rules, so that the wage earner over there might be almost as well off as his fellow-laborer on this side, notwithstanding the considerably smaller compensation for his work.

But the farmer, the merchant and the manufacturer in England is charged 100 per cent. more for the transportation of his goods than his competitor in the United States.

It is to be feared that the railroad employees in France, also those in Germany, are not as well off as the workingmen in the United States, for no protective regulations in either of those countries can make up sufficiently for a range of wages ruling from 50 per cent. to 65 per cent. below the prevailing wage schedule in this country. Further, in France and Germany, as in England, the farmer, the merchant and the manufacturer is charged 100 per cent. more for the transportation of his goods than his competitor in the United States.

The following comparative table shows the volume of freight handled by the roads in the above countries, likewise the capital or cost of construction per average mile of road:

	Tons of freight carried per mile.	Capitalization, per mile.
England	500,000	$271,000
France	410,000	136,000
Germany	770,000	100,000
U. S. A.	800,000	64,000

It seems unnecessary to make any comment on these figures; however, it should be remarked that this exhibit is the more striking, when considering the higher wages paid for construction work in the United States. Each of the four countries is amply provided with all material required for the construction of the permanent way and for the building of rolling stock.

Relatively speaking, the people of the United States have considerably more railroad mileage at their command than those in either of the three European countries. In the United States the railroad mileage per capita is four times as great as that in the three European countries under contemplation.

The efficiency of the American roads is also illustrated by the following table:

	England.	U. S. A.
Volume of freight traffic, per mile	500,000 tons.	800,000 tons.
Ratio: double track, sidings and yard track*	130 per cent.	45 per cent.

*Compared with single track.

These figures clearly indicate the success of the scientific methods adopted in the operation of the American roads, in being able to carry 60 per cent. more freight with 65 per cent. less trackage facilities than the English roads do. Owing to this shortage, principally in double track, it is not surprising that the managers of the American roads, knowing their needs, should urgently demand an increase in trackage and yard facilities for the more rapid handling of the constantly growing volume of freight.

Originally the cost of securing the right-of-way, the laying of a single track, also the acquisition of terminals in the cities, has been effected under favorable circumstances for the railroads, owing to the more sparsely settled and undeveloped condition of the country. To-day, however, the conditions, especially in the larger commercial and manufacturing centers, begin to approach the state of affairs which prevailed in England at the time of the construction of her railroads. In other words, it will henceforth cost the American systems much larger sums to acquire additional trackage and terminal facilities than it did to bring the roads to their present state of development.

In order to satisfy the public demand, it may cost the American roads as much to complete their property as it has cost them up to the present time. Even then, the capitalization of the American

railroads will only amount to one-half that of the average English road.

Practically speaking, after the payment of operating expenses, maintenance charges and taxes, the remainder of income serves to compensate the services rendered by capital invested in the cost of the road and rolling stock. It is paid out either as interest on the funded debt or as dividends on the capital stock.

It is, therefore, important to compare the percentage of net earnings thus available for distribution on the capitalized cost of the railroad systems in the countries under contemplation:

England	3½ per cent.	Average of the above countries	4½ per cent.
France	4 "		
Germany	6 "	U. S. A.	4½ "

From this it should be inferred that in the United States the compensation for the use of capital is no higher than the average return received on the investment in railroad enterprises in those three European countries. D. G. BOISSEVAIN.

Prevention of Collisions on Prairies.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I see by your issue of last week that the state of Texas has passed a law requiring all locomotives in the state to be equipped with electric headlights. This law will presumably be classed as a safety measure, for an engine with a 2,000 candle power arc light, backed by a suitable reflector, can easily announce itself at any station when it is still ten miles away, "wind and weather permitting"; and yet a butting collision of freight trains occurred down in that region a year or two since, where both of the trains had electric headlights and were running on straight track. Besides this there was on one of the trains a brakeman riding on the cowcatcher and carrying in his hand a lighted fusee. If the legislature desires a headlight arrangement which will really safeguard trains I would suggest that there be on the front of each engine a row of a half dozen or a dozen 2,000 c.p. lights side by side, part of them preferably red or green. With all westbound trains thus equipped and all eastbound trains forbidden to show any light at all the dangers of competitive dazzling between opposing trains would be done away with and the scheme would be a shining success. Then, by sending men ahead from each train with two red lanterns in their hands and fusees on their heads, the only thing lacking would be a wireless automatic thought-transferring apparatus connecting from train to train.

I admire the electric headlight, but engines which in the perversity of their iron wills are determined to collide, will continue their destructive course, the Legislature of the state of Texas to the contrary notwithstanding. H. C. E.

The Profitable Weight and Speed of Freight Trains.

Baltimore, Md., Feb. 20, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Perhaps you will allow me some space to offer some comments on the communications of those gentlemen who were good enough to criticise in your last issue the table you printed for me in your issue of Feb. 8, in the matter of the most profitable speed at which to run freight trains.

The crux of this question undoubtedly lies in the amount of load cutting required in order to secure increased speeds. My figures were given to me by a former Engineer Officer of the Baltimore & Ohio Railroad as the result of actual tests carried on on this road. Now if we will fix our minds on speeds of 15 miles and 20 miles an hour the difference between my scale and Mr. Worthington's is the difference between 30 and 35. If a running speed of 20 miles an hour can be obtained for a cut of 30 per cent. in a load that allows a speed of 10 miles only, and this running speed would produce an inclusive speed of 15 miles per hour, then my table shows that the 15 miles an hour with the 30 per cent. reduced load would be more profitable than the 10 miles an hour operation. Now it is noted that the running speed of Mr. Worthington's trains, 15 miles an hour, was reduced six miles or to nine miles an hour by delays; for 15 miles in 60 minutes plus 40 per cent. for delays, or 40 minutes, equals 100 minutes for 15 miles, or nine miles an hour. As against this I reduce the running speed for the much lighter load from 20 miles to 15 miles, or five miles, and in view of the notorious fact that despatchers find the greatest difficulty in giving movement to the present-day heavily loaded freight trains it is quite a fair question whether this five miles is not more than would be required to take care of the delays to the lighter trains. Why cannot we hear from some gentlemen who have had despatching experience on this point? And if the five miles were not required and the running speed of 20 miles gave, let us say, an inclusive speed of 18 miles I could concede to Mr. Worthington the 35 per cent. cut he asks for and still show a profit of some $5,000 for the lighter load. Let it also be remembered that my reductions in cost per train-mile cover nothing more than a reduction in car repairs on account of the small number of cars, as I stated in my first letter, and if proper reductions per train-mile were made for less fuel, less overtime, less water and less stores, all of which are entirely warrantable (as to which consider passenger train-mile costs) and further a considerable reduction in the rate of repairs per car-mile, due to less wear and tear, I could concede to Mr. Worthington a 17-mile inclusive speed for a 35 per cent. cut in the load and still show a handsome profit over the 10 mile an hour operation.

It has been a matter of observation how little attention is given by the advocates of the big train load to the heavy increases in costs per *train-mile* for fuel, stores, delays and wear and tear both to track and rolling stock. On this point it would be interesting to know whether Mr. Henderson in working out his cost per 1,000 ton-miles has made allowance for the important elements of delays and increased wear and tear due to concentration of weights.

It is noted that Mr. Henderson's scale of reduction for increased speed does not agree with Mr. Worthington's. As to this the layman can only exclaim "who shall decide when doctors disagree?"

With regard to the communication from Mr. Daly, of the Illinois Central, it is noted he says that my conclusions must necessarily be in error, and he gives an example to demonstrate his assertion. He produces his results, however, by mutilating my figures, so to speak. As he has commenced this sort of thing I will continue it. Under heading "A" he increases the speed of return empties from 15 miles to 20 miles an hour, or 33.3 per cent. But what is sauce for the goose is sauce for the gander, and to be fair he should increase the speed of the return 28 cars under his heading "B" by the same percentage and give them a speed of say 27 miles an hour. Are not our heavy engines capable of running or is it not safe to run 28 cars, mostly empties, at this speed? If Mr. Daly will give "B" the same advantage as "A" he will find, using the figures of my table, that his "B" trains will earn for him $40.82 more net revenue than his "A" trains.

With regard to Mr. Daly's adding device to which he calls our attention, I understand this to be a device that increases or decreases the weight of cars according to the distance the car is from the engine. Such a device could not be used on railroads which have their load schedules printed to show adjusted tonnages based on actual experiments of what the engines to be used will do under all conditions of service, and what adjustment per car is necessary. Its use in conjunction with such schedules would clearly be a double addition to the visible weight and result in reducing the load below the proper figure.

There appears to be something radically wrong with the comparison that Mr. Worthington makes of a low class with a high class traffic line, inasmuch as he shows the high class line actually with a lower revenue per ton-mile than the low class line. No wonder the ratio of expenses to earnings of the high class line is much higher considering that it undertakes to do a high class business at a very low class rate. It would also appear that the so-called high class line has a larger proportion of passenger business, and, of course, no one would pretend that the passenger business can be carried on at the same operating ratio as the freight business; not because the passenger train-mile costs more than the freight train-mile, for it costs very much less, but because the passenger train-mile revenue is very much less than the freight train-mile revenue. Nevertheless the passenger train service, where the business is abundant, might be made to earn a larger return on the capital investment required for it than a freight train service running at an inclusive speed at from seven miles to ten miles an hour would earn for its capital investment, owing to the five or six times greater rapidity with which the passenger business is done. An operating ratio is apt to be a very misleading thing.

Finally it is noticeable that while none of my commentators are inclined to agree with my table they all agree that freight trains are not moving fast enough. What then is the matter with our methods? Mr. Worthington says I have a notion that the delayed freight trains in transit are responsible for a large share of the extreme car shortage. Am I wrong in saying that an increase of 50 per cent. in the inclusive speed with which cars are handled for a decrease of 30 per cent. in the number of cars handled would have the permanent result of placing 20 per cent. or one-fifth more cars at the disposal of shippers over what are now available at Mr. Worthington's speed of nine miles an hour or thereabouts? Mr. Worthington speaks about density of traffic, meeting points, etc. It appears to be becoming fairly plain that the filling up of a company's tracks with a lot of new cars before we have learned to give reasonable despatch to the cars already in use would simply block the railroads, and, in fact, induce so much "density of traffic" as to bring the whole business to a standstill. M. B. WILD.

Union Pacific System,
Chicago, March 21, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The *Railroad Gazette* of February 8, 1907, contained an article on the profitable weight and speed of freight trains, by Mr. M. B. Wild, from which the conclusion was reached that 25 miles an hour was the most profitable freight train speed, this result having been

obtained by computations showing that more tonnage could be handled by locomotives at that speed than at slower ones, this additional tonnage reducing net revenue sufficiently to offset the higher cost per ton-mile of the faster service.

It seems to me the vital point lost sight of in this computation is that a well regulated railroad would not consider itself operated in the most economical manner unless provided with sufficient locomotives to move all traffic offered and, in cases where the traffic becomes too dense, with additional tracks on which to move it. With such provision, the additional tonnage referred to instead of being moved at 25 miles an hour could be moved at 10 miles per hour at a reduction in cost, according to Mr. Wild's computations, of 25 per cent.; in other words, Mr. Wild's statement referred to is in itself sufficient evidence that for any given amount of tonnage to move, with adequate power to move it, the lowest speed he takes —10 miles per hour—is very much the cheapest. His statement shows that if a railroad had just 2,000,000 loaded car-miles to move, the cost of moving it at 25 miles per hour would be 40 per cent. more than at 10 miles per hour, but that if more traffic is handled the reverse is the case, so that the further computations given to make a lower cost at 25 miles per hour do not seem to be warranted.

W. A. WORTHINGTON.

The Necessity for Increasing Rates.

Chicago, Ill., Feb. 16, 1907.

To the Editor of the Railroad Gazette:

Within the last 10 years there has been a very heavy increase in the cost of the materials entering into the operation of railroads. On our line the average is about 54 per cent. The increase in labor runs from 15 per cent. to 30 per cent. In the last 10 years it is well-known that the average rate per ton-mile has decreased. This reduction in rates could not have been made in the face of the heavy increase in expenses but for the enormous sums spent in physical improvement of railroad properties. The reduction of grades and the introduction of heavy equipment combined have reduced the cost of operation and made it possible to meet the situation. Grade reductions on many lines have been completed, heavier equipment has been purchased and is in service, all the economies resulting therefrom have been secured, and now we are face to face with a still further increase in wages and materials; therefore a reasonable advance in freight rates would seem to me to be imperative. The merchant and manufacturer, when he finds his expenses increased, marks up the price of his goods and the public pays the increased cost; why should not the railroads be permitted to do the same thing? It would seem that the railroad is fairly entitled to its share, and I believe that public opinion, which is always right in the end, will support the railroads in any reasonable and proper advance in their rates, especially when it is so distributed as to have no practical effect on the individual consumer.

S. M. FELTON,
President, Chicago & Alton Railroad.

Roanoke, Va., March 7, 1907.

To the Editor of the Railroad Gazette:

That there is urgent necessity for advance in rates on the part of transportation companies, in order to meet the increased demands on them from all quarters, particularly the necessity of increasing their facilities and equipment, the interest on increased capitalization, and increased cost of transportation, there can be no question on the part of those familiar with the situation, for the only source of revenue to the carriers is selling transportation.

As an illustration, the increase of about 10 per cent. in payrolls on the Norfolk & Western will represent an increase of $1,100,000 a year. Taxes show a startling increase. Comparing our taxes for 1906 with 1901, there is an increase of 109 per cent. in rate of taxation per mile of road.

The prices of all staple supplies required by railroads have increased very materially, comparing the prices of December, 1906, with December, 1901, and in a number of important items the increase has been 50 per cent. or more.

There is no doubt that freight rates in many parts of the country and on many commodities, made at a time when trade conditions were at a low ebb and when the cost of operating railroads was at a minimum, are no lower than prevailing commercial and railroad conditions warrant. They should be brought up to standard of reasonableness.

The thoughtful student of the questions before the public today must admit that there is no more potent factor for the general advancement of our commercial well-being, and I think I may say with propriety, our civilization as a great nation, than the fostering of our railroads, since they contribute more towards the development of our country than any other instrumentality. Therefore, any stay of the hand raised for the upbuilding of the waste places of our land, the development and extension of industries must bring disaster to our best interests as a people.

The argument so often and so freely used, which has had much to do with forming public opinion, that the railroads are paying large dividends and should, therefore, reduce rates, is accepted as sound logic by a large majority of those who are only interested in transportation as shippers or travelers. They do not consider the long period of time during which stockholders either received no dividends or very small ones, nor that in order to prepare for the great development now going on, large sums of money must be spent increasing facilities of every kind, thus increasing interest account, as much of this money must be borrowed. Again, it is a notorious fact that expenses of every sort to which a railroad is subjected, have increased greatly, so it is plain to see that without increased revenue there can be but one result: diminution of net revenue and perhaps in the end bankruptcy, results which can only be averted in one way, namely, increase in rates, there being no other means of producing money by the railroads.

L. E. JOHNSON,
President, Norfolk & Western Railway.

Baltimore, Md., March 22, 1907.

To the Editor of the Railroad Gazette:

When we consider that rates in general are very low at present and expenses all along the line have largely increased it would seem that the railroads of the country are perfectly justified in advancing freight rates on certain commodities. The wave of prosperity sweeping over the country has developed an abnormal volume of traffic, and it has been almost impossible for the railroads to increase their carrying capacity fast enough to handle it with reasonable promptness and satisfaction. This has required increased equipment, trackage and terminal facilities, all of which cost much more than they did several years ago.

Rates have always been flexible, decreasing in times of depression and advancing in times of prosperity. The man who places his money in railroad stock has confidence in his judgment that it is a fair investment and he is just as much entitled to a reasonable percentage of profit or interest as the lawyer who defends you in court is deserving of a fee for his professional work. So that there shall be a surplus applicable to dividend payment when striking a balance at the end of the year, the earning power of a railroad must of necessity be regulated by the cost of equipping, maintaining and operating it and the volume of business handled. The earnings come almost entirely from the traffic hauled over its lines, and the extent of gross receipts is dependent on the rates charged for carrying various commodities. The stockholders' dividend, however, would have only a faint influence on rates if the percentage of operating expenses remained untouched. Much of the present prosperity of the country is due to its unexcelled system of railroads and rates of transportation lower than in any other country in the world. Rates are infinitesimally small when compared with the value of the article transported or the cost of supplies to the public.

The cost of running a railroad has largely increased, especially during the past year, while rates remained practically the same. The great increase in motive power during recent years has gone far to decrease the cost of hauling because they pull more cars and much larger tonnage, but the exigencies of trade have demanded more power. There has been an advance in the price of practically everything used in building, maintaining and running a railroad. If the Baltimore & Ohio uses the same quantity of lumber and crossties during this year as it did last, there will be an increase in cost of about $375,000. The same general ratio of increase applies to all kinds of supplies, from a spike to a completed locomotive.

In equipment, it is estimated that during the years 1905 and 1906, as compared with the preceding half-decade, 1899-1904, the increased cost to the Baltimore & Ohio for various kinds of freight cars ranged from 20 to 80 per cent. The increase in cost of steel coal cars and box cars used for hauling coal, grain and merchandise has been heavy. I mention them because they comprise most of the freight car supply of the road, and the addition in cost must be reckoned with seriously. The steel hopper coal cars delivered to the Baltimore & Ohio in 1906 cost about 30 per cent. more than those of the same carrying capacity (of 100,000 lbs.) brought five years before. Last year an 80,000-lb. capacity box car cost 75 per cent. more than one of 60,000 lbs. capacity bought in 1900. While competition and trade demand larger cars of heavier construction and greater carrying capacity, the minimum weight of shipment for carload rating is still much below the hauling capacity of the car built six or eight years ago. In such cases the railroad company is compelled to pay the extra cost for equipment and yet receives no larger ratio of earnings from it.

While the advance in the cost of locomotives has not been as great as in freight cars during the same period, there has been an increase of 36 per cent. in cost of freight locomotives, 18 per cent. for switching locomotives, and 9 per cent. for passenger locomotives. The cost for material used in locomotive and car repair work since 1904 has increased about 14 per cent., and the cost of labor about 8 per cent.

Another important point to be considered is that in order to

handle the increased volume of traffic offered by reason of the industrial development going on along its lines the Baltimore & Ohio has been obliged to make large expenditures. It has been necessary to build much additional track and enlarge terminals. Much of this work is in progress at various points on the system, probably the largest being at Brunswick, Md., where the terminal yards for handling freight are being doubled in size, at a cost of approximately $1,000,000. Much money is also being spent in terminal improvements at Philadelphia, Baltimore, Wheeling, Parkersburg and Chicago Junction. I particularize in this instance only to show the heavy expense in running a railroad and the necessity of providing earning power to meet it.

Living expenses have also advanced and to meet this and recognize good service railroad employees generally have deserved and received an advance in salaries and wages. The Baltimore & Ohio has been applying the merit system in increasing pay as it does in filling vacancies in the service. Instead of making a horizontal increase, the employees considered most faithful and deserving have been rewarded with proportionate increases of salaries or wages. Earlier in the year the increase of wages of trainmen averaged about 11½ per cent. As a result there has been added to the payroll of the operating department alone nearly $1,750,000 a year. Since then the increase of wages in the general offices and other departments has made the total advance approximately $2,500,000 a year. The trainmen who had their wages advanced in January haul the same train the same distance and are not any more competent than they were in December. Now, when they make a trip they get the larger pay for doing the same work. The company therefore must look to the traffic handled by the road to reimburse it for this heavy increase of expenses.

The figures I have given you serve to explain the heavy increase of expenses in railroad operation. This must come from the earnings just as the head of a household looks around for more money to meet the increased cost of supporting himself and family. This country has been enjoying great prosperity and everybody would like to see it continue. The promise of this will be strengthened and the welfare of the country best served by harmonious and cooperative relations between the railroads and the public whom they serve.

OSCAR G. MURRAY,
President, Baltimore & Ohio Railroad.

Freight Traffic on the Great Northern and the Northern Pacific.

The following figures, taken from a booklet called "The People and the Railroads" by Howard Elliott, President of the Northern Pacific, are interesting as showing the distribution of freight traffic by divisions on these two Hill roads and the increases in the calendar year 1906 over 1905. They include all freight, of every kind, passing over the lines:

Northern Pacific System.

Name of division.	Ton-miles 1905.	Ton-miles 1906.
Lake Superior	443,349,432	543,473,217
St. Paul	310,446,463	374,497,732
Minnesota	366,305,477	435,157,229
Dakota	420,358,054	502,270,603
Yellowstone	709,197,575	820,403,343
Montana	596,570,601	715,280,829
Rocky Mountain	601,120,741	712,650,905
Idaho	1,072,191,439	1,304,251,530
Pacific	501,940,187	632,467,349
Seattle	67,919,910	86,061,381

Great Northern System.

Name of division.	Ton-miles 1905.	Ton-miles 1906.
Terminals	4,648,406	4,930,217
Superior	198,218,055	228,658,656
Mesabi	939,769,829	972,115,879
Fergus Falls	367,996,470	400,486,039
Northern	181,842,618	246,361,271
Willmar	384,243,992	487,386,193
Breckenridge	207,412,268	250,856,834
Dakota	249,794,380	305,965,824
Minot	328,762,143	432,378,829
Montana	506,036,494	633,912,394
Great Falls	46,810,447	64,989,662
Sweet Grass	26,616,435	28,920,441
Kalispell	292,649,412	359,229,692
Spokane	316,051,516	413,887,833
Cascade	140,370,276	193,919,274
Montana Central	307,061,096	334,510,786

There is also a comparison of freight density on these and various other roads with comments by Mr. Elliott as follows, the figures being for the year ended June 30, 1906:

Name of road.	Average miles operated.	Freight ton mileage.	Density.
Chic., Mil. & St. Paul	6,961	4,663,808,007	669.965
Chic. & North-Western	7,428	5,156,074,115	694.068
Chic., Burl. & Quincy	8,896	6,347,902,891	713.568
Chic., Rock Island & Pac.	7,218	3,715,621,556	514.766
Soo Line	2,020	1,084,153,866	536.605
Great Northern	5,906	4,933,530,997	835.287
Northern Pacific	5,401	5,245,260,080	971.139

For the year 1905, four eastern systems give the following figures, showing how greatly density is affected by concentration of business:

Name of road.	Average miles operated.	Freight ton mileage.	Density.
Penn., P. R.R. division	1,817	11,515,165,537	6,337,525
Pennsylvania R. R. Co.	3,839	16,885,185,241	4,398,407
Lake Shore	1,529	5,099,918,891	3,335,299
New York Central	3,774	8,421,437,108	2,231,435

The Pennsylvania has four tracks, so has the New York Central. The Lake Shore & Michigan Southern has two. Yet there are many divisions in the Northwest where these records are equaled in the busy months every year. On the Mesabi division of the Great Northern, 115 out of 295 miles being double track, if the business done last October were taken as the standard, the density for the year would be nearly 7,000,000. On the Lake Superior division there was a showing at the rate of 2,800,000 freight ton miles per annum. And for the same month the average of the Montana division would give over 1,800,000 miles for the year.

On the Minnesota main line of the Northern Pacific, from Staples to Fargo, the traffic in October last showed a density for the month of 461,000 miles, which is at the rate of over 5,500,000 per annum. Taking the same month as a standard, the density for the year on the Montana division between Billings and Helena, with a grade of 116 ft. to the mile and a tunnel to pass through, would be 3,500,000. From Helena to Missoula, over the main range of the Rocky mountains and through another tunnel, it would be the same. From Spokane to the foot of the Cascade mountains it would be 3,600,000; and between the Yakima valley and Puget sound, over the Cascade range, with a grade of 116 ft. to the mile, the density falls little below 4,000,000.

Uniformity in Specifications for Railroad Construction.*

The construction and betterment of the subgrade of railroads requires careful preparation of agreements for such work. Much benefit would result from an advance toward uniformity of requirement, increased clearness of specification, and reduction of friction in carrying agreements into effect.

CLASSIFICATION.

Nearly all railroads find it useful to retain classifications in their forms of agreement. Such classifications give a solid rock material at one end, and an earthy material at the other, with, generally, as intermediate material called loose rock, and frequently an additional hardpan classification, formerly more common than now.

Classifications grew out of a recognition that different materials varied in cost of removal. Each classification was an attempt at segregating material into groups of approximately similar cost. Having a classification, the contractor could guess with some accuracy, from his experience, the cost of the different materials under the given conditions and eliminate the hazard of their proportion.

Twenty-five years ago an unclassified price was exceptional; to-day much the larger volume of excavation is paid for unclassified. If any tendency can be discerned, it is strongly in the direction of letting all excavation unclassified; or of limiting it to one classification for rock, and another for all other materials. On the part of the railroads there is the argument that classification is prolific of lawsuits, and there is an unfounded belief that an unclassified price prevents them. It is also increasingly difficult in practice for the Chief Engineer really to go into or review any classification.

On different roads classifications are not exact, even by definition, are largely modified by custom, and that custom varies with individual engineers in charge, and, from time to time, even upon the same railroad. However exact the contractor's estimate may be, on what he considers a proper classification, he is practically at sea as to what is to be paid. Should he bid upon an anticipated favorable classification, it might be changed during the progress of the work; if he assumes the unfavorable, possibly he may lose the work. In addition, he thinks that he has clearly detected instances where classification was influenced downward by financial considerations, pressure from the management, preliminary estimates being exceeded, and so on.

As a result of these uncertainties, the writer believes that most of the responsible contractors of to-day, in weighing the two hazards —their own both as to proportion and cost of materials, or the other as to what kind of classification they will get from the engineer—generally prefer to take their own risk upon an unclassified price. In making an unclassified price, either from necessity or choice, the contractor not uncommonly finds difficulty in getting bidding information which is sufficiently clear as to quantities and disposition of material. Some engineers present a profile, but refuse to give quantities in detail, being afraid that claims may be made if there be any change. Contractors, to keep their business going, are compelled to bid in the form in which the engineers, their customers, require. Under such circumstances they make the best approximation possible; but when full information is not available

*Extracts from a paper by W. F. Dennis, read before the American Society of Civil Engineers, March 6, 1907. Reprinted from the *Proceedings* for January, Vol. 33, p. 39.

there is less competition, and the work goes, not to the best-informed or best-equipped competitor, but to the most optimistic. It is economically wrong to let the work too high or too low, and the engineer is inexcusable who does not secure and present clearly every piece of information that will eliminate the risk of the work as much as possible.

The basis and aim of classifications are to associate in one group classes of material for which the cost of handling is supposed to be approximately the same. The class, location and magnitude of the work, and the kind of equipment which is best adapted to it, have a very important bearing upon the cost, even of the same material. The company agrees to pay definite prices for definite services in a definite time. The contractor thereupon proceeds to perform the service, providing such appliances as his judgment, particular plant, or financial ability will justify. If he knows exactly how he is to be paid, from a well-understood classification, or similarly with an agreed unclassified price, he can then make his calculations as to heavy-plant expense and lower working cost, or the reverse, and longer or shorter time. The classification of a given material should be rigid, for removal by any appliance, and irrespective of quantities or location. If special appliances can reduce cost, competition will make the reduction appear in the price for the classification. The classification should be made, not by names and descriptions of material, but by some definite physical characteristic susceptible of uniform test.

A simple, measurable test, easily applicable, and defining what should be properly in the "earth" classification, is whether or not the material can be plowed in its natural state by a definite plow pulled by a definite number and weight of stock. Whether this material is moved by scraper, grader, cart, car, wheel-barrow, or steam shovel, what is meant is clearly described, namely, a material which a designated plow will produce in shoveling condition. This description excludes from the earth classification some material included in some earth specifications, and includes some material which, in others, is classed as loose rock or as hardpan. If the material is too wet to be plowed, as in case of swamp muck, quicksands and some gumbos; or is too hard to be plowed, like hardpan, cemented gravel, etc., holding to the proper theory of grouping by rough similarity in cost, no designation by name can properly make it "earth," in a cost sense, for all appliances, although it might be for some. Additional costly work may be required to get the material loaded or transported. In some cases the cost of unplowable earthy material may approximate and exceed that of solid rock; but, speaking generally, the cost is somewhat similar to the cost of loose rock, and such material is most fairly included in that classification.

A composite view of several descriptions of rock and loose rock would reduce to about this: Rocky material which can be removed without blasting is loose rock; and that which cannot is solid rock. The word "can," then, for reasonable interpretation, depends upon some rate of removal. A solid mass of rock might be seamy to the extent of permitting wedging or barring out 1 or 2 cu. yds. per day, but that possibility does not make it loose rock. On the other hand, a certain material might be dug slowly by a steam shovel without blasting. If it could be loaded faster, as a result of blasting, it would be taken out customarily by blasting, but, under the specification, that fact would not necessarily make the material solid rock. On the other hand, the same material, under nearly all specifications, might be solid rock by reason of the impracticability of removing it with pick or bar with reasonable rapidity.

The difference between materials in a construction sense depends on the operations necessary in loading such material on their transporting appliances. Earth is a material which can be reduced to loading condition by plowing, or equivalent inexpensive picking or blasting. Loose rock is a material which generally can be put into handling shape by picking, barring and light sledging, or, in lieu thereof, by moderate blasting, but it is not quite as easy to load as earth. Solid rock is a more refractory material, requiring drilling, strong explosives and general sledging, and, with this additional expense, is not capable of reduction to a loading condition as favorable as the other materials. In seeking for some limit between solid and loose rock, it is impracticable to fix any rate of drilling or quantity of explosive. The condition after blasting cannot be taken as a guide, because that will depend upon the foregoing, as well as upon the cohesion of the material. The requirement of ringing under the hammer is inapplicable; the expression, "continuous blasting," is inexact, and can be worked as a swindle by either side.

It is known that certain soft or fractured rocks can be picked or barred apart with reasonable rapidity, and customary specifications state the fact, but do not state the rate. By definition of that rate the classifications of rock can be clearly defined. The rate of disintegration for loose rock should be within the performance of two men thus employed. A material requiring more than two men working with pick and bar to keep one shoveler busy is certainly a material that "may better be removed by blasting" and which "can only be removed by blasting," in a reasonable sense.

A consideration of importance is the size of the rocky mass that must be exceeded in order to constitute a solid-rock classification. The writer thinks that 1 cu. yd.—the limit most frequently specified—is too high; 3 cu. ft., although right in one view, is probably too low; and that the compromise limit of ½ cu. yd. would be about right.

The writer proposes the following as an outline classification:

Excavation, excepting foundation pits for structures, elsewhere classified separately as foundation excavation, shall be either classified or unclassified, as may be determined at the time of the contract. If classified, the following classification shall apply:

Earth.—Material which in its customary natural condition can be plowed—or is equivalent to a material which can be plowed—with a plow cutting a furrow 10 in. wide and 10 in. deep, drawn by a team of four horses, or mules, each having an average weight of 1,100 lbs., and moving at a reasonable plowing speed, shall be classified as earth.

Loose Rock.—The following shall be classified as loose rock: Earthy or mixed materials, not susceptible of plowing under the foregoing test; soft, fractured, disintegrated or other rocky material, soft or loose enough in its natural condition to be barred or picked apart by two men thus employed serving one man shoveling or loading by hand; solid rock in separate masses exceeding 1 cu. ft. each, and not exceeding ½ cu. yd. The continuous or occasional use of explosives, at the contractor's option, shall not affect the classification, but it shall be governed solely by the test above set forth.

Solid Rock.—The following shall be classified as solid rock: Rocky material in masses exceeding ½ cu. yd., which cannot be broken apart, or displaced from its natural position, except by the use of explosives; and other rocky material which cannot be picked or barred apart by two men thus employed serving one man shoveling or loading by hand.

Where any excavation contains material of more than one classification, the relative percentage of each shall be determined by measurement and observation during the progress of the work.

Experiment will determine whether or not the material can be plowed, and actual picking or barring of the material will determine whether or not two men can keep one shoveler going. Classification becomes, not a matter of opinion, but of demonstration.

For heavy steam-shovel work, the writer's opinion is that there is no especial benefit in a distinction by classification between loose rock and earth, and, for that class of work, a classification for solid rock and another for all other material would be sufficient; but nearly all steam-shovel work involves more or less miscellaneous accessory work for team and hand appliances, and the loose-rock classification is needful for them; furthermore, classification on all work would become better established by its uniform practice.

FOUNDATION EXCAVATION.

Experience shows that the reliable unit to be used in computation is the cost of the excavated material per cubic yard. Specifications do not generally define the quantity of material which shall be measured. The following seems to the writer to be reasonable practice and definition:

Excavation for foundations of pipes, masonry or other structures, shall be classified as foundation excavation under the following heads:

Dry-Foundation Excavation.—Material of whatever nature, excepting solid rock, found above water level.

Rock-Foundation Excavation.—Material, elsewhere defined as solid rock, found above water level.

Wet-Foundation Excavation.—All material below water level.

By "water level" is meant the average or mean level during construction at which pumping or bailing becomes necessary in the work of excavating. The quantity of wet excavating shall be computed as a prism having a height equal to the distance between the average level of the bottom of the foundation pit and the water level and a base equal to the area of the foundation course plus 4 ft. all around. The dry and rock excavation quantities shall be computed on a base equal to the bottom area of the wet excavation as above defined, with the necessary slopes to the natural surface.

Wet excavation shall include the cost of excavating, piling, coffer-dams, pumping, bailing, leveling off the bottom, and the expense, of whatever nature, necessary to complete the foundation pit from low-water level to the level finally determined for the bottom, and to maintain the foundation pit open until the structure shall have been placed therein, not, however, including the placing of iron, timber or piles in permanent artificial foundations, these items being paid for under a separate schedule elsewhere described.

The prices for all classes of foundation excavation shall include the cost of removing the spoil, and depositing it in adjoining fills, or of wasting the spoil, if such deposit in fills be not required by the engineer; and also the cost of removing such portions of coffer-dams as the engineer may require, for appearance or for reducing obstruction to the waterway.

OVERHAUL.

The overhaul is legally enforceable only upon a specific line shown to the contractor at the letting of the work. Any hardship

that comes upon the contractor, from changes, will legally release him from the contract, unless they are adjusted to his satisfaction. With no overhaul specified, there is no base agreed upon for change.

There is complication in the overhaul question, arising from what is a proper overhaul distance to specify. A 1,000-ft. overhaul on steam-shovel work may be immaterial, but it is a very serious matter for team haul. The difference could be taken up by specifying that locomotive overhaul price shall apply beyond a certain distance, and on team overhaul beyond a shorter distance. On work which, by reason of location, small magnitude, or for other cause, naturally requires hand or team appliances for excavation, the overhaul price would be made for these appliances, and would generally be high enough to require wasting and borrowing before the proper limits of steam-shovel haul were reached. Where steam shovels, wholly or in part, are anticipated, the overhaul price will come down to such an extent that there will be no controversy as to appliances, because it will be uneconomical to make any team overhaul for the price of locomotive overhaul. In sections where scrapers are the ruling appliances, specifications give properly low limits for the commencement of overhaul—300, 500 and 600 ft.; 1,000 ft. is common elsewhere, and, occasionally, 1,500 and 1,600 ft. For team appliances, 1,000 ft. is too high; 1,500 ft. entirely unreasonable. The nonsensical stipulation, of an overhaul after an average haul on the section or contract, has about disappeared, so that nothing need be said in criticism. For steam-shovel overhaul, there is no standard of custom. Some roads pay under the general overhaul; some include it in the yardage price.

There is considerable difference in the practice of estimating overhaul, and confusion as to just what it means. The customary meaning of overhaul is, that every yard of material moved, over and beyond the free-haul distance, is subject to the contract allowance for overhaul. This carries the implication, as is also the common understanding, that the free overhaul distance shall be measured on the route actually taken by the hauling appliance used; that the route be of grades customary for such appliance; and that the appliance be appropriate to the particular case. In the event of, say, a 100-ft. cut into a 100-ft. fill, it can be seen that the question of proper grades and appliances might become very complex. To avoid controversies, the method of measuring overhaul should be stated clearly so that the contractor, in bidding, could cover the ordinary hauls, as well as the special hauls called for by exceptional conditions. The simplest method would be to locate the stations of free haul, and then deal with the cut and fill on either side by locating the station of the center of mass of each. These points could be identified and understood during construction, and the overhaul computation could be checked at any subsequent period. Unless the method of calculating the haul be defined, the common usage will prevail, the effect of which is that, at a later date, no man can check another, or even himself.

SUB-CONTRACTING WORK.

It is as usual to see agreements specify that no work is to be sublet as it is to see, in the execution, sub-contractors more or less peacefully performing their assigned tasks. What is the purpose of the prohibition? It is generally a dead letter in the enforcement. The writer cannot think that experienced engineers consider it a system of double profit. If it is, is not the contractor, having obtained his work in competition, entitled to share his profit with the sub-contractor, if he is so generously inclined? The sub-contractor exists because his services in detail, as foreman, manager or contractor, coupled with his financial interest in results, and his special plant, are at times more efficient than can be obtained in other ways.

The most reasonable view is not to prohibit a perfectly business-like arrangement, but frankly admit it, and, in admitting it, control the form. A stipulation that would seem to cover the whole case would be to require the sub-contractor's agreement to read something like this:

"The company and the contractor shall have all rights and power as to the sub-contractor, that the company has as to the contractor, in its contract with him; and the work assigned to the sub-contractor shall be done subject to all the conditions stated in the specifications of the company, or embodied in the contract between the company and the contractor."

RIGHT OF WAY.

One of the scandals of railroad construction is the absolute disregard of plain business methods in the acquisition of right of way, and the consequent unfair saddling of useless expense on the contractor. Many engineers allow themselves to be hustled into starting work with immature plans and without right of way. They would have an easier time, save money for everybody, and do the right thing, if they consistently refused to let contracts until these matters were thoroughly in hand.

INDEMNITY.

All agreements are elaborate in provisions to save the company harmless against any acts of the contractor during construction. These provisions are proper, provided the contractor is legally liable; they are wrong where the company withholds payments to force the contractor into settlements, whether proper or not. Many agreements recite that in the event that the company is a party to the action, the company may settle without the consent of the contractor and charge against him, together with such legal expenses as the company may choose to fix as its cost of defense. If the contractor, as an individual, is sued jointly with another individual, he must defend himself as best he can. There is no method by which he can recover the expense of defense, either against the party who sued or on account of whom he is sued.

The writer can see no fair ground why the company should be more favored in the case of construction contracts than in any of its other agreements where it takes its chance according to the general law. The fair principle is that, if the railroad pays the contract price, it should get the goods; if the contractor incurs liability, then, by agreement, he should indemnify the company against loss, and the obligation should end there. In accepting the contractor, the company should consider his ability to save it harmless, just as it considers and accepts his ability to perform the work. If the company is sued jointly with the contractor, it may either let the contract or defend, looking to his satisfying any decision, or, if it elects to defend also, it should do so at its own expense, as it would in any other action.

POWER AND AUTHORITY OF THE ENGINEER AND OF THE COMPANY.

The powers claimed on the average may be summarized as follows:

Contractor to do the work where and when the engineer shall direct, whether the procedure is, or is not, a reasonable one in economical organization, and whether or not the procedure is fair.

Where the company is in default from any cause, the expense shall be borne by the contractor, his relief is in extension of time, provided he gives notice and the engineer considers the point well taken.

The contractor shall equip his work with such forces and appliances as the engineer shall direct. In case he does not, the company holds the right to employ the force and charge the expense; to annul the contract in whole or in part; to seize the contractor's plant, and to withhold any unpaid sums of money which may then be due. The contractor's employees are subject to discharge by order of the engineer. A reservation of 10 per cent. is withheld from the contractor's payments in addition to withholding, by custom, another part at the discretion of the subordinate engineer. The company, of its own motion, without default on the part of the contractor, holds the right to terminate the contract at any time, to suspend the work, to hold the contractor to resume, with stipulated denial of the contractor's right, not alone to damage but even for recovery of expense. The contractor must obey all orders of the engineer and accept his determination as final, at a time when the engineer holds the relation of an employee and agent of the company; the contractor knowing at times that the engineer has no detailed knowledge of the work, and that the information which he certifies as his final judgment is, in fact, the work of an assistant, with whom he may not be even personally acquainted.

Requirement that the company shall have the right to save itself in case of claims against the contractors; to make an *ex parte* examination, to settle the controversy and charge the contractor with the award and such expense as the company shall set, without consultation with the contractor, and without his acceptance. Requirement that the contractor shall exhibit complete receipts, showing that all accounts have been paid. Requirement that the contractor shall save the company harmless from every matter growing out of the construction.

Requirement that, before the contractor can get final payment for matters not in dispute, he shall accept the engineer's estimate as a total and release each and every matter and sign in full settlement, with a more drastic wording in some contracts; that the contractor shall have accepted the final, as handed out by the engineer, before the company shall have incurred any indebtedness to the contractor.

Requirement that, after the contractor shall have done work which is satisfactory to the inspector appointed for it, the work may still be condemned and required to be done over.

The stipulation in favor of the contractor is, that he shall have the right to accept without protest the sum of money the engineer shall say is due him.

It is safe to say that in no other business relation between men are such one-sided agreements customary; in no other relation is a man conceived to be clothed, by reason of a written instrument, in a mantle of infallibility, as is the engineer in customary railroad contracts. As far as the writer's observation goes, the average and general result is good, without much genuine offset; but every now and then there is an instance of gross tyranny and outrageous wrong under these powers. The delays, safeguards and forms appropriate for a peaceful civilization would paralyze an active army. Railroad contract work requires somewhat of the army's autocratic directness of control, but the control should be within well-defined and reasonable lines.

The objection in a practical sense, however, comes, not so much from arbitrary or unfair use of the engineer's power, but

from his carrying out, or being forced into carrying out, requirements which are too broad or are unreasonable, which he may have thoughtlessly included in his agreement, put there from mere copying of precedent, or at the suggestion of a legal department which considers only its side of the case. Ordinarily, these clauses are unnecessary. In spite of them, most engineers have to and do make fair adjustments and settlement for the majority of work goes through with mutual satisfaction. With these clauses too strongly drawn, the engineer, in spite of a personal desire to be fair, may be forced by his company into an opposite policy, in accordance with the stipulations of the contract. In no class of cases is there greater real damage done than when organized work is suspended or stopped.

As the writer understands the obligation of contracts, in matters of measurement, classification, workmanship, meaning and application of specifications, and the like, which have to be decided by an expert, and for which the engineer is nominated by agreement as such an expert, his finding and decision will be held final in the absence of fraud. All other matters are at least open to court review. Therefore, a clear, fair contract interpreted by the engineer has a better chance to be upheld in its final than one which is unfair and extravagant in its stipulations in favor of the company. The time has about come for the companies to be willing to assume the risk of their own acts and plans, and not to saddle these risks further upon contractors.

In conclusion, the main thought in this whole discussion is: That a contractor and a company enter into an agreement for mutual benefit. Every matter not clear, subject to whim and opinion in its working out, unfair in its intent, or in the nature of a "strangle hold," is unfair to one side and reacts upon the other, and that the business of both parties is best served by a fair agreement.

Construction methods, throughout the United States, at least, are fairly uniform for like classes of material. There is, however, the widest variation in customs, requirements, specifications and general clauses for the agreements for such work. There is no valid reason why the agreements should not be standardized. A standard form would not interfere with special modifications which might be necessary at times. These matters could be covered by special specifications, attached to the standard form.

Representatives of all the Russian railroads in 1903 offered 5,000, 3,000 and 1,000 rubles as prizes for an automatic coupler which should answer certain specified requirements. The committee which received and examined the models, etc., handed in for the competition reports that none of them fulfils the requirements, but that one designed by an engineer named Bouareau comes so near doing so that they award it the prize of 1,000 rubles ($516).

Grade Separation in Cleveland on the Cleveland & Pittsburg.

The plans for grade separation in Cleveland on the Cleveland & Pittsburg, which is operated as part of the Northwest system of the Pennsylvania Lines West, provide for the elimination of 29 grade crossings on the 6.8 miles of line from the southerly city limits to Alabama street. This is being done in accordance with a city ordinance passed in 1902. The work has been laid out in five groups, as shown in Fig. 1. The work under way at present is that included in group No. 5, extending from the city limits to Jones avenue, 1.1 miles (Fig. 2). This was begun in August, 1905, and is now nearly finished; the work remaining to be done includes only the bridges and the adjustment of buildings to the new grades of Broadway and Harvard street. The line was relocated to the west four-tracked. Before the present improvement there were within these limits 2,120 ft. of single-track road, the only stretch of single track on the road between Pittsburg and Cleveland. There was a sharp reverse curve on a 1 per cent. grade; the new location is on a 4 degree curve with a grade of only three-tenths of 1 per cent. The old line crossed Broadway at such an angle that it ran in the street for some distance. The street, therefore, could not be lowered to its new grade while the old line was in operation, so Harvard street and Broadway were excavated near their intersection, a temporary trestle being built across Harvard street to support the old track, and then the new line was built. Fig. 3 shows the new line crossing the two streets on temporary trestles; in the foreground is the street railway track along Broadway and under the trestle to the left can be seen the temporary trestle supporting the old line across Harvard street. Fig. 4 shows both the new and old locations at this point. The excavation of Harvard street and Broadway was then finished, all the excavated material being used for filling on the new line. As it was not possible to lower the building to the new street level during excavation work, concrete piers or wooden posts were used to shore up buildings, and temporary sidewalks were built at the old street grades. New passenger and freight stations were built near Harvard street. The relocation to the west, referred to above, involved the diversion of Mill Creek into a new channel, as shown in Fig. 2, and the filling of the old channel with 120,000 cu. yds. of borrow material, most of which was taken from a borrow pit about a mile south of the city. This material was handled by a 45-ton Vulcan shovel, loading cars of three and four yards capacity which were hauled in ten car trains and

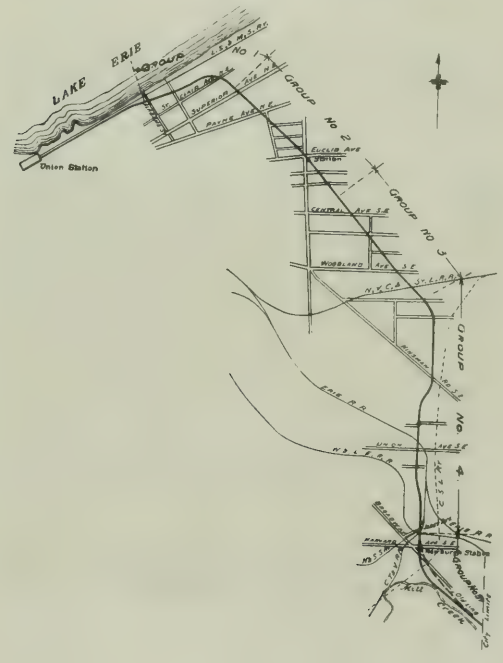


Fig. 1—Grade Separation in Cleveland; Cleveland & Pittsburg.

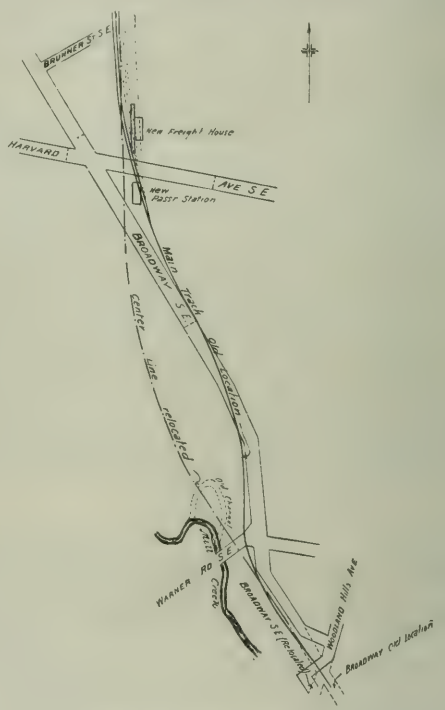


Fig. 2—Section on Which Work Is Under Way.

dumped from a trestle over the creek. All this work was done in the winter with two 10-hour shifts a day. The relocated channel and the new fill are shown in Fig. 5.

Retaining walls and abutments are made of concrete, but the bridge seats and copings of sandstone. When concrete was placed during freezing weather it was kept warm by steam pipes running from the steam concrete mixers. The concrete was carried in small cars on trestles from the mixers to the works. Highway bridges at Warner road and Woodland Hills avenue are of the pony truss type with reinforced concrete floors. All railroad bridges have solid floors, waterproofed with concrete and Hydrex felt. The retaining walls in the passenger station subway are also waterproofed with Hydrex felt and backed with common brick.

For the photographs and description of the above work we are indebted to Mr. R. Trimble, Chief Engineer of Maintenance of Way of the Northwest system of the Pennsylvania Lines West, in whose office the plans were prepared. The work was carried out under Mr. B. E. Tilton, of Mr. Trimble's office.



Fig. 3—Looking South from Intersection of Broadway and Harvard Street, Cleveland.

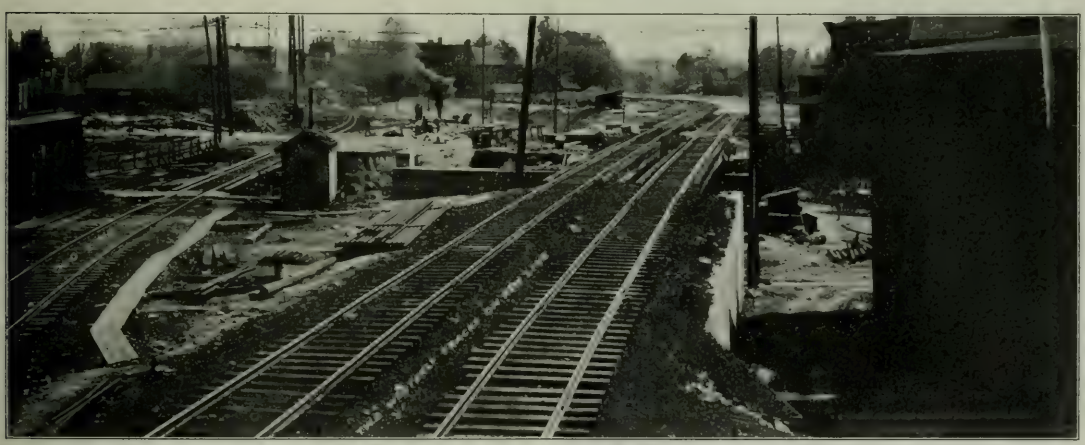


Fig. 4—View from a Point Just North of Harvard Street, Cleveland, Showing Old and New Locations.



Fig. 5—New Channel of Mill Creek and Fill on New Line in Cleveland; Cleveland & Pittsburg.

The Engineering and Maintenance of Way Association Convention.

The eighth annual convention of the American Railway Engineering and Maintenance of Way Association was held at the Auditorium Hotel, Chicago, March 19, 20 and 21. The attendance was fully as great as last year, and more than 200 members registered during the meeting. The present membership is 602, the net gain for the year being 74. The balance in the treasury is $13,355.

The proposed amendments to the constitution on the matter of membership submitted to letter ballot of the association in February and published in Bulletin 85 were reported adopted. The following amendment to Section 1, Article II., has been proposed and will be submitted to letter ballot: "All members who are members of this association at the time of the adoption of this section shall retain their membership as active members."

The constitution was also amended during the year reducing the term of the office of President to one year. The officers for the ensuing year are: President, A. W. Johnston (N. Y. C. & St. L.); First Vice-President, Walter G. Berg (L. V.); Second Vice-President, William McNab (G. T.); Secretary, E. H. Fritch (re-elected); Treasurer, W. S. Dawley (M. & N. A.), re-elected; Directors for three years, L. C. Fritch (I. C.), and W. G. Besler (C. R. R. of N. J.).

President H. G. Kelley (M. & St. L.) in his annual address spoke of the very great responsibilities resting on this association. The specifications already adopted by the association are considered authoritative standards, emphasizing the need of exercising due care and most thoughtful consideration in their proceedings; no final action should be taken until every feature of the subject has been determined. Reference was made to the representation of the association on The National Board on Fuels and Structural Materials appointed by the President of the United States, which has held two meetings during the year; and to the special committee appointed to confer with a committee of the American Railway Association on the subject of third-rail working conductors and their relation to equipment. This brings the association directly in touch with the matter of electrification of steam roads, and its effect on maintenance of way methods and an operation will require early future attention. The subject of securing funds from the railroads to enable a series of experiments to be conducted to determine the dynamic effect of moving trains on bridges was considered by the board of direction and the proper steps taken to learn whether the member roads would support the undertaking. The indications were declared to be encouraging. The seriousness of the tie-timber situation requires the most particular attention of the association. The investigations of the Government Forest Service and its publications on this and kindred subjects affecting the timber supply are of the highest value in this connection.

DISCUSSION.

Uniform Rules. Organization, Etc.—The rules adopted last year were revised in a number of instances and some new ones added. The revised and new rules were read one at a time for consideration by the convention, and were adopted practically without discussion. The committee accepted a suggestion to incorporate into the rules one requiring track supervisors to look after swinging ties at bridge ends.

The "Rules Governing Supervisors of Structures" submitted in the report were new and were therefore taken up seriatim for consideration. All were accepted as submitted except the last, No. 11, reading: "They shall make from time to time observations of the flow of water of the various streams passing under the track, so as to determine whether sufficient waterway is provided by the present structure, and tabulate this information for future reference." Mr. Hunter McDonald (N. C. & St. L.) thought this delegated to the supervisor duties which, as a general thing, he was not prepared to carry out. After some discussion the paragraph was amended to read: "They shall, in time of flood, observe and record the flow of water of the various streams passing under the track, and report to the proper officer all cases where the waterway provided seems insufficient." It was then thought that the supervisors of track should be required to do the same thing and a motion was adopted to have a similar paragraph included in their rules. The entire report as amended was then adopted and will be printed in the Manual of Recommended Practice of the Association.

Ballasting.—The committee asked that the ballast cross-sections for the three classes of track—A, B and C—given in the report be approved as good practice. They were taken up in order.

Objection was made to bringing the sod line over the top of the sub-grade shoulder as the sections showed it, as it would interfere with the drainage. But a number of members whose practice accords with the committee's idea, testified that there was no trouble of that sort, and that the arrangement protected the shoulders from erosion and was of great value in maintaining the edge of the embankment in proper grade and line. The practice was given the formal approval of the association by the adoption of a motion to that effect. On motion, the slope on the stone ballasted section was changed from 2 to 1 to 1½ to 1. The sections for class A track named crushed rock and slag as the ballast materials. Attention was directed to the fact that the term "slag" is variable, including materials from the consistency of sand to large lumps. Following some discussion as to the best way to clear the matter, the chairman of the committee suggested leaving the title remain and adding a foot-note explaining the character of slag intended. This and the sections for crushed rock and slag were then approved as amended.

Proceeding to the sections for gravel, cinders, chats, etc., for class B track, Mr. A. S. Baldwin (I. C.) moved that the sod shown on the embankment side also be shown on the cut side with the same width of sod line, and extending through the ditch and up the side of the bank. He said he had followed the practice of the cultivation of sod through ditches for years and found that it affords greater economy in the maintenance of the slope of cut and berm of roadbed than any other method known. It does not interfere with the drainage if the grass is kept cut. If there is much water, tile drains should be provided. The motion was carried. The sections were then approved as amended, and the sections for class C likewise adopted. All sections will be published in the Manual.

Signaling and Interlocking.—Action was asked on the conclusions to the report. The first of these provided for the adoption by the association of the specifications for mechanical interlocking adopted by the Railway Signal Association. It was accepted without discussion.

No. 3, providing for the division of expense of the operation and maintenance of interlocking plants on a unit basis as given in the report, was next considered. Asked why the division was not made on a lever basis, it was explained that this often creates a tendency to overload levers by putting more than one unit thereon, to reduce the proportion of expense to certain of the interested parties. Objection was made by Mr. Frank Rhea (P., C., C. & St. L.) to the division of the operation expense on the basis proposed, or in fact on any basis of levers, functions or operated units, as being inequitable. He advocated an arbitrary division of this expense between the interested companies, and moved to amend the conclusion by substituting "renewal" for "operation." The committee signified its willingness to adopt the proposed amendment, largely because it felt that it was not in its province to decide regarding the division of operating expense. The conclusion was finally adopted with the words "installation and renewal" substituted for "operation."

The three provisions of conclusion No. 2 were then read, which recommended the adoption of the principles of giving indications by red, yellow and green lights for night, and of semaphore indications in the upper right-hand quadrant for day, as covered in the report. Regarding the recommended system for night indications, which has been adopted by the Railway Signal Association, the President asked if any of the roads represented in the convention have the system in use, and a number of members replied in the affirmative. A motion to adopt this clause of the conclusion was carried. The other sections of the conclusion relative to day indications were likewise adopted. Mr. Cushing then called attention to the fact that some action was necessary to harmonize the action just taken with the provisions of the Manual of Recommended Practice covering the present system of indications, which it was not desired to stamp as bad practice. The committee therefore prepared and submitted at a subsequent session of the convention the following paragraph as an amendment to conclusion No. 2: "The adoption of the following principles is recommended in view of the recent trend of the development of the art and should not be understood as condemning the present practice indorsed by the association as recommended good practice."

The remaining time of the committee was taken up in reading the indications given in the report as being what was required in a complete system of signals using the principles just adopted, and in answering questions regarding the same, it being desired to get the opinion of the members on the indications needed, for the guidance of the committee this coming year. At its conclusion the committee's recommendations were adopted, also a motion instructing the committee to prepare a comprehensive signal system based on these recommendations, for submission next year.

Records, Reports and Accounts.—Action was asked on the five conclusions to the report. No. 1 asked for the adoption as representing good practice Forms M. W. 1,017, M. W. 1,018 and M. W. 1,019. The report explained the workings of these forms. Further explanations were made by the Chairman of the committee, responding to questions of members, and after accepting the suggestion that No. 1,018 bear the further caption "Executive Authority," and 1,019, "Executive Appropriation," the conclusion was adopted. The remaining conclusions were adopted with little discussion.

Economics of Railway Location.—In the absence of the Chairman and Vice-Chairman of the committee, Prof. Allen (M. I. T.) occupied the chair. He read the introductory portion of this voluminous report, occupying the first seven pages, and explained briefly the character and points of particular interest in the remaining parts. Members were requested to express their views on various details of the report and to make suggestions for further study by

the committee. The committee also desired to know what the roads were doing along this line and to have the results of any investigations or tests that had been made, the President explaining that it was not alone the problem of train resistance that was confronting the committee, but the broad economical features of location as it will affect the cost of operation and maintenance. Many members related results obtained by grade and curvature changes in particular instances. Mr. M. L. Byers (Mo. P.) told of an experience where tests had shown a certain ruling grade would permit a tonnage of 2,350 tons at 12 m.p.h.; but service results showed the trains had to be cut to about 1,900 tons to avoid excessive overtime. Study of the situation showed the distance between side tracks on single-track lines to be a most important factor. Records taken showed trains lost on the average 20 minutes due to entering and leaving the siding. Distances between sidings required careful consideration in connection with grade reduction. Mr. Berry (C., R. I. & P.) stated that statistics taken on a line from Omaha to Grand Island showed 32 per cent. of the schedule time between termini was occupied in waiting on side tracks. Mr. Baldwin (I. C.) said if the committee's work would develop the economical limit for grade reduction it would supply some much desired information. It was stated for the committee that this matter was under investigation and it was hoped to have something to submit at the next convention. Mr. C. C. Anthony (P. R. R.) said that the relation of signals to the movement of trains might have some bearing on the work of the committee. The discussion also included references to momentum grades—the necessity for, and the objections to them and their disadvantages. The report was regarded as only preliminary in character and no formal action concerning it was taken by the convention.

Buildings.—The Chairman of the committee, Mr. Raymer (P. & L. E.), read portions of the report concerning current practice and designs for locomotive coaling stations, and discussion was asked on same. Mr. J. P. Snow (B. & M.) asked if the investigation of the committee had shown any difference in the cost of handling lump coal and fine coal. The committee had no figures, but the President stated that on his road, for certain plants where the coal was shoveled from cars to bins, the cost of handling was raised 1 to 2 cents where certain large lump coal was used, compared to smaller lump coal.

Mr. E. F. Wendt (P. & L. E.) told of a mechanically operated coaling plant where the force running same unload the coal, run the pumping plant, likewise the water treating plant, cleans the locomotive ash-pans, supplies the sand, and the night force does the hostlering of any locomotives lying over at the point. It is a main-line plant and serves road engines in a minimum time—a most important consideration on a busy line. In such a plant the storage bins must be kept filled for two reasons: To avoid breaking up the coal badly by dropping to the bottom of the bin, and to have a full reserve supply in case of the plant being disabled.

Mr. Lum (Southern) spoke of a mechanical plant they have at Asheville, N. C., with buildings of reinforced concrete, which is proving satisfactory in all respects.

Mr. Snow (B. & M.) asked if any members were still using the trestle with 25 per cent. incline and power car-haul, and results from same. Mr. Bremner (C., B. & Q.) said they had some, which gave economical results. Mr. Storey (A., T. & S. F.) said they had this type of plant along with others, there being cases to which it was particularly adapted and it is cheaper in first cost. It can serve only two tracks, of course. Mr. Chamberlain, of the committee, said that the Great Northern has mostly this type of plant; also that many western roads had, in renewing trestles with the 5 per cent. incline and switch-engine service, substituted the 20 per cent. incline and power service. Mr. Storey said they used a cable and link attached to the coupler in hauling the car up, with a chain passed around the axle as a safety feature.

Prof. Allen (M. I. T.) pointed out that where a coaling plant was to be placed in a large yard on one of limited room, the necessities of the general yard would influence considerably the type of plant adopted rather than the economy of its performance, the economy of the yard as a whole being the determining factor.

The conclusions were presented for action. It was not desired to have the first one go into the Manual, so that it was omitted and the second one became No. 1. It was adopted, as were the next four, without discussion. No. 6, providing "that where self-clearing cars cannot be regularly obtained, either a locomotive crane or a trolley hoist, using a bucket of the clam-shell type, is desirable," aroused considerable discussion. It was objected that in such an arrangement the committee was proposing to supplement one coaling station by another which involved the use of a locomotive crane, temporarily. The matter was finally adjusted by substituting for "desirable," the words "preferable to unloading by hand," and the conclusion was adopted in that form.

The next conclusion reading "that for a small terminal the two-bucket hoist seems to have good points, where a deep foundation is not too expensive" likewise aroused discussion. The committee was asked what it considered a "small" terminal. Also it was objected that the conclusion in effect recommended a proprietary device in specifying the two-bucket hoist. It was explained by the committee that while there are in use on a number of roads a two-bucket type of plant that is covered by patents, the committee was recommending a principle—that of self-counterweighted hoists—in naming the two-bucket type, and specified no particular design or make. After further discussion regarding the advantages and performance of this type of plant under the conditions the committee was endeavoring to provide for, the conclusion was adopted after substituting for "small terminal" the words "limited space and small storage capacity."

No action was taken on the last conclusion at the request of the committee, as they desired to amend it or add further information for their next report. Mr. Berg (L. V.) thought the two preceding, which had just been adopted, should receive like treatment, as the three were supposed to present a concise summary of the opinion of the association as to the distinctive cases or characteristics governing the choice of locomotive coaling plants for certain given conditions, and the conclusions were hardly in shape to warrant that opinion. He therefore moved to refer them back to the committee for further consideration and report next year, and the motion was carried. It was suggested that the committee include the matter of ash-handling in its next report.

The matter in the report concerning placing sheds over freight car repair tracks was presented as information.

Roadway.—The specifications for a steam shovel for roadway construction were offered for discussion. The recommendations were taken up seriatim and in all but one or two instances were adopted as read, without discussion. The paragraph recommending cable hoist was one of the exceptions. The successful use of cable hoists is comparatively recent and a number of questions were asked the committee concerning the basis for its recommendation. Mr. Bremner, for the committee, said that while there were only one or two makes of shovels using the cables, the results they yielded fully justified the committee in making the recommendation it did; in fact, he thought that even the makers of chain-hoist shovels would not seriously disagree with the recommendation. Mr. Storey (Santa Fe) said that while some contractors claimed the cable hoist is suitable for all conditions, others consider them adapted only to certain classes of material; but he thought the committee's recommendation a proper one for general railroad work.

The conclusions to the report were adopted without discussion.

Iron and Steel Structures.—Practically the only matter presented to the convention under this report was that relating to the matter of conducting experiments to determine the dynamic effect of moving trains on bridges. It was desired that the fund for making these experiments be contributed by the railroads, and a circular letter was recently sent out by the President of the association to the different roads represented in the association inquiring regarding their willingness to support the undertaking. A number of favorable answers to this letter were read by the President, most of the roads in question offering to share the expense on a mileage basis. Also a number of members of the convention gave similar replies for their companies. Some companies made even more liberal offers, agreeing to participate with a stated number of other roads to defray the entire expense, if necessary. The provision of funds is thus assured.

The new recording extensometer perfected during the year by Prof. Turneaure, of the University of Wisconsin, who gave an explanation of it, was on exhibition at this session of the convention. A drawing of the instrument is shown on the following page. Prof. Turneaure's explanation was as follows: "This apparatus is merely an autographic extensometer for recording the deformation of bridge members and multiplying that deformation by some factor like 80 or 90, and recording it on a moving strip of paper. The recording end only of the apparatus is shown here. This is clamped to an I-beam or angle bar, or any projecting corner of a bridge member. There is another clamp connected to the member at a distance of 3 or 4 ft. or greater as desired. The two are connected by a light rod, pipe, or something of that sort by means of a universal coupling. The deformation in that length of member is then recorded, multiplied by the factor mentioned, by means of a single lever. In the interior of the apparatus is a rod, running from the connecting rod to the short end of a lever, where there is a knife edge bearing. The long end of the lever is very stiff and is made of aluminum to be as light as possible. At its end is a pencil to record its movement on a moving strip of paper. Experience with a similar apparatus in which the multiplication was much larger indicated that the points which needed to be observed in the design of such an apparatus was not to have too great multiplication, and to have very rigid and light parts so that the inertia of the moving parts would be as small as possible. I think we have accomplished this to a somewhat better degree than in the Frankel instrument, where the multiplication is something like 140 or 150. Some tentative experiments with this apparatus indicate it will do better work on short members where the stresses vary very rapidly. It has been tried on 10-ft.

I-beam stringers, under speeds of 30 or 40 m.p.h., with quite satisfactory results. I am not sure that it would give such results on such short members under higher speeds, but on girders and members of 15 to 25 ft. and upward, I think the result will be quite satisfactory; certainly for everything above; and for a 30 or 40 ft. plate girder the result will be reliable.

"It is proposed in carrying out experiments of this sort to have eight, ten or a dozen such instruments attached simultaneously to the different parts of the structure; they can be connected up electrically so that the papers can be started in motion simultaneously. Then to move across the bridge a loaded train with whatever type of engine is selected, at different rates of speed. It is not proposed to make calculations of what the stress ought to be, but to run a train at slow speed—10 or 15 miles an hour—and take the stress developed as the static stress; then vary the speed of the train up to the maximum limit.

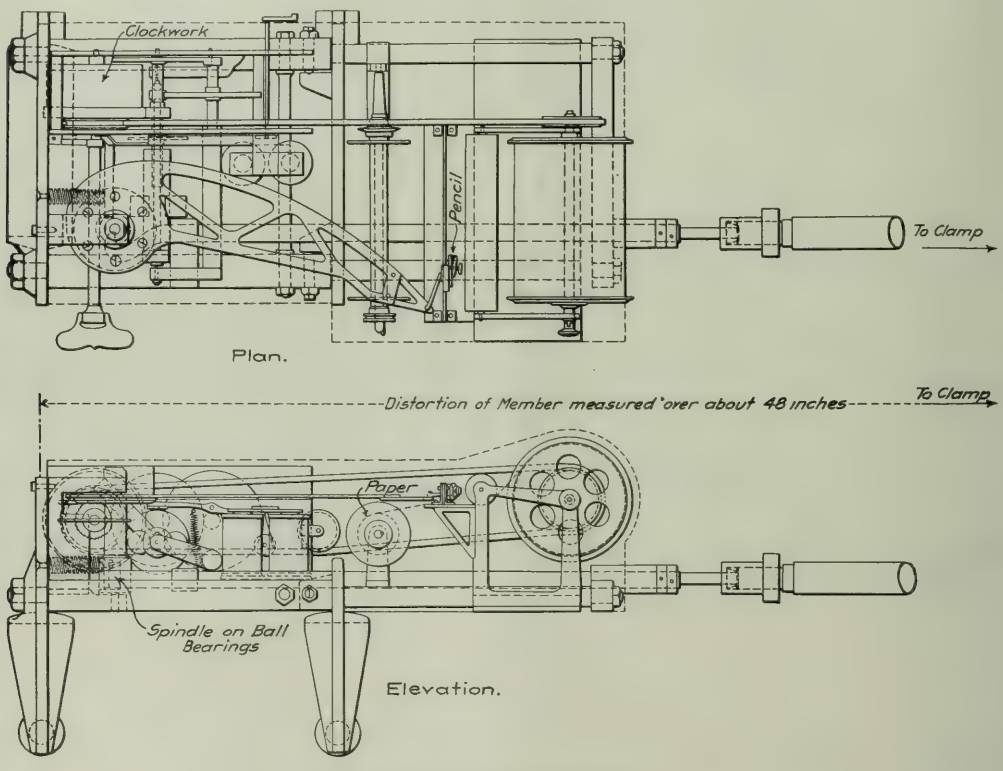
"The relation between the measured stress and the calculated stress is a question that can be taken up independently of the question of impact; but the question of impact can be got at rapidly for any structure provided we have an experimental train to run over the bridge at any desired speed. By having a number of inarators, and be bolted together. The edges with most sap shall be placed downward." It was modified to, "Stringers shall be sized to a uniform height at supports. The edges with most sap shall be placed downward."

Clause 25, "Ties shall be surfaced to a uniform thickness and shall be placed with the rough side upward. They shall be spaced regularly, cut to even length and line, as called for on the plans," was revised by changing the first sentence to, "Ties shall be framed to a uniform thickness over bearings."

Clause 26, "Guard rails shall be framed as called for on the plans, laid to line and to a uniform top surface, and spliced at each joint by a half-and-half splice over tie. They shall be firmly fastened to the ties as required," was modified to, "Timber guard rails shall be framed as called for on the plans. They shall be firmly fastened to the ties as required."

The second conclusion asking that the definitions of standard defects of structural timber given in the report be approved, was adopted. The third, asking the approval of the standard names for structural timber, was not adopted, this part being received as a progress report instead.

Ties.—There were two conclusions to the report which the



Turneaure's Recording Extensometer.

struments a pretty thorough test can be made on an ordinary bridge in a day's work, or at most in two days."

The President announced that it was hoped to at least start the experiments during the coming year.

Wooden Bridges and Trestles.—The adoption of the specifications for workmanship for pile and frame trestles was asked. This was done after the following modifications had been approved: Clause 5 of "General Clauses," reading "Holes must be bored for all spikes and drift bolts, etc.," was revised by striking out "spikes and drift."

Clause 12 under "Detail Specifications" read, "All piles shall be carefully selected to suit the place and ground where they are to be driven. When required by the engineer, pile butts shall be banded with iron or steel for driving, and the tips with suitable iron or steel shoes; such rings and shoes will be furnished by the railroad company." This had the words "rings and" stricken out.

Clause 23 read, "Stringers shall be sized to a uniform height. They shall be laid with alternating joints, provided the plans indicate a length to extend over two panels. If required, the stringers under each rail shall be provided with packing spools or sepcommitee desired adopted. The first provided that the standard tie for class A track be 7 in. x 7 in. x 8½ ft.; for class B track, 7 in. x 8 in. x 8 ft., and for class C track, 6 in. x 8 in. x 8 ft. It evoked a long discussion involving many expressions of opinion regarding the suitability of the sizes recommended, particularly that for class C track, to which strong objection was made by a number, the availability of suitable ties, the effects of different tie sizes on maintenance, etc., in which it became evident that the subject had many viewpoints. Space will not permit giving even an abstract of this discussion here. Near its conclusion Mr. Berg (L. V.) pointed out that the utmost care needed to be exercised in adopting a conclusion of the character of the one proposed, as it would undoubtedly be most far-reaching in its effects, and in its abbreviated form, without any qualifications, its adoption might produce results of an undesirable and serious character later on. The committee now had the benefit of full and free discussion on the floor and he moved that the conclusion be referred back to the committee for report at the next convention. After some further discussion, in which members of the committee objected rather strongly to the proposed

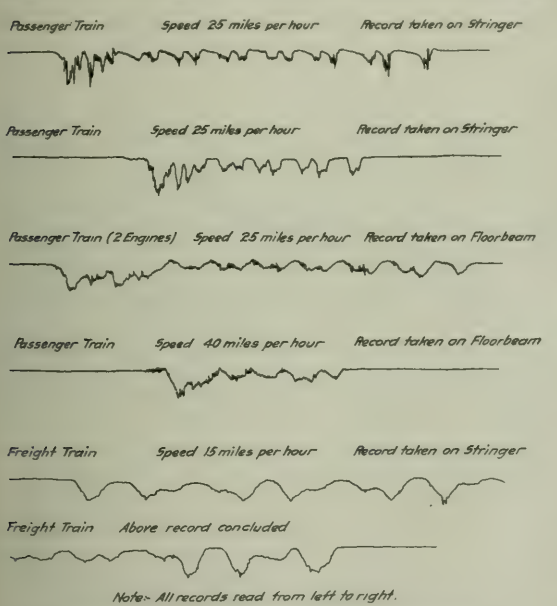
action, the motion was adopted. The committee then asked for an informal expression from members present regarding the suitability of recommending *any* standard size of tie, but acting on the suggestion that it would be better to obtain the sense of the entire association on this point, a motion to have this done during the year by letter ballot was adopted.

Conclusion 2, relative to the specifications for tie treatment, was adopted without discussion.

Signs, Fences, Crossings and Cattle-Guards.—There was only one conclusion to this report. The committee desired its adoption. It embodied the committee's recommendation that a swing board right-of-way gate be used where highway traffic is light and a hinged board or hinged tubular wire gate at other points, depending on cost. The conclusion was adopted without discussion.

Mr. McDonald (N. C. & St. L.) spoke of automatic highway crossing alarm bells and asked if members could cite experiences from their use. He thought there were possibilities connected with their use that affected unfavorably their desirability. Mr. Johnston (N. Y. C. & St. L.) thought it was a matter of the particular device used, one he had had experience with having given satisfaction.

Track.—The report contained recommendations regarding turnouts and turnout material, including the best types of switch stands, switch points, frogs, guard rails and throat clearance. The recommendations were considered separately. Objection was made by some members to the lengths of switch points recommended, some thinking the 10-ft. length would give too sharp an angle in certain



Records from Turneaure's Recording Extensometer.

locations, while others thought this length all right, but the 16½-ft. length not required for the turnouts recommended by the committee; others, again, favored the latter recommendation. On motion, the matter was finally referred back to the committee with instructions to ascertain from members by letter ballot what they considered the most economical lengths.

Regarding switch stands, Mr. L. R. Clausen (C., M. & St. P.) objected to the type recommended for several reasons. (1) That the indications given by the switchstand was a matter for the signaling committee rather than the track committee. (2) It cannot be applied to all switches, as in many places they come too close together. Also, it is impossible on account of clearances to apply it to two-track and four-track layouts at all points, making some other type necessary, giving an inconsistent system of indication. (3) It resembles semaphore indications, making its use objectionable in proximity to interlocking plants. The Reading and Pennsylvania railroads in their automatic block signal territory have either dispensed with switch stands or use extremely low pot signals. (4) In automatic block territory the presence of such a stand between block signals would cause a confusion of indications, presenting a clear indication, for example, to an engineman who was proceeding with caution as a result of the indication of the signal at the block entrance. The signaling committee intends presenting at the next convention its recommendations for switch stands and there would undoubtedly be conflict. On motion, the recommendation was referred back to the committee for further consideration and for conference with the committee on signaling and interlocking.

The recommendation on split switches was referred back to the committee, with instructions to consider in connection therewith the matter of the use of a facing-point switch with unbroken main line rail, for high speeds.

Switch points were recommended to be made of open hearth steel. Mr. McDonald said that while this is desirable, there is much doubt about its practicability. Information being asked on this point, Mr. G. W. Parsons, formerly of the Pennsylvania Steel Company, said that if the section of rail to be used by a road for this purpose is the A. S. C. E. standard it ought not to be very difficult for the switch manufacturer to arrange for a supply of rails of open hearth steel of the various weights. He thought though that the specification for open hearth steel is a little too broad. Some very poor steel might be put into a rail that had been cast from an open hearth ingot. It might not be at all suitable for it, and if an association so powerful as this undertakes to deal with this subject it should be looked into very carefully and not only specify the process as open hearth or Bessemer, but specify the limitations of the deleterious elements and conditions of drop tests, etc.

Another point raised was concerning the height of the stock rail relative to the switch point. This brought out discussion regarding the desirability of having the switch point elevated above the stock rail, as against equal heights for the two. Both practices were represented in the convention. The report recommended elevation of the point. While the switch recommended by the committee was declared a distinct advance over general practice, there were some points which were thought to need reconsideration, and on motion the subject was referred back for that purpose.

The recommended length of 15 ft. for frogs was objected to. Some thought there should be no limitation placed on the length. Mr. Kittredge (N. Y. C.) pointed out that where electrical appliances are used, with a frog of ordinary length it is hard to get a properly insulated joint at the heel of the frog. Mr. Clausen (C., M. & St. P.) indorsed this from the signalman's standpoint.

Mr. Ewing (P. & R.) moved that in view of the recommendation for the use of open hearth steel for frogs and that manganese steel for yard frogs is the most economical, the paragraph be referred back to the committee. The latter part of the recommendation he thought not always true, it depending on traffic conditions and the life of an ordinary rail frog. Mr. A. W. Newton (C., B. & Q.) said they had been investigating the manganese frogs and found that they were not serving their usefulness, in that the manganese portion is still good after the rest is ready for the scrap heap. The motion to refer back was carried.

Coming to guard rails, some members thought that the end bend recommended by the committee was too short and therefore too sharp; that it should be as long and easy as possible to minimize the jar of entrance for a train going through at speed. Also, the report recommended a 2-in. flangeway, and explanation was asked. Mr. Knickerbocker, of the committee, said it was based on the M. C. B. standard for flange thickness, which had lately been increased. Mr. Camp stated that this increase was only about $^{6}/_{64}$ in. at the top of the rail. Mr. Ewing said that the M. C. B. minimum distance between backs of flanges—4 ft. 5 in.—really fixed the location of the guard rail in order that the wheels would trail through the frog naturally. This gives the present flangeway of 1¾ in. A motion to refer back was carried.

Conclusion 2, recommending glazed sewer pipe with bell ends for wet cuts, was also referred back. The remaining conclusions required no action by the convention.

Water Service.—Conclusions 1 to 4 inclusive were adopted practically without discussion. Likewise the section under "Relative Economy of Different Types of Softeners." Mr. Bremner (C., B. & Q.) said that in some cases where they used soda ash at softening plants the pipes clogged up rapidly and the valves suffered, necessitating sometimes rebuilding and enlarging the plant. Mr. Shurtleff, Chairman of the committee, said it was due to an excess of the reagent, which was unnecessary; that while it was thought by some that an excess was required, he knew of a large number of plants where the best results were obtained by using only enough soda ash to precipitate the sulphates

The three paragraphs following, entitled respectively "Reagents," "Foaming or Priming" and "Minimum Quantity of Solids in Solution to Justify Treatment," were approved without discussion. Concerning the final paragraph, on barium hydrate, Mr. Shurtleff said: "The Board of Direction requested the committee to investigate the barium hydrate question and to report whether it would be economical as a reagent in place of soda ash. The committee has deduced an equation which will show at what price barium hydrate would be equivalent to soda ash, and the adoption of this conclusion would carry with it that equation. Personally, I would hesitate a long time before using barium hydrate as a reagent. It is a poisonous substance. With almost constant watching, occasionally we get an excess of reagent in treating our waters. Our trainmen *will* use tank water for drinking purposes on some of our Western lines.

Even though they might not get enough to be deadly, I do not believe in the idea of introducing slow poisons into the systems of our trainmen. The operating officers have enough trouble with trainmen as it is, without adding this. Another point is that it has not been used in practice as yet, and in acting on the sulphates of lime and magnesia alone, the barium sulphate is so evenly divided that it will take hours to precipitate it, except in those cases where we have the carbonates in the water in the form of heavy flakes, and magnesium hydrate, which is mucilaginous and will carry it down. Still, there may be some of the fine stuff left, and that is poisonous. I am opposed to the barium hydrate treatment."

The paragraph was received as information.

In connection with this report the President announced that a communication had been received from J. L. Campbell, Engineer Maintenance of Way of the El Paso & Southwestern, concerning the electrical treatment of boiler water on his road. Because of its length the letter was not read. It reported the process as efficient for their waters at the points used, although there were some practical difficulties that affected its desirability.

Masonry.—The chairman of the committee stated that since the report had been printed, careful consideration had been given by the committee to the specifications for stone masonry and recommended certain revisions to make them more concise, without changing their intent. There was not time for the convention to take up the revised version in detail, and Mr. Berg therefore moved their adoption for publication in the Manual with a footnote to the effect that it was a revision of previously adopted specifications, subject to formal action and adoption at the next convention. The motion was carried.

The Work of the United States Forest Service on Timber Preservation.

Mr. C. G. Crawford, of the United States Forest Service, addressed the convention of the American Railway Engineering and Maintenance of Way Association at its Thursday afternoon session, telling what his department is doing toward the prolongation of the life of ties and other timbers. He said: "The railroads are very large users of timbers, their annual consumption of this class of material being very great. This consumption is made up, of course, of bridge timbers, ties and other kinds, but largely of tie timber. We have heard here a good deal of discussion on the future timber supply, and committees have based some of their recommendations on the timber supply and caused certain recommendations to be made because of the scarcity of the timber. Each year the supply is becoming less and prices are going up. It has been stated on the floor of this convention that the railroads need the very best ties that can be had. It seems there are at present not enough facts to warrant the adoption of concrete or steel ties, and the wooden tie, for a while at least, must largely serve the purpose of the railroads. Unless something is done to lengthen the life of the tie to get a greater service out of it than at present, the railroads will experience a great deal more difficulty than at present in securing enough ties for annual renewals. This question, it seems to me, is one of the most vital matters confronting the railroads to-day. As you all know, the tie fails through decay and mechanical abrasion. These two causes largely aid each other; that is, when the tie becomes cut by rail wear, that aids in its decay. It makes a place for the accumulation of water and moisture, and the lodgment of fungus spores, which bring about the best conditions for decay.

"The Forest Service is carrying on a large number of experiments to ascertain the very best method of handling and treating timbers for the various uses. We feel very strongly that the reason the various timber consumers are not employing methods which will give a long life to timbers, is because there is not sufficient data available from which to decide on the best method to adopt, and for that reason we are strenuously laboring to secure information which will aid the consumers of timber in this country to decide upon methods of preservation which will give a long length of service to different timbers. In these series of experiments one largely augments the other. The various elements which enter into timber treatment and timber handling are best demonstrated by actual use. Of course, a thorough knowledge of the technological characteristics of the timber and of the different species, helps to estimate approximate results, but the final determination of the results which count are those obtained from actual use. Therefore, we are laying a large number of experimental tracks. We are laying them wherever we can find an opportunity to lay them and wherever we can get the railroads to co-operate with us in this work. In these different experimental tracks, each of a mile or two in length, we are using ties of different species treated under various methods—methods which are receiving most attention to-day, and which are considered most important. Then we use various forms of tie plates and various forms of spikes—the conditions which bring about the destruction of the ties and the ones which bear on the results which are necessary to solve these different problems. We are getting results on these timbers long before one would expect to get results. We are asked if it will not take 10 or 25 years before we will know anything about these results. I want to say that it is not necessary to wait so long. It is surprising, when you make a careful survey of the tracks, how quickly you get results in some form or another. The ties do not begin to decay in two or three years, but we know the conditions which bring about decay. We observe the checks in the ties, dampness or fungus spores, and we can often tell by the appearance of a tie how long it will last, and we are in a better position to estimate the length of the life of the tie. We consider the experimental tracks are of prime importance in solving the problems which are going to confront the railroads and other users of timber in a short time, which will make it imperative for them to adopt some systems other than the ones now in use to get greater length of life out of the tie.

"This experiment is being supplemented by others, and there is one in particular which I wish to mention, one in which we are carrying on experiments on timbers, not in the form of ties, but mine timbers. The experiments are being carried on largely in the anthracite mining regions of Pennsylvania. We have conditions of a regular rotting pit, where we can get results quickly. Large timbers, 13 in. in diameter, are destroyed by decay in so short a time as eight months. We are applying different preservatives to these timbers, and preservatives in different quantities, so as to ascertain what preservatives are the best and how much of the preservative is necessary to secure the best results. We are working on the question, too, of the character of the preservatives and the different constituents of the preservatives which are most essential to preserve the timber, and right in these mines we have the best conditions we could possibly wish for to prove out and demonstrate the value of these constituents."

Location Surveys for the Eastern Half of the Grand Trunk Pacific.

The eastern section of the Grand Trunk Pacific, from Moncton, N. B., west to Winnipeg, Man., often called the National Transcontinental Railway, is being built by the government of Canada through the National Transcontinental Railway Commission, of which H. D. Lumsden is Chief Engineer. In a recent address as retiring President of the Canadian Society of Civil Engineers, Mr. Lumsden gave the following account of the surveys for the new line:

The assumed distance between Moncton and Winnipeg was 1,890 miles, which was divided into six districts, averaging about 315 miles each. A district engineer was appointed to each district as the work progressed, and control of the survey parties in each was directly under the district engineer. District A, New Brunswick; District B, Eastern Quebec, and the prairie or westerly portion, or about 65 miles of District F, being comparatively easily accessible, the parties on preliminary surveys consisted of an engineer-in-charge, transitman, leveller, topographer, two rodmen, two chainmen, picketman, five axemen and a cook. When location was begun these parties were supplemented by the addition of a draftsman and one or two axemen.

The country from the St. Maurice river westerly to within about 100 miles of Winnipeg, on the route laid down to be explored, was one of which little was known outside of explorations made by the Geological Survey up various streams, which almost all ran at right angles to the general course of our line, and one or two survey lines in Northern Ontario and Manitoba. The survey parties employed in the unknown districts were considerably larger, having in addition five or eight men as axemen and packers, who were continuously employed in bringing in to their parties provisions from the nearest caches or depots. Previous to our beginning work the Grand Trunk Pacific had put a number of parties in the field between Winnipeg and North Bay, and made a preliminary survey of a greater portion of the route, and in the winter of 1904-05 we took over from them all the plans, profiles and information they had obtained of that portion of the country, and made use of them where practicable, also taking over what provisions they had on hand in that district. During the winter of 1904-05 we had in all 11 parties making preliminary surveys in New Brunswick, 11 parties between New Brunswick and the Quebec boundary and Weymontachene on the St. Maurice river, or Clear Lake, eight parties between the last mentioned points and the boundary between Ontario and Quebec and two parties, one south and one north of Lake Abitibi. In January, 1905, one preliminary and five exploration parties were sent out in District F, between the northwest angle of Lake Nepigon and the Manitoba boundary, to make a thorough examination of the country, with a view of shortening and improving the line previously run by the Grand Trunk Pacific.

At the end of March, 1905, we had 38 parties, and by the middle of the summer, 45 parties in the field, of which about one-half were in inaccessible districts, necessitating the transport of supplies for their maintenance for distances up to 200 miles from the nearest available transport routes. Owing to the heavy snow and lack of much knowledge of the possible routes to reach the various parties, great difficulty was experienced during the first

winter in keeping parties fully supplied, but since then, by better knowledge of the country and the cutting of a few winter roads to the principal distributing points or depots, and pack trails thence to caches on or near our line, or to points to which transport by water in the summer is good, we have now little trouble, and not one-third the expense in keeping parties fully supplied, and maintaining at least a bi-monthly communication with all of them.

Printed books of instructions to engineers were issued early in 1905, in which were set out the duties of various classes of engineers, transitmen, levellers, topographers, field draftsmen, etc., and giving general instructions as to the plotting of plans, profiles, etc. They also contained memoranda of necessary camp outfit and supplies, medicine chests, stationery boxes, etc., for 18 men for 200 days. These were modified according to the circumstances under which parties were working. Supplementary instructions were also issued from time to time in regard to the engagement and paying off of men, the making up of pay-rolls, expense accounts, the precautions necessary to prevent forest fires, and copies of the regulations in force in each province for that purpose, also instructions and precautions to be taken by men in charge of canoes.

During the summer the numerous waterways were the only routes available, and with the exception of a few pointers or lumbermen's boats, canoes were the only means of transport. This necessitated a large amount of manual labor, packing outfits and provisions over the numerous portages, varying in length from a few yards to several miles. Great difficulty was found in procuring a sufficient number of men suitable for this service, as only those who had previous experience in this sort of work were at first of much use for the arduous labors of packing. Numbers of men, thinking because they had been frequently in canoes they were quite competent to take part in such work, soon found that canoeing for pleasure was a different matter from this, and that the carrying of numerous loads of 100 lbs. or more, on their backs, over even a portage a quarter of a mile long, was more than they could stand, while men such as half-breeds and Indians, who had been brought up to such work, would with ease carry double the load the novice could do, and keep at it all day. The principal canoes used for this purpose were made of basswood, but a few cedar and canvas canoes were also used. They varied in length from 16 ft., which were used for light work and carrying mail, to 22 ft., the latter being of extra beam and depth, and capable of carrying over a ton of provisions, together with the necessary crew. During the summer of 1905 we were exceptionally unfortunate, and the accidents to parties in canoes were numerous, causing the loss of a number of valuable lives.

Our experience has been that by far the most economical means of transport, outside of rail or steamer, is by horses and sleighs where practicable, and the cutting of a few miles of winter road connecting or following large bodies of water, has been the means of saving thousands of dollars. The provisions also were delivered in much better condition, rainy or hot weather, leaky canoes and carelessness of men contributing largely to the depreciation of the value of many kinds of goods while in transit by canoes. The distribution by teams beyond certain distances was found to be impracticable, owing to the fact that either all fodder had to be brought in at great expense, or no lakes and streams were available, and the amount of provisions required was not sufficient to warrant the cutting of sleigh roads for the whole distance.

To overcome this difficulty we have been making use of a number of men, dogs and toboggans with very satisfactory results, distributing from our main caches, or stores, to smaller ones in the vicinity of our line, say 10 or 20 miles apart. Few people who have never had the actual experience with the use of dogs as a means of transport can form any idea of their capabilities, and the ease with which they seem to do their work, provided the men in charge take proper care of them and see that they are regularly fed and sheltered on cold or stormy nights. A team of dogs may consist of any number from two to six, or even more, but in a rough timbered country from three to five is the most one man can conveniently handle. The dogs used by us were all, with a few exceptions, bought in the towns and villages, and as long as they were of sufficient size, and not too young or too old, they were acceptable. Few days are required to break in a team of dogs, especially if one broken dog can be found for a leader. A man and five dogs will, in a moderately rough timbered country, move 500 lbs. six to eight miles a day and return for another load. In a level country, with a good trail, they can make 10 to 12 miles a day and return. Where lakes and rivers are available, and there is good going, 30 to 50 miles a day have been frequently covered by dogs with a light load. For freighting purposes every dog's load can be considered as 100 lbs. The drivers of dogs should be active, hardy and of good temper. All that is necessary for a dog trail is that several men go over it with snowshoes, cutting out all brush and logs for a width of say 2 ft., avoiding as far as possible all sharp turns or steep hills. The more such a trail is traveled over the better it becomes, especially where in a timbered country it is protected from drifting snow. The toboggans used are about 8 ft. long and 14 in. wide, preferably made from split-out strips of birch, maple or ash ½ in. thick. Each toboggan is provided with a canvas cover, in which all goods are securely covered and lashed to the toboggan with cod-line, or light rope, a light rope being also attached to the rear end of the toboggan for the driver to hold on to, and enable him to hold back when going down hill. Regular leather harness is provided for dogs, the only precaution necessary being to see that the collars fit each individual dog and do not gall the shoulders or neck.

Having personally had considerable experience in railroad location, I may say that in my opinion when surveys are to be conducted in a country which is timbered and little known, it is in the long run a great saving in time and money if it is practicable to have the engineer who is to have charge of the survey, accompanied by a good assistant and say half a dozen or more men, go over the country as best he can, running rough compass lines, using a micrometer, pacing or estimating for distances, taking barometrical altitudes, and generally becoming acquainted with the nature of the country and the principal difficulties he may expect to have to overcome. Having gone over the whole of the section allotted to him, and thoroughly explored the country for several miles on either side of his rough compass line, he will have naturally formed some idea of the best route to be followed, and save the cost of a large party running instrumental lines that may prove after weeks of hard labor utterly impracticable through running into some unforeseen obstacle.

The engineer in charge of work of this character should be one who has had considerable experience in a timbered country, able to find his way anywhere and not afraid of being lost. He should be able to establish his latitude and approximate longitude by observation, though owing to the difficulty in carrying a reliable chronometer the latter is seldom to be relied upon. On reaching his point of departure, his aneroid barometers, of which he should have at least two, or better, four, having all been previously compared and rated, he will assume a datum for elevation for his work, and all altitudes should be reduced to that datum. By arranging the movements of his party he can provide that one barometer will always be stationary, and if a half-hourly record of its readings is carefully kept all altitudes taken by the party in the field can be reduced to one datum, the party having kept record of the time at which the observations were made. As it is well known, such barometrical altitudes cannot be explicitly relied upon, but with care and good barometers it is surprising what close approximation to the true altitudes can be obtained. My experience has been that the aneroid barometers best suited for rough work are those about 2½ in. in diameter, divided to read 5 ft. The range of such barometer does not generally exceed 2,800 ft., but they are much less liable to get out of order than the larger ones, which are supposed to read by verniers to one foot.

Having thoroughly explored the country through which he is to operate, the engineer in charge selects a route for his preliminary line, and having been joined by his transitman and the rest of his party, he proceeds with the running of such a line. If the country is rough and broken a transit should be used, but if tolerably level a picket line, run by the aid of field glasses, the angles being turned with a transit or box sextant, is generally the faster method, and sufficiently accurate for preliminary purposes if the line is checked by compass bearings. The chainage should be done with a light steel chain. Having assumed a datum for elevation, the leveling should in all cases be carefully done and checked wherever practicable, bench marks being established at least every half mile. Cross-sections should be taken by the topographer as frequently as the nature of the country may require, to enable him to show contour lines for every 5 ft. of elevation on either side of the line for considerable distances. As the through levels are not in any way affected by the cross-section work, these sections can be taken with sufficient accuracy with a good hand level, the distances, right or left being measured with a chain or tape. It is a good practice to insist that the field notes of all instrument men be plotted up by the men who made them each night as the work progresses; this will save time and avoid many errors.

Having completed his preliminary line the engineer in charge lays down on his plan, with the aid of contour lines, a proposed location and proceeds to stake it on the ground, the levels being checked with those of the preliminary line, and bench marks established every 1,000 ft. Having completed his first location and made any revisions that may have occurred to him, the engineer who has been in charge of such work should be moved on to other work and a new man put in charge for final location. This new man should, before taking charge of the party, be furnished with the plans and the profiles, and given ample time to go over the lines run by his predecessor. He may or may not be able to improve on the previous line, but in any case the judgment of two in place of one is obtained on final location.

The commissariat for a survey party to-day is a very different matter from what it was 30 years ago. Formerly, if a party was well supplied with bacon, beans, flour, tea and sugar, it was all

that they expected, whereas to-day the addition of canned meats, dried fruits, vegetables and canned goods generally, has added much to the variety of food supplied; but the one thing that in the old days contributed more than others to the well-being and comfort of a party is still the same, namely, a good cook.

The Orenburg & Tashkend Railroad.

The Orenburg & Tashkend Railroad, opened for traffic throughout its full length of 1,150 miles April 1, 1906, has had its traffic reported for each month down to August last. The line extends from Orenburg, which is in Russia near the southern end of the Ural mountains, southeast through a semi-arid grazing country, the bottom of an old sea, to the fertile Central Asian territory. This country produces cotton and fine fruits. The 1,151 miles of this railroad are worked in connection with 235 miles of an older railroad to Orenburg, connecting with European Russia. Its gross earnings were $365,844 in August, 1906, and 40 per cent. more than in 1905, when it was not yet opened through to Tashkend. This is at the rate of $264 per mile for the month. The wool, camel's hair, hides and other products of the vast herds and flocks of the plains have increased greatly in value in consequence of this new outlet to market, which seems likely to divert nearly all the traffic of the fertile country in the Tashkend country from the Asiatic Midland Railroad to the Caspian, heretofore its only outlet. There is good coal on the line, and immense deposits of salt, copper and silver mines too poor to be worked when there was no railroad, and some petroleum. Already it is proposed to build several branches, some of considerable length.

The Flatbush Avenue Terminal of the Long Island Railroad.

BY CHESTER A. CRANDELL.

The new Flatbush avenue terminal in Brooklyn is the common terminus of two distinct subways. It is entered on the Atlantic avenue side by the Atlantic Avenue Improvement subway of the Long Island Railroad. The Brooklyn subway, which connects with the subway system of Manhattan by means of the East river tunnels, enters from beneath Flatbush avenue.

At present the only connection between the two subways is a passenger subway shown in Figs. 1 and 2, which is below the level of the tracks and leads up to the platforms of both stations by

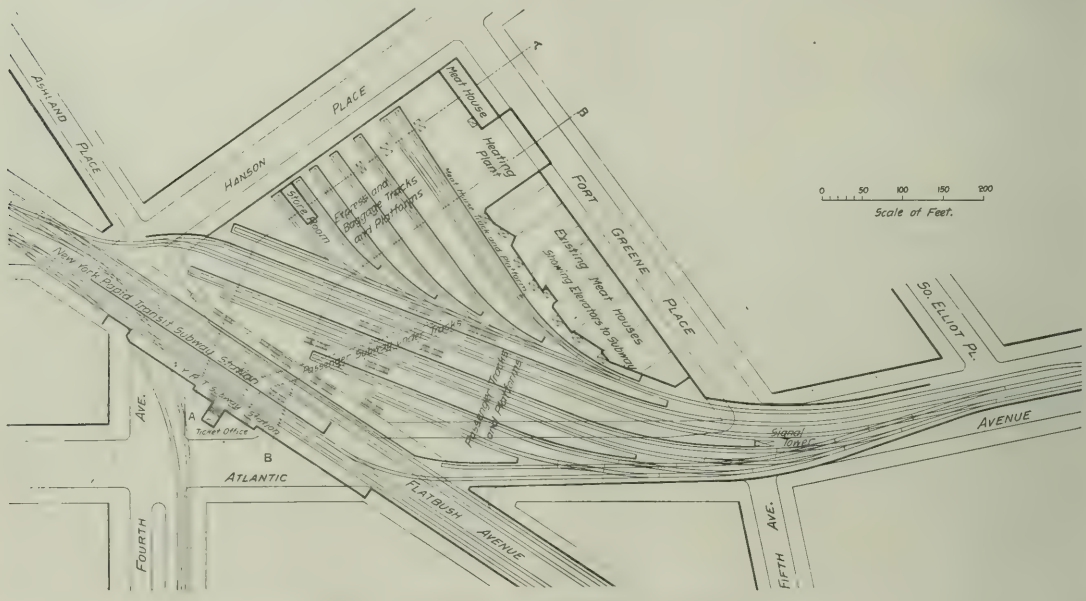


Fig. 1—General Plan, Flatbush Avenue Terminal.

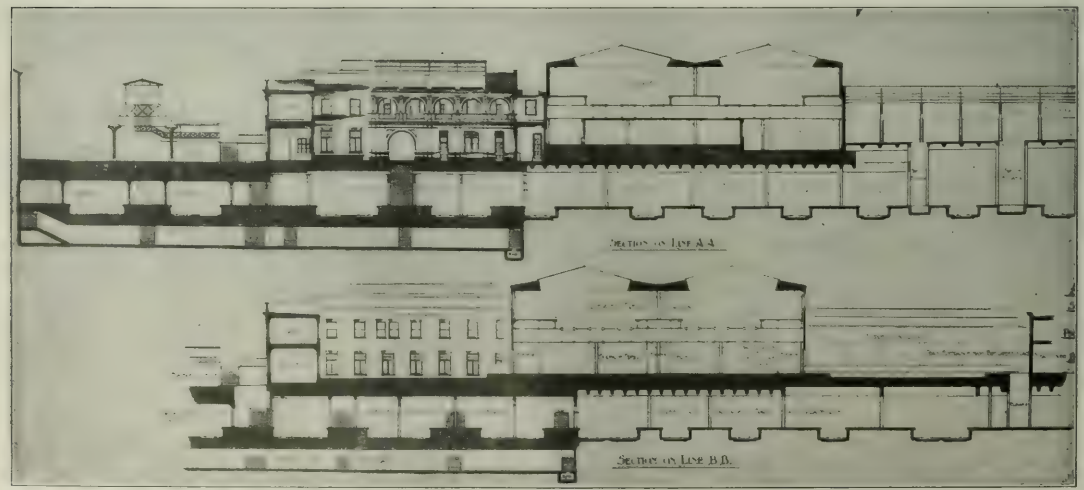


Fig. 2—Section Through Flatbush Avenue Subway Terminal.



Fig. 3—Grillage, Looking North.

means of stairways. Provision is being made, however, in the construction to permit of two single-track connections at some future time should occasion demand. These proposed tracks appear in Fig. 1.

In a general way, as will be seen from the sections in Fig. 2, the terminal consists of three levels. The lowest of the three is for the railroad subways and the train platforms. The connecting passenger subway before-mentioned, alone is below this level.

The second, or street level, is entirely clear of tracks, and is devoted to the main floor of the Long Island Railroad station, driveways, etc. Station L of the Brooklyn postoffice occupies a wing of the station building.

The freight tracks of the Long Island Railroad are brought into the terminal at the third level on an elevated structure. This structure is connected with the Atlantic avenue subway by an incline between Carlton avenue and Sixth avenue, five blocks east of the terminal.

The station building proper and the post-office station are built of terra cotta brick. This is almost the only part of the work where bricks are used. The granolithic station floor is founded on a cinder



Fig. 4—Express Platforms.

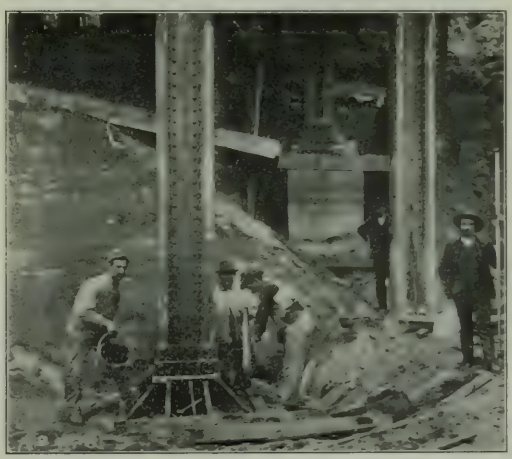


Fig. 6—Pouring Method of Grouting Columns.

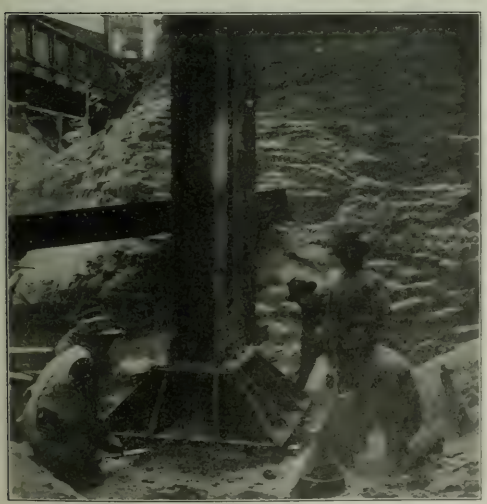


Fig. 5—Ramming Method of Grouting Columns.

base, spread over the roof of the terminal, while the walls are supported by steel grillage, shown in Fig. 3, bearing on the main columns of the terminal below. Fig. 4 shows the general type of construction, which, as will be seen, was arranged to conform to the arbitrary column locations as determined by the track layout. Perhaps the most distinctive feature of this undertaking is the lack of difficulties attending it. Indeed, its progress has been so fortunate that at the time when sand and stone were needed for the composition of the concrete retaining walls, platforms, etc., a sand bed was struck in the course of the excavation; and sufficient rock had been previously blasted to supply the crusher. Another evidence of this feature was the character of foundation at the rear of the "existing meat houses," as shown in Fig. 1. The ground was such that, by the introduction of mud sills, each building could be supported while a trench was dug and a concrete wall built from the low level of the terminal to the old footing of the building.

After the excavation had been completed and the retaining walls built, the steel work was begun simultaneously at two points. From the boundary line at the end of the Atlantic Avenue Improvement, the erection was carried west, while from a line near the middle of the passenger section it was carried both east and west.

Figs. 5 and 6 show the two methods of grouting columns, viz., ramming and pouring, which gave equal satisfaction. As may be inferred from these pictures, the columns were temporarily suspended from the girders above by bolts and then plumbed. After grouting, the steel work was riveted, and the work proceeded very smoothly.

As a result of this facility, there has been little or no demand

for novelty of method. With perhaps the exception of the method used in temporarily supporting the elevated structures, there is nothing very new to the engineer.

Fig. 7 shows quite clearly the provision made for carrying the elevated railroads and their traffic while the columns were undermined to erect the permanent foundation. Advantage was taken of the exposed rivet heads on the columns, and timbers were set up beside them and held with clamps which were tightened as the timbers were driven solid against the columns. The rivet heads, being imbedded in the wood, afforded, in total, adequate bearing surface to support the structure, leaving the base of the column exposed.

A few leading figures may serve to give a more definite impression of the extent of the work on the terminal. They are as follows:

Excavation	170,000 cu. yds.
Concrete	20,000 "
Granolithic pavement	80,000 sq. ft.
Steel	3,700 tons.

The excavating and the steel and concrete work are being done by the Degnan Contracting Company. The passenger station was built by the P. J. Carlin Construction Company of New York. The Hedden Construction Company of New York has the contract

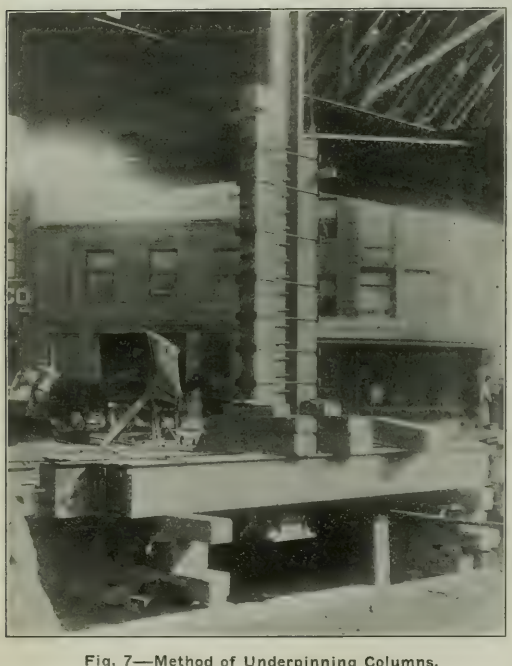


Fig. 7—Method of Underpinning Columns.

for the express office, while the corrugated iron express shed was built by the Long Island Railroad.

For the photographs and information of this work we are indebted to Mr. Ralph Peters, President of the Long Island Railroad; Mr. Lawrence J. Carmalt, Principal Assistant Engineer, and Mr. Charles H. Berry, Resident Engineer of the Atlantic Avenue Improvement.

The Oldest Railroad Junction in the World.

BY W. B. PALEY.

In the *Railroad Gazette* of August 23, 1901, mention was made of the centenary of the first British public railway act, which occurred on May 21 of that year. The line was described as a horse tram-road, solely for general merchandise traffic, termed the Surrey Iron Railway. It possessed a short branch, only about 1⅝ miles in length, from a point on Mitcham Common to certain mills at Carshalton. The exact spot where this branch diverged from the main line is still quite visible, about 150 yards west from the platform of Mitcham Junction station on the London, Brighton & South Coast Railway. The site of the tram-road junction now forms part of the Brighton Company's Croydon & Wimbledon branch, which for a little way on each side of it occupies the old course of the tram-road. So far as can be ascertained, the place may certainly be considered the site of the oldest railroad junction in the world. It has not, however, even when reckoning the present Mitcham junction as virtually its successor, been in use continuously as such ever since the Surrey Iron Railway opened in 1803, for on August 31, 1846, that line was finally closed for traffic and completely dismantled soon after. From then until the Croydon & Wimbledon line was opened, on October 22, 1855, there was no railroad near the place, nor any junction again till October 1, 1868, when the Brighton Company opened a line from Peckham Rye to Sutton. This passes under another bridge, and is of course, now in active use; it unites with the Wimbledon line at the west end of Mitcham Junction station and runs off at the east end, forming part of the London & Portsmouth route.

No sign of the permanent way of the tram road remains in its original position, but two or three of the small stone blocks that carried the ⌋⌊ plates may be seen here and there, utilized as boundary marks at corners, and so on. The course of this branch curves away with a bold sweep from the junction to the south, and can be well viewed from the bridge. A public right-of-way along it, still called Tramway Path, is no doubt a survival from the time when people used to walk freely along the tram-road. Evidently it was a double line for a little way, like the main line, but was probably not so throughout. The site of the branch is soon lost in the back yards of the houses of Tramway Terrace, behind which the path runs, but it comes to light again at the Goat Inn at Beddington Corner and forms the raised footpath by the road side, marked by posts and rails. Whether the branch was completed when the rest of the Surrey Iron Railway was opened on July 26, 1803, is not known to the writer, but a most interesting "toll-sheet," or list of rates, in the South Kensington Museum, proves that it was in use by June, 1804, at any rate.

At Carshalton the branch ended at the oil mills of Mr. Shepley, but these have long disappeared and a tan yard takes their place. The line approached the mills along the east bank of the River Wandle, in the line of the private road now leading to the tan yard. Between Beddington Corner and this point the line ran across Hackbridge Green, which has since been enclosed, but a curved row of trees still marks the course the tram road took. One or two old maps appear to show a sub-branch from near the Goat Inn to certain other works a little lower down the Wandle, but while probable enough the writer has been unable to confirm their testimony.

The country about here is very pretty in summer and well worth a visit from anyone who appreciates the part these humble old horse trams played in leading up to their great successors, the steam railroads of to-day.

Grover Cleveland on Attacks Against the Railroads.

The following is from an interview with ex-President Grover Cleveland published in the *New York Times* of March 24th:

There is much of the nature of delirium in the popular outcry against railroad corporations, for instance. We shall all be ashamed of it by and by. I dare say I have some reason to know of the real iniquities of corporations, and I do know them, but there is much that is not only groundless, but wrong, in the offhand attacks made on the railroads by thoughtless people on all sides. What is well founded in them will be cured, but the craze of denunciation will soon pass. We shall reflect that railroads are vitally related to our prosperity, and that to attack them needlessly is to attack ourselves. It is not the stock of soulless millionaires, but the property of citizens, of widows and orphans, whose savings are invested in railroads, that is being damaged. We shall recall what railroads have been and are still to be in the development of our country, and this craze will pass.

Of course there must be some form of governmental supervision, but it should be planned in a quiet hour, not in one of angry excitement.

Popular emotions follow peculiar laws. The psychology of a craze is most interesting. The temptation is well-nigh irresistible to do what we observe our neighbors do. If they begin to throw stones, we hunt for missiles ourselves. The railroads have had a hard time lately. Every man's hand is against them. Wherever a railroad head is to be seen it is safe and amusing to hit it; its owner has no friends. There are some pretty big difficulties before railroad managers just now. Before long we shall have a crop to move, under perplexities greater than those of last year. And the increasing production of the country will increasingly embarrass the railroads. But I have faith to believe that whenever a thing must be done Yankee wit and pluck will find a way to do it—especially if there is any profit in it.

Only we should help and not hinder. I have observed those passionate outbursts during a life of threescore years and ten. I trust I have a fitting appreciation of the justice which lies beneath the present popular clamor against corporations, and especially railroad corporations, but I believe that as a frenzy it will pass, and that the people will demand of the party to which they give their suffrages the enunciation of a principle rather than the denunciation of a condition.

Doubtless the questions which the press keeps so persistently

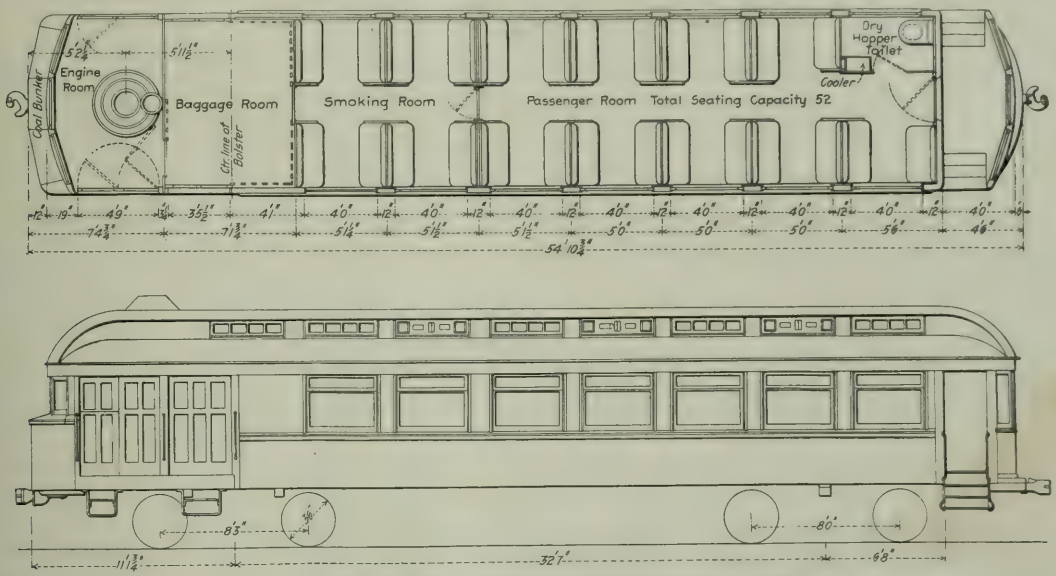
before the public attention and in which there is indeed keen public interest are urgent and important. They must be met and solved. They will be solved by common sense and justice. I am no friend of corporations. I am afraid I should wipe out the possibility of the existence of the evil ones, but I see in the question as to whether railroad fares should be 3 cents or 2 cents a mile no great principle.

Ganz Steam Motor Car for the Rock Island.

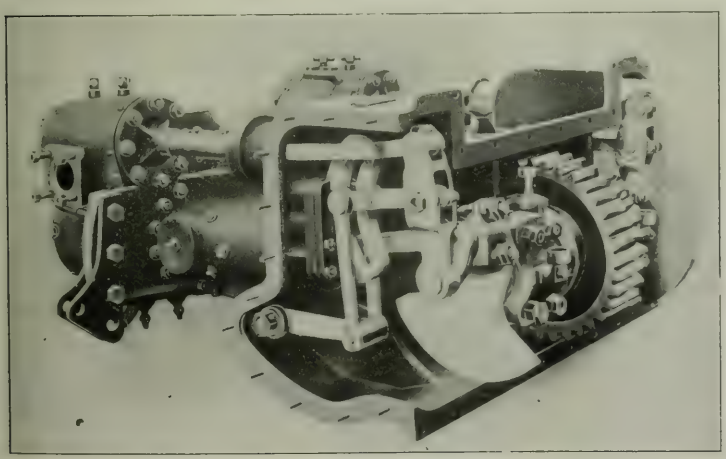
The Chicago, Rock Island & Pacific is soon to receive a Ganz steam motor car from the Railway Auto Car Company, New York, the company which controls the patents and manufacturing rights for the Ganz system in the United States. The general plan and a side elevation of this car are shown herewith. The total length over end sills is 54 ft. 10¾ in., and the car has seats for 52 passengers, including 16 in the smoking compartment. The baggage room is 7 ft. 1¾ in. long, and the motorman's compartment at the forward end of the car, which contains the generator and accessories, is but 6 ft. 4¾ in. long over all. The coal bunker is supported over the front end sill, and the coal is removed through a small sliding door opening into the motorman's compartment. The coal bunkers carry sufficient fuel for a continuous run of 50 miles.

The feed water for the steam generator is carried in two longitudinal steel tanks suspended from the underframe of the car. These tanks have a total capacity of 600 gallons, or sufficient for a continuous run of about 60 miles. The steam generator is of the standard Ganz type, and is 42 in. in outside diameter. This steam generator is capable of developing a maximum of 120 h.p. in conjunction with the compound steam motor, which is mounted in the forward truck and which drives on the rear axle thereof.

The second illustration shows a view of the steam motor with the cover enclosing the gears and link motion removed. This motor is compound and steam jacketed, and is entirely enclosed. The gear case is partly filled with oil so that all moving parts receive a continuous and thorough lubrication. The normal speed of this motor is 600 revolutions per minute, although it can be operated satisfactorily up to a speed of 900 revolutions per minute. The working pressure is 270 lbs. per sq. in., and the steam is superheated. The motor is controlled from levers conveniently located at the right hand side of the motorman's compartment.



Ganz Steam Motor Car for the Chicago, Rock Island & Pacific.



Motor of Ganz Car with Crank Case Removed.

The car body is of all-steel construction, with the interior finished in quartered oak. The design of the car body is in accordance with what is now considered to be the most advanced practice in passenger car design. That is to say, the vertical load is taken care of by the sides of the car, which form deep girders, while the buffing strains are taken care of by relatively light longitudinal center sills. The total weight of this car in working order, fully loaded, is 36 tons. The car is equipped with Westinghouse automatic brakes with an air compressor of the axle-driven type mounted on the trailer truck.

The car is designed to maintain a speed of 35 miles an hour on a level track, 24 miles an hour on a 1 per cent. grade, and 15 miles an hour on a 1½ per cent. grade. The car is also capable of hauling a trailer at a speed of 30 miles per hour on a level track, and 15 miles an hour on a 1 per cent. grade. The fuel is to be coke, and the consumption is not to exceed 16½ lbs. per mile.

This is the first standard car of the Railway Auto Car Company which will be built and delivered in this country, although other cars of this general type are now being built.

The Society of Italian Chambers of Commerce has issued a circular complaining of the bad condition of railroad traffic, in which it cites as instances three shipments of freight from Milan to a station 3¾ miles distant. One of these shipments arrived 44 days, the second 45 days after delivery to the railroad, and the third had been shipped more than a month previously, and nothing further was known of it.

Exhibits at the Maintenance of Way Convention.

The number of exhibits was about the same as last year—a little greater possibly—and it was again evident that the space available for their display at the Auditorium is entirely inadequate. It is understood that some definite action will be taken during the coming year toward procuring suitable quarters elsewhere for exhibit space for future conventions. It is to be hoped that this will be done. The list of exhibitors follows:

Adams & Westlake Co., Chicago.—Samples of "Adlake" signal lanterns.
Ainsworth & Sons, Wm., Denver, Colo.—Samples of Brunton pocket transits, Ainsworth precision transits, and engineering instruments.
Allith Manufacturing Co., Chicago.—Full-sized door, showing application and operation of Allith adjustable door hanger.
American Flange Frog & Railway Improvement Co., Roanoke, Va.—Model of Graham flange frog.
American Guard Rail Fastener Co., Philadelphia.—Samples Anchor guard rail clamp.
American Hoist & Derrick Co., St. Paul.—Photogsaphs of "American" railroad ditchers.
American Railway Device Co., Chicago.—Model of "Economy" separable switch point.
American Steel & Wire Co., Chicago.—Samples of steel wire fence.
American Tracing Cloth Co., Paterson, N. J.—Samples of "Peerless" tracing cloth.
American Valve & Meter Co., Cincinnati, Ohio.—Full-sized samples of "Economy" switch stands and model of track and switch showing operation of Anderson interlocking switch stand.
Atlantic Equipment Co., New York.—Photographs of "Atlantic" steam shovels and contractors' saddle-tank locomotives.
Atlas Railway Supply Co., Chicago.—Atlas rail joints, braces and tie-plates, including the Atlas insulated and compromise joint.
Barrett Manufacturing Co., New York. Samples of Barrett roofing materials.
Beaver Dam Malleable Iron Co., Beaver Dam, Wis.—Samples of malleable iron tie-plates and rail braces; also F. & N. anti-spreader and anti-creeper.
Belle City Malleable Iron Co., Racine, Wis.—Samples of L. & S. anti-rail-creeper; L. & S. adjustable rail brace; L. & S. stationary rail brace; also model of track, showing effect of application of L. & S. anti-rail-creeper.
F. W. Bird & Son, East Walpole, Mass.—"Paroid" roofing, "Hydrex" waterproofing and "Neponset" insulating paper.
S. F. Bowser & Co., Ft. Wayne, Ind.—Full-sized samples of Bowser self-measuring oil tanks.
Brinker Safety Switch Attachment Co., West Lebanon, Ind.—Model of safety switch.
Wm. Brown Paint Co., Chicago.—Samples of painted materials.
Browning Engineering Co., Cleveland, Ohio.—Card showing Browning locomotive coaling cranes.
Bryant Zinc Co., Chicago.—Samples of crossing bells, batteries, relays, etc.
Buda Foundry & Manufacturing Co., Chicago.—Paulus, Buda and Wilson track drills, switch stands, rail benders, car replacers, ratchet and friction jacks, etc.
Cambria Steel Co., Johnstown, Pa.—Sample 100 per cent. rail joint and 100 per cent. insulated rail joint.
Carnegie Steel Co., Pittsburg.—Sample of Duquesne splice bar and steel cross tie; also samples of built-up steel tie after six years and ten months' service in main track of Lake Shore & Michigan Southern Ry.
Central Iron & Steel Co., Harrisburg, Pa.—Samples of "American" steel cross tie.
Chacamas Plantation Co., Chicago.—Samples of timber ties.
Chameleon Signal & Manufacturing Co., Edwardsville, Ill.—Full-size sample of "Chameleon" automatic block signal.
Chicago Pneumatic Tool Co., Chicago.—Samples of riveting and chipping hammers, drilling, reaming and boring machines; also sand rammer.
Chicago Steel Tape Co., Chicago.—Measuring tapes and jointed leveling rods.
Cleveland Frog & Crossing Co., Cleveland, Ohio.—Samples of "Prentice" anti-rail-creeper.
Climax Stock Guard Co., Chicago.—Samples and model showing "Climax" shale clay stock guard; also models of "Climax" and "Eureka" gates.
Conley Frog & Switch Co., Memphis, Tenn.—Wooden model of Conley frog.
Cook's Standard Tool Co., Kalamazoo, Mich.—Full-size samples of Cook's collapsible rail drill and drill grinders; also standard track jacks and Cook's combination steel and wood cattle guard.
Cortright Metal Roofing Co., Philadelphia.—Samples of metal roofing and model showing application.
Detroit Graphite Manufacturing Co., Detroit, Mich.—Photographs and pamphlets describing suspension graphite paints.
Danville Car Co., Danville, Ill.—Photograph showing new car plant.
Dickey, G. W., Chicago.—Model of "Dickey" rail joint supports.
Paul Dickinson, Chicago.—Dickinson movable smoke jack and Dickinson ventilator; full-size section of 40-in. cast-iron jacks; also full size samples of Dickinson cast-iron chimneys and ventilators.
Dilworth, Porter & Co. (Ltd.), Pittsburg, Pa.—Samples of tie plates.
Dodge & Co., H. B., Chicago, representing Jas. G. Wilson Manufacturing Co., New York.—Models of swing and rolling doors.
Dressel Railway Lamp Works, New York.—Samples of signal lamps.
Economy Separable Switch Point Co., Louisville, Ky.—Model of "Economy" separable switch points.
Eastern Granite Roofing Co., New York.—Samples of perfected granite roofing and sand-surfaced roofing.
Electric Storage Battery Co., Philadelphia, Pa.—Samples of "Chloride" and "Exide" accumulators, battery cells, etc.
Expanded Metal & Corrugated Bar Co., St. Louis, Mo.—Transparencies showing examples of concrete reinforcement with Johnson corrugated steel bars in bridge abutments, culverts, elevators, storage tanks, retaining walls, etc.; also photographs and full-size samples of Johnson corrugated bars.
Eyeless Tool Co., Newark, N. J.—Samples of eyeless picks, hammers, sledges, etc.
Fairbanks, Morse & Co., Chicago.—Full-size No. 0 inspection car; also samples of Barrett track jacks, rail drills, stand pipes, wheels, etc.
Firefight Sales Co., Pittsburg, Pa.—Literature describing "Firefight" paint; also samples of paint in various colors.
Flexible Compound Co., Philadelphia, Pa.—Samples of application of "Flexible" water-proof compound.
Franklin Manufacturing Co., Franklin, Pa.—Samples of asbestos shingles, lumber and smoke-jack materials.
General Fireproofing Co., Youngstown, Ohio.—Samples of cold-twisted lug bar for concrete reinforcing, expanded metal lath and diamond mesh fabrics, and pin-connected frames for concrete girder and beam reinforcement.
Wm. Goldie, Jr., & Co., Bay City, Mich.—Samples of Goldie perfect tie plug.
Goodwin Car Co., New York.—Photographs and booklets describing the Goodwin steel dump car.
Gordon Battery Co., New York.—Samples of Gordon primary cells.
Graves & Co., N. Z., Chicago.—Samples of building and structural paints.
Greene, Ernest F., Silver Creek, N. Y.—Model of Greene's automatic safety device for facing point switches.
Grip Nut Co., Chicago.—"Grip" nuts in various sizes.
Hall Rail Joint Co., Chicago.—Samples of the Hall rail joint for various sized rails.
Hayes Track Appliance Co., Geneva, N. Y.—Full-size samples Hayes lifting and Hayes pivot derails.
S. P. Holmes & Co., Chicago.—Samples of "Cellular" steel.
Wm. B. Hough & Co., Chicago.—Samples of Ransome twisted bars and sheet steel piling; also literature descriptive of Ransome concrete mixers, bars, Troy wagons and pilling.
Hussey-Binns Shovel Co., Pittsburg, Pa.—Samples of shovels and scoops.
H. W. Johns-Manville Co., New York.—Samples of asbestos roofing, pipe coverings and packings; also electrical devices, fuses, "Transite" board, etc.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.—Full-size samples of hand cars, velocipedes, track drills, jacks, gages and levels, new wheel with reinforced tread, Root scraper and flanger, and Moore chuck.
Keuffel & Esser Co., New York.—Sample steel tapes, transits, surveying and measuring instruments.
Kinnear Manufacturing Co., Columbus, Ohio.—Full-size model of Kinnear rolling door, roundhouse type.
B. R. Kozlowski, Chicago.—Model of simplex "T" tie and rail fastenings.
Lackawanna Steel Co., New York.—Full-size samples of Abbott track gage plate, Abbott track gage and tie plate, Abbott rail joint plate, Abbott reinforced rail and Abbott composite rail tie.
Walter D. LaParle, Chicago.—Samples of combination wire and cable fencing and plate nut locks for railroad crossings.
Lehon Co., Chicago.—Samples of "Roofrite" roofing.
Lufkin Rule Co., Saginaw, Mich.—Metallic and linen tapes, steel rules, etc.
McClintock Manufacturing Co., St. Paul, Minn.—Samples in operation of McClintock mercury contact relay.
McCord & Co., Chicago.—Model of new structural steel "Gibraltar" bumping post.
McMyler Manufacturing Co., Cleveland, Ohio.—Full-size sample of "Economy" separable switch and Odenkirk switch stands.
Morden Frog & Crossing Co., Chicago.—Model of track and switch showing "Security" switch stand, samples "G. L. M." switch stands, working model of "Universal" switch stand, samples of adjustable open side switch sockets; also photographs of Leighten-Hansel continuous rail crossing.
National Coal Dump Car Co., Chicago.—Photographs and literature illustrating the "National" coal dump car.
National Lock Washer Co., Newark, N. J.—Samples of various sizes of "National" lock washers.
National Railway Materials Co., New York.—Samples Murray anti-rail-creepers, guard-rail braces and clamps, rail braces, etc.
National Rooting Co., Tonawanda, N. Y.—Samples of "Security" mineral asphalt roofing.
Newman Clock Co., Chicago.—Samples of Newman watchman's clocks; also railroad special clock for yards, depots, docks, etc.
Nichols, P. Nicols & Bro., Chicago.—Catalogue descriptive of Nichols transfer tables, traveling cranes and transfer table attachments.
Ohio Motor Co., Sandusky, Ohio.—Sample of Ohio gas and gasolene engine.
Jos. Odin, Buffalo, N. Y.—Metallic railroad tie.
Otto Gas Engine Co., Philadelphia and Chicago.—Photographs showing coaling stations, water tanks and cranes, sand blast, and pneumatic tool car.
The Pennsylvania Steel Co., Philadelphia, Pa.—Models of "New Century" switch with adjustable stand and double crank, Manard switches; also photographs of steel bridges.
Pepple Steel Tie Co., Hillsboro, Tex.—Sample of Pepple metallic railroad tie.
Percival Concrete Steel Tie Co., Galveston, Tex.—Samples and photos of Percival reinforced concrete tie.
Pruyn Railroad Tie Co., Chicago.—Samples of Pruyn concrete tie.
The Rail Joint Co., New York.—Full-size sample of "Continuous" insulated rail joint, "Continuous" standard, Wolhaupter standard and Weber standard, continuous, step and compromise and insulated rail joints.
Railroad Supply Co., Chicago.—Samples of Wolhaupter, Q. & W. and Servis tie plates.
Railway Specialty & Supply Co., Chicago.—Samples of Smith improved lock nut, P. & M. rail anchor and Buckeye light.
Harry Raymond, Chesterton, Ind.—Model of self-closing switch.
Arthur E. Rendle, New York.—Full-size sample of "Paradigm" fire-proof windows and skylights.
Ritter Folding Door Co., Cincinnati, Ohio.—Full-size sample in operation of Ritter horizontal folding door.
Roberts & Schaefer Co., Chicago.—Photographs showing coaling stations erected for various railroads.
Rubberset Brush Co., Newark, N. J.—Panel showing illustrations of "Blue Ribbon" paint brushes.
St. Louis Frog & Switch Co., St. Louis, Mo.—Souvenir match boxes.
Sandusky Portland Cement Co., Sandusky, Ohio.—Samples of Medusa water-proof compound.
Scherzer Rolling Lift Bridge Co., Chicago.—Album and miscellaneous photographs showing Scherzer rolling lift bridges.
Scott Manufacturing Co., Racine, Wis.—Samples of "Racine" rail anchor and pamphlet describing the "Hercules" bumping post.
Sellers Manufacturing Co., Chicago.—Samples of Sellers anchor bottom tie plates and splice bars.
Spencer Otis Co., Chicago.—Samples of Hart tie plates and photographs of the "National" coal dump car; also samples of McKee rolled shoulder tie plates.
Standard Asphalt & Rubber Co., Chicago.—Samples of water-proof bridge coatings and mastic floors; also pipe dips and insulation materials.
Standard Cattle Guard Co., Birmingham, Ala.—Samples Abernathy cattle guard.
Standard Patent Appliance Co., Philadelphia, Pa.—Sample of Samson rail bender.
Arthur L. Stanford, Chicago.—Model of Stanford rail joint; also sample of "American" track jack.
Strauss Bascule & Concrete Bridge Co., Chicago.—Working model of the Strauss trunnion bascule bridge; model of ribbed reinforced concrete bridge.
Taylor Iron & Steel Co., High Bridge, N. J.—Full-size samples of "Panama" steel excavator teeth.
Templeton, Kenley & Co., Chicago.—Samples of "Simplex" track jacks.
Thomas, W. R., Watertown, Wis.—Model of Thomas boltless rail joint.
Truss & Cable Fence Co., Cleveland, Ohio.—Samples of wire board fencing.
United Indurated Fibre Co., Lockport, N. Y.—Samples of Indurated fibre for rail insulation.
U. S. Blue Print Paper Co., Chicago.—Samples of blue print paper, Nigra solar print paper, transits, levels, drawing instruments, drawing pencils and draftsman's specialties.
U. S. Graphite Co., Saginaw, Mich.—Literature descriptive of Graphite paint; also sample of graphite, from which this paint is made.
U. S. Wind Engine & Pump Co., Batavia, Ill.—Full-size samples of switch stands and semaphores, and literature describing the new U. S. adjustable water columns; also water tanks.
Universal Portland Cement Co., Chicago.—Transparencies showing concrete bridges, conduits, bridge abutments, reservoirs, etc., built with "Universal" Portland cement.
Verona Tool Works, Pittsburg, Pa.—Samples of track tools, nut locks, gages, etc.
Weir Frog Co., Cincinnati, Ohio.—Samples of high switch stand with adjustable throw, heavy adjustable guard rail clamps.
Western Railway Supply Co., Chicago.—Sample of Latimer switch point lock for facing point switches.
C. H. Whall & Co., Boston, Mass.—Samples of Whall special railroad insulating fibre.
Wm. Wharton, Jr., & Co., Inc., Philadelphia, Pa.—Photographs and samples showing Wharton manganese-steel frogs; also switch stands
Jas. G. Wilson Manufacturing Co., New York.—Full-size sample of sliding swing door; also samples of rolling doors.
E. J. Winslow Co., Chicago.—Full-size sample of "Hydrolithic" battery vault and chute; also photographs and literature describing "Hydrolithic" battery vaults, cisterns and "Hydrolithic" water-proofing.
Wire, Frank E., Libertyville, Ill.—Model of steel tie.
S. Woods & Co., Chicago.—Photos of Scaife water purification plants installed on various railroads.
Julian L. Yale & Co., Chicago.—Samples of "Universal" cast-iron pipe.

Track Deformations and Their Prevention.*†

BY G. CUENOT.

Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway

III.

STOCK FOR EXPERIMENT.

The first experiments were made by an engine with three axles coupled, weighing 38.58 net tons in working order, with tender of 26.46 net tons.

These weights were thus distributed among the axles:

				Spacing.	Diam. of wheels
Engine.	1st	axle	12.26 net tons	6 ft. 5 7/16 in.	4 ft. 3 3/16 in.
"	2d	"	13.37 "		
"	3d	"	13.37 "	4 ft. 7 1/8 in.	4 ft. 3 3/16 in.
Tender	1st	axle	13.34 "		3 ft. 11 1/4 in.
Tender	2d	axle	14.11 "		3 ft. 11 1/4 in.

The locomotive and its tender were followed by a car. After having referenced the top of the tie by means of a measuring rule, the train was brought to position, in such a way that the third axle should be as near as possible to the cross tie. After leaving it in this position for about 10 minutes, the measuring rule was introduced right at the cross tie and the second reading was made. (See Fig. 8.)

EXPERIMENTS OF THE MONTH OF MAY, 1903.

The trials took place on nine wood cross ties and on 21 composite cross ties; the curves of deformation which have been observed are represented with a black line on Figs. 9 and 10. The figures are inscribed in tenths of millimeters.

It is remarked that all the curves of the wood cross ties present a well defined figure, always similar, in the form of a basin. The edges are slightly inclined up to a point near the rail, nearly at 23.62 in. from the axis of the track, and the bottom, which unites the two edges, is nearly horizontal, tending to rise towards the center and thus presenting its convexity upward. The maximum sinking of the cross tie is produced a little beyond the rail, proceeding from the extremities towards the center, and the bending, which consequently gives unequal distribution of the pressure on the ballast, is, so to speak, maximum near the rail, producing a greater sinking than at any other point.

The trials took place on four wood cross ties provided with P. L. M.-A. rails, and five others provided with P. M. rails, these rails being more rigid than the first. Fig. 11, No. 1, on which has been placed the mean of the figures inscribed on Nos. 1 2, 3 and 4 of Fig. 9 (full black line) gives the general form of the deformation for the five cross ties considered, the errors of reading being thus more or less compensated. This general form is that pointed out above, a basin with slight swelling in the center. The mean cross tie seems to be depressed only slightly at first, a maximum .022 in., then to be inflected in the ballast proportionately to the pressure which it transmits to it. Apart from the general sinking, the piece has bends in relation to the line which joins the extremities of the elastic line defined, bends which are at 5.12 in. from the rail on the side of the long radius, where the inclined part comes to rejoin the bottom of the basin, 0.093 in., at the center 0.085 in., at 5.12 in. from the rail, on the side of the short radius, where the inclined part of the elastic line rejoins the bottom of the basin 0.101 in.

The four cross ties supporting P. M. rails furnish a mean curve of deformation similar to the first, Fig. 11, No. 2; but the mean bending and sinking which results from it are inferior to those stated above, because the rail is more rigid and because it transmits the load over a greater number of cross ties. The deformation reaches the following values at the same points:

5.12 in. from the rail on the side of the long radius	.043 in.
At the center	.051 "
5.12 in. from the rail on the side of the short radius	.059 "

More rigid rails, distributing the pressure on a greater number of cross ties, diminish the flexure, and seem to distribute the load in a more uniform manner on the ballast.

Tests were also made on 21 composite cross ties; their curve of deformation is given in Nos. 1, 2 and 4 to 22 of Fig. 9 (full black line). The latter presents a very characteristic form, a horizontal straight line when the bed of the cross tie is equally resistant, and one which inflects on the side where it is the most compressible. Thus the cross ties of the even-joint, those of the following end above all, which are submitted to the shocks in consequence of the drop of vehicles from the advance one to the following one, inflect on the side of the short radius, following an inclined plane, whose declivity is on the side of the center of curvature. The curve of mean deformation, which includes the aggregate of the curves obtained (Fig. 11, No. 2) has been recorded on the curve of deformation of the wood cross ties supporting P. M. rails like the composite cross ties, in order to show a comparison; but naturally we have separated from the mean the curves of the cross ties of the even-joint, since they have nothing comparable with the wood cross ties. This mean curve is very close to a straight line, since the maximum flexure is 0.12 in. at 5.12 in. from the rail on the side of the short radius; that is to say, four times less in value than with wood cross ties. The mean sinking is about .063 in. less over its whole length, except at its extremity on the side of the short radius, than the sinking of the wood cross tie.

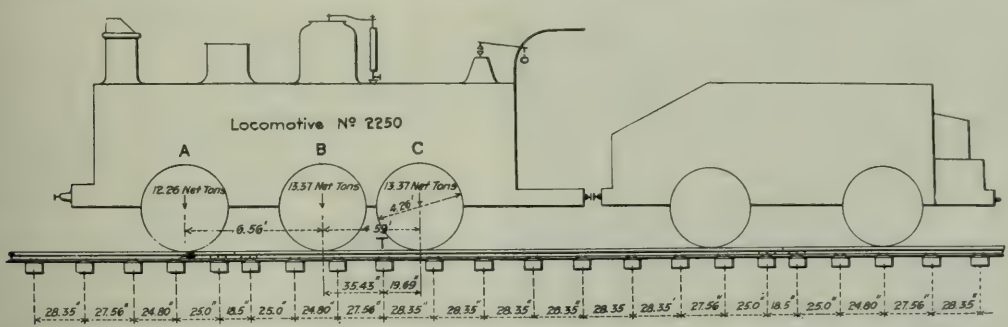


Fig. 8—Comparative Tests of Flexure Under Static Load of Composite and Wood Ties. Distribution of Axle Weights.

The locomotive was placed over the tie, T, so that the tie was 35.4 in. from wheel B, and 19.69 in. from wheel C. All the ties, composite and wood, were loaded in the same manner. This arrangement was made to allow the introduction, between the wheels, of the rule used for measuring the flexure shown in Fig. 6.

EXPERIMENTS IN JUNE, 1903.

These experiments took place after a relatively dry period; the ballast was somewhat dried up. The same train was employed. The work was carried on in the same manner, that is to say the third axle was brought as closely as possible to the cross tie to be studied. The trials were made on the same cross ties as before; they were extended, however, to the wood cross tie 21 supporting P. M. rails, and to composite cross tie No. 8. The results of these trials are recorded in Nos. 1 to 9 of Fig. 9, so far as the wood cross ties are concerned, and in Fig. 10 for the composite cross ties; they are represented by full line followed by two dots.

It will be seen that this experiment worked better; the deformation has diminished, which is natural, since the ballast was dried out and the cross ties rest on a more solid and more homogeneous bed throughout its length. Between times, besides, the joints were rewedged by placing hoop-iron between the splicing and the bottom of the base; the effect is perceptible, together with the greater solidity of the bed on the side of the short radius. The flexure and the sinking have diminished considerably.

The mean curve of deformation of the wood cross ties provided with P. L. M.-A. rails, obtained as has been described above (Fig. 11, No. 3) is similar to that which was obtained in the month of May preceding, the same form of basin with a tendency to relief in the central part. The characteristic figures of this curve are the following:

Bending at 5.12 in. from the rail on the side of the long radius	.092 in.
At the center	.091 "
At 5.12 in. from the rail on the side of the short radius	.111 "

The apparent sinking of the cross tie has sensibly diminished; its bending has remained nearly the same, which should be expected. For when the ballast is impregnated with water as in the first case, the water sustains the cross tie above the ballast. This

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†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.

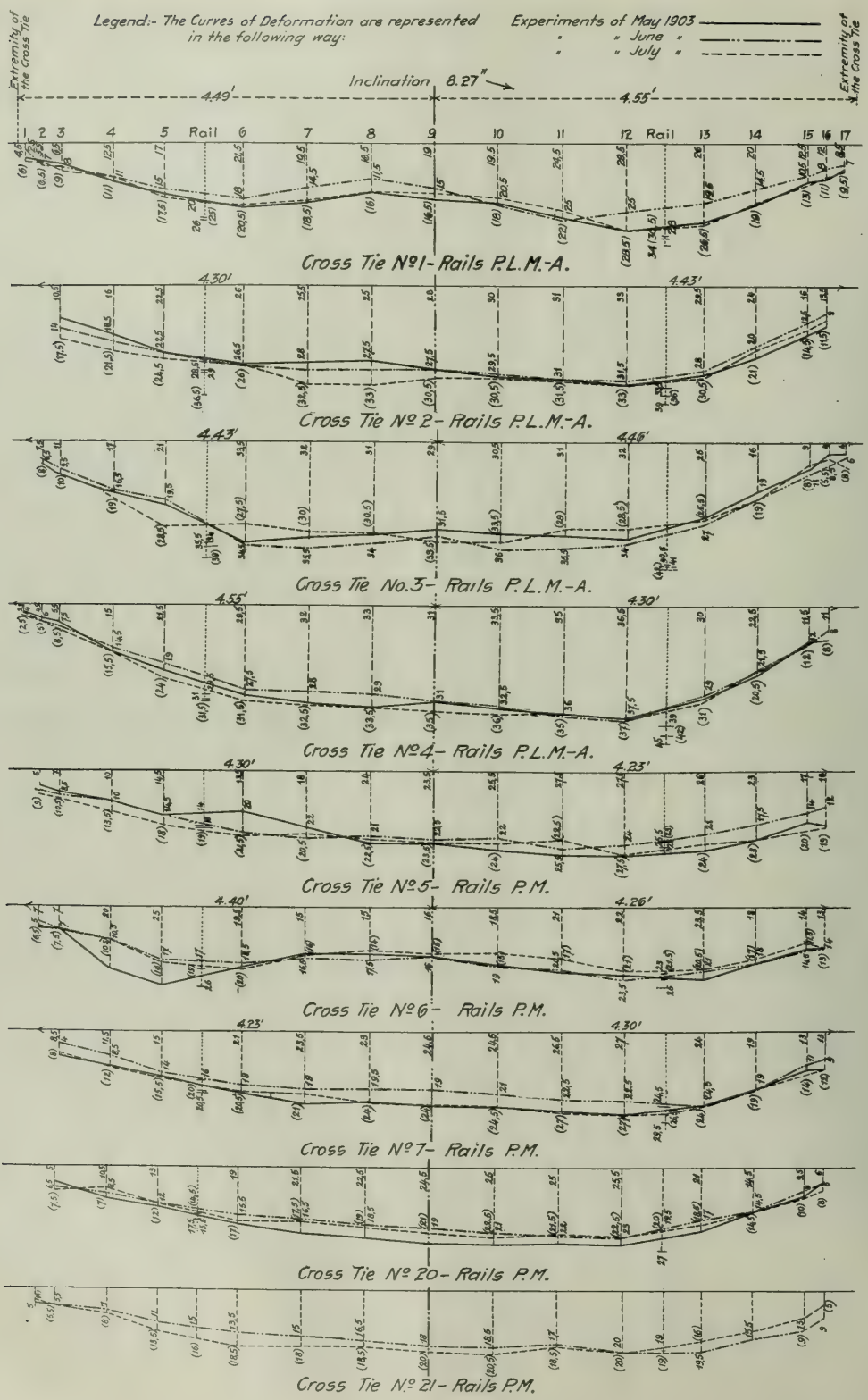

Legend:- The Curves of Deformation are represented in the following way:
Experiments of May 1903
" " June "
" " July "
Extremity of the Cross Tie
Inclination 8.27"
4.49'
4.55'
Rail
Cross Tie Nº1- Rails P.L.M.-A.
4.30'
4.43'
Cross Tie Nº2- Rails P.L.M.-A.
4.43'
4.46'
Cross Tie No.3- Rails P.L.M.-A.
4.55'
4.30'
Cross Tie Nº4- Rails P.L.M.-A.
4.30'
4.23'
Cross Tie Nº5- Rails P.M.
4.40'
4.26'
Cross Tie Nº6- Rails P.M.
4.23'
4.30'
Cross Tie Nº7- Rails P.M.
Cross Tie Nº 20- Rails P.M.
Cross Tie Nº 21- Rails P.M.

Fig. 9.

water has to be driven out by the tie, spreading on both sides. The void is thus more considerable than when the ballast is more dry, and, in the last case, the cross tie, which is depressed in proportion to the dryness of its support, reaches it more rapidly. In a word, this ballast acts as a sponge when it is impregnated with water; it swells and heaves up the track; on the contrary, when it is dry it diminishes in volume and lowers the track.

The mean curve of deformation of the wood cross ties supporting P. M. rails (Fig. 11, No. 4) presents the same minute details, perhaps less accentuated. The characteristic figures are the following:

Bending at 5.12 in. from the rail on the side of the long radius	.043 in.
At the center	.043 "
At 5.12 in. from the rail on the side of the short radius	.055 "

The mean curve of deformation of the composite cross ties is still more regular than in the first case (Fig. 11, No. 4); the curvature has diminished a little, and a straight line is almost obtained, since the bending is only .008 in., that is to say, five times less than that of the wood cross ties. The mean sinking is no more than .054 in., a little less than the value attained in the month of May.

EXPERIMENTS DURING JULY.

These experiments were made during a period of rain, following one of considerable heat. About the same conditions were found as in the month of June. The ballast was not more dried out. The same experimental train was employed and the third axle was placed as near as possible to the cross tie. The experiments were made with the same cross ties. The curves of deformation, represented on Figs. 9 and 10, present the same general form. The flexure and the sinking observed in the month of June are maintained, with a slight tendency to diminish.

The mean curve of deformation of wood cross ties provided with P. L. M.-A. rail, obtained as above (Fig. 11, No. 5), presents some irregularities besides, of little importance. Thus the maximum sinking on the side of the long radius should be produced at 9¼ in. from the rail; the central part should be nearly horizontal, but the maximum sinking should be maintained at 5.12 in. from the rail on the side of the short radius, and should have attained .125 in.

The characteristics of flexure are the following:

Bending at 5.12 in. from the rail (side of long radius)	.083 in.
At the center	.087 "
At 5.12 in. from the rail (side of short radius)	.094 "

The general sinking is a little more than in June.

The curve of deformation of the cross ties provided with P. M. rails (Fig. 11, No. 6) is almost precisely the same as that in June. The general sinking of the ties is about .051 in. and their flexure can be thus defined:

At 5.12 in. from the rail (side of long radius)	.043 in.
At the center	.043 "
At 5.12 in. from the rail (side of short radius)	.051 "

The composite cross ties are deformed as a whole, following almost a right line inclined according to the superelevation. Their general sinking is about .055 in. and the greatest flexure about .011 in., four times less than that of the wood cross ties under the same conditions.

SUMMARY AND CONCLUSION.

The experiments which we have just related can be summarized in the following table:

(Figures in fractions of an inch.)

Type of tie used.	Mean sinking—May.	June.	July.	Mean flexure—May.	June.	July.
Wood, with P. L. M. A rails	.077	.076	.084	.090	.097	.087
Wood, with P. M. rails	.066	.069	.066	.047	.043	.043
Composite, with P. M. rails	.053	.059	.059	.008	.008	.008

The table shows:

(a) That the mean sinking of the wood cross tie provided with P. M. rails is nearly the same as that of the composite cross tie, although slightly superior.

(b) That its flexure is nearly six times greater.

But it is not necessary to depend upon these results; if it is interesting to know the mean sinking and the flexure of cross ties, it is still more so to know the value of that sinking and of that flexure right at the rail. It is given in the table below:

Sinking and flexure right at rail.

Type of tie.	Month of—May.	June.	July.	Mean flexure.
Wood with P.M. rails	.087 in.	.083 in.	.081 in.	.084 in.
Composite with P.M. rails	.073 "	.046 "	.062 "	.065 "

Thus the movement of a track is reduced by 25 per cent. by the employment of the composite cross tie; and this reduction would be still more considerable with rails less worn and a ballast less spongy. Another interesting fact brought out by these experiments is that the wood tie, which is regarded as bearing over its whole length, descends in the track by a greater quantity than the composite tie, which has only a limited bed, 4.59 ft.

We have sought the cause of this anomaly, which did not, at first view, appear explicable. The composite tie exercises a uniform pressure on the ballast at each of its extremities over a length of 27.56 in.; the cube of ballast elastically displaced by this pressure is proportional to the hatched surface of Fig. 11, No. 6. (Experiments of July, 1903). On the side of the short radius this surface is .01942 sq. in., and, on the side of the long radius, is .01307 sq. in.; these two numbers, 1,942 and 1,307, are respectively proportional to the cube of the ballast displaced. Now this cube is itself proportional to the pressure received by the ballast within the limits of elasticity, which ought not to be reached in the particular case; it follows, then, that the wood cross tie, which exercises on its own account an equal pressure, being submitted to the same loading, ought to displace a volume of ballast equal to that which is compressed by the blocks of the composite cross tie, and that its real length of support is determined by this condition. Thus, in the particular case, the length of support of the wood cross tie ought to be the height of the mixti-lineal trapezium comprised between the original axis of the cross tie and its curve of deformation, the surface of which trapezium should be equal to that of the hatched part. It is thus found, by neglecting the extremities of the cross tie which, being removed from the center of pressure, should react feebly, that the surface of support of the wood cross tie, which is indeterminate by reason of the irregularity of the tamping, does not exceed the length of the blocks of the composite cross tie, that is to say that it extends about 13.78 in. on both sides of the axis of the rail. The central part of the cross tie is, therefore, not utilized to distribute the pressure, and serves only as a tie bar to unite the support of the rail. It is even probable that this central bed not only does not press on the ballast, but even that it is uplifted by a kind of sub-pressure, due to the elastic compression of the ballast right at the points of support. The ballast can be likened to an elastic matter, peat for example, which is depressed at the point where the pressure is exercised, only to flow back farther away.

The German engineers who have studied this question with much care, Messrs. Weber, Winckler and Zimmermann, have admitted, without ever having demonstrated it, that the pressure, P, of the ballast per unit of surface of the cross tie which it supports is, at each point, in direct ratio with the sinking, Y, of the latter. They thus place $P = C Y$, an expression in which C is a coefficient depending upon the qualities of the ballast, invariable for the rest, and whose numerical value is determined by experience.

For $Y = 1$ cm, we have $P = C$. Consequently, it is the pressure in kilograms on the unit of surface (square centimeters) necessary to produce a sinking of 1 cm, and its value introduced into the calculation takes the name of coefficient of ballast.

The hypothesis of the sinking proportional to the pressure can only be admitted within the limits of elastic deformations. The statement of the proportionality of the sinking and of the pressure in certain limits, the determination of the latter as well as the numerical determination of the coefficient of ballast, have given occasion, on the part of German engineers, for researches whose results are the following:

(a) The results of experiments agree quite closely with the supposition that the pressure on the unit of surface is in direct proportion with the measure of the sinking.

(b) With a subsoil supposed to be good, the magnitude of the coefficient of ballast has been found, for gravel ballast (without metalled bed) $C = 3$; for gravel ballast (with metalled bed) $C = 8$; for ballast of small stones and scoriæ, $C = 5$.

(c) Loads, such as are found in regular operation, produced, almost exclusively, elastic flexures. The permanent deflections, which have been observed, probably have the effect produced by repetition of dynamic actions as their cause.

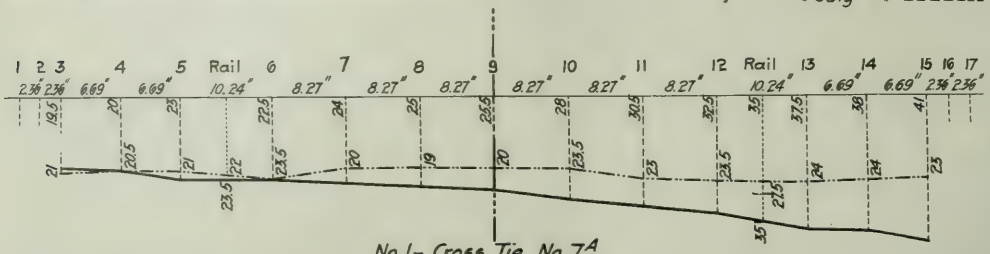
(d) The sinking observed under a load in motion, at speeds varying from 40 to 60 kilometers (24.85 to 37.28 miles) per hour, were not much greater than the sinking observed under the same load in a state of repose.

All this very ingenious theory errs in the premises, because its authors have admitted, as an axiom, that a loaded cross tie should have a bearing over its whole length. The experiment made with composite cross ties, whose bed on the ballast is well defined, and which bends little, allows us to pronounce on this point without possible controversy. The pressure which the rail transmits to the ballast by the intermediary of the cross tie is exercised only on a very limited zone of support, a zone which does not exceed 13.78 in. on both sides of the point of application of the load. The German engineers believed that this zone of influence of loads was of tolerably large extent, for they have fixed the length of cross ties at 8 ft. 10.3 in. and recommended the employment of pieces as long as possible. It is the conclusion at which Mr. Ast, notably, has arrived in the fifth section of the International Congress of Railways, in a memorandum on track:

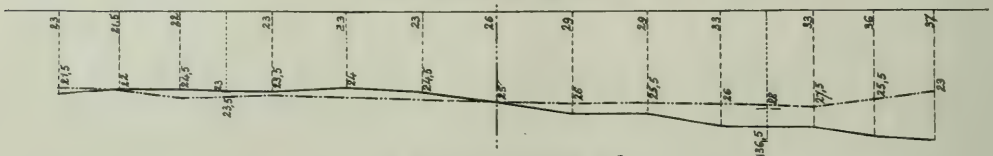
"A better means for distributing the given load on the greatest possible number of cross ties, and, consequently, on the greatest possible surface of ballast, consists in the reduction of the spacing of the cross ties and in increasing their surface of support. These two measures have, however, their limits; the first because it is necessary to preserve the possibility of tamping, the second because, on the one hand, the width of ties cannot be too great, if one wishes

Legend:- The Curves of Deformation are represented in the following way.

Experiments of May 1903 ——
" " June " —·—·—
" " July " - - - - - -



No.1- Cross Tie No. 7A



No.2- Cross Tie No. 7B



No.3- Cross Tie No.8.



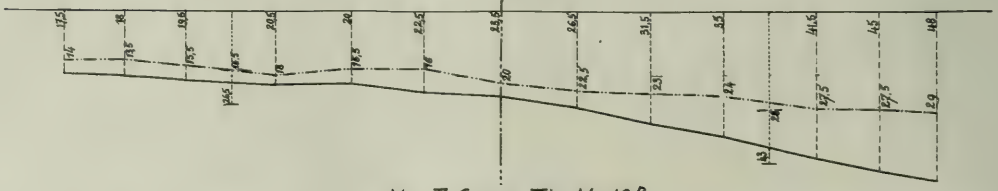
No.4- Cross Tie No.9.



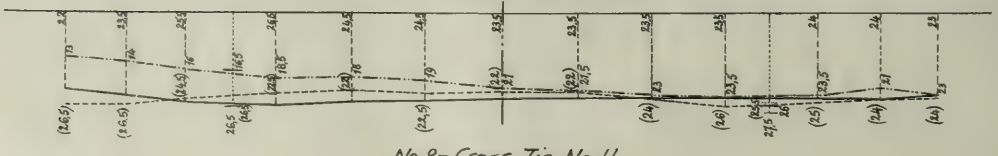
No.5- Cross Tie No.10.



No.6- Cross Tie No.10A

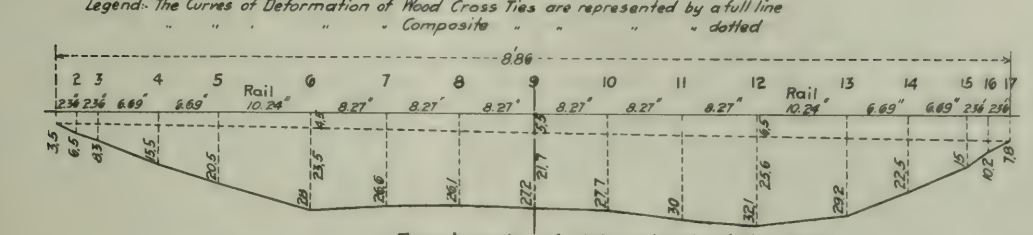


No.-7 Cross Tie No.10B



No.8- Cross Tie No.11.

Fig. 10



Experiments of 4th. and 5th. of May 1903

No.1- Mean Curve of Wood Cross Ties Nos. 1, 2, 3, 4. Rails P.L.M.-A.



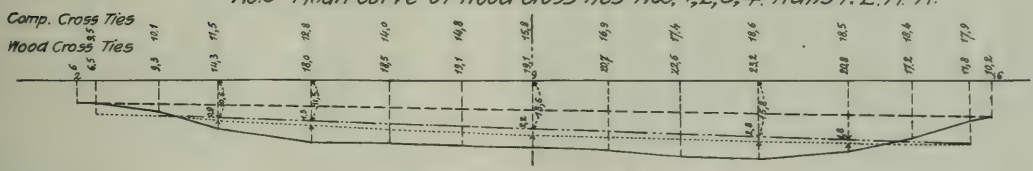
Experiments of 4th. and 5th. of May 1903

No.2- Mean Curve of Wood Cross Ties Nos. 5, 6, 7, 20. Rails P.M.



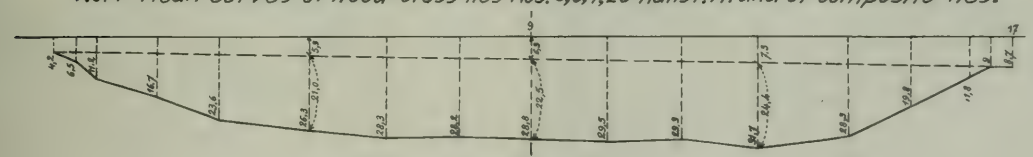
Experiments of 19th. and 20th. June 1903

No.3- Mean Curve of Wood Cross Ties Nos. 1, 2, 3, 4. Rails P.L.M.-A.



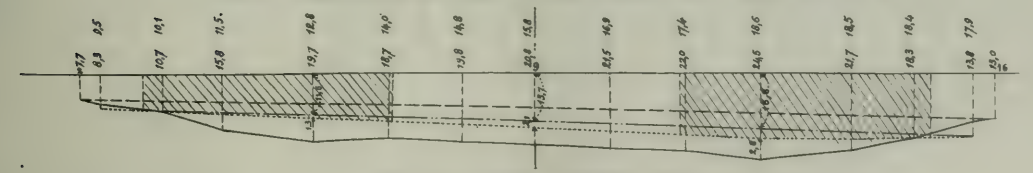
Experiments of 19th. and 20th. June 1903

No.4- Mean Curves of Wood Cross Ties Nos. 5, 6, 7, 20 Rails P.M. and of Composite Ties.



Experiments of 30th. July.

No.5- Mean Curve of Wood Cross Ties 1, 2, 3, 4 Rails P.L.M.-A.



Experiments of 30th. July.

No.6- Mean Curves of Cross Ties No. 5, 6, 7, 20. Rails P.M. and of Composite Ties.

Fig 11.

to be able to tamp well underneath, and because, on the other hand, the length which can be conveniently given to them depends on the gage. The prolongation of ties can only bear, in fact, on the parts situated at the exterior of the two lines of rails. When this prolongation surpasses a certain limit, the loads on the rails, which act on the interior of the gage, provoke a super-elevation of their extremities, and the parts of that length in excess no longer have a bearing."

This last fact has been verified; Mr. Ferry, Sub-Engineer of the P. L. M. Co., has obtained curves of deformation of long cross ties 8 ft. 6.4 in. to 8 ft. 10.3 in. placed in resistant ballast (broken stone), on which the extremities are seen raised up above the axis of the part not loaded. The experiments performed show also, although in a less clear manner, this fact: the more wet the ballast is, the more gentle is the slope of the extremities, for the pressure is transmitted over a greater surface; on the contrary, when the ballast is dry, the ends of the cross tie have a tendency to raise up.

Therefore it is impossible to diminish the sinking of ties by increasing their length; moreover, independent of its uselessness, this prolongation produces a grave disadvantage, for it increases the bending. It is not by this means that we should seek to reduce the deformation of the track, but by widening the cross tie, by concentrating the material about the points of support, and above all, by augmenting its moment of inertia.

The composite ties have an effective length of 8 ft. 2.4 in., but the useful length, that is to say that comprised between the two extremities of the blocks, is no more than 7 ft. 2.64 in.; it is at once seen in Fig. 12, Nos. 2, 4, 6, that, reduced to 7 ft. 2.64 in., the cross tie would still have a less flexure. This last consideration, joined with the examination of the curves of deformation of the ties of 8 ft. 6.36 in., has led to research as to what ought to be the length of a tie and of its tamped bed in order to reduce the flexure in the greatest measure possible. The long ties affect the deformation pointed out above with concavity directed upward; the short cross ties ought, on the contrary, to be deformed according to a convex curve; between the two there ought then to be such a length that the deformed curve approaches a right line. We propose to make that research which appears to us to present a great practical interest.

But before entering upon this new order of ideas, it would have been interesting to present the theory of the cross tie which results from these experiments, and which is very far removed from that admitted by Winckler; it would have been established that theory was in accord with experiment, that is to say, that the curve found experimentally was quite like that of a beam placed on an elastic support, but less elastic than it, loaded at two points with loads exercising their influence on a predetermined zone of support. It would, then, be a question of determining, with that hypothesis, the reactions of this support, and of demonstrating that, in the central part, the cross tie was found to be submitted to a counter pressure. Unfortunately, time was wanting for examining this problem of elasticity, which is long and difficult; the elements acquired will doubtless permit of giving the solution after a brief delay.

In the meantime, we desired to determine the coefficient of ballast in the experiments carried on, this coefficient being defined, as has been stated above. The axle loading being 26,455 lbs., the load on the rail, that is to say the load on the tie, was about 13,228 lbs. (for it is admitted that on a track with rigid rails the maximum load on a given cross tie is about 50 per cent. of the load on the axle); the 13,228 lbs. ought to be distributed between the two composite blocks proportionately to their sinking. The block on the side of the short radius will thus support 7,945 lbs., and that on the side of the long radius 5,282 lbs. The mean sinking of the first block being .052 in. and that of the second .048 in. (Experiments of July 30, 1903, Fig. 11, No. 6) the pressure of the ballast per unit of surface will be 29.15 lbs. per sq. in. on the side of the short radius, and 19.34 lbs. per sq. in. on the side of the long radius. The coefficient of ballast, that is to say, the pressure per unit of surface capable of producing a sinking of $^{20}/_{64}$ in. in the ballast and the subsoil considered would be 160.14 lbs. per sq. in., that is to say three times higher than that adopted by the German engineers. The ballast and subsoil considered were, in fact, of mediocre quality. It is then supposable with some reason that with a good ballast and a very solid roadbed the coefficient of ballast will be at least 284.5 lbs. per sq. in. The precise experiments which we will next undertake will permit of elucidating this point more completely.

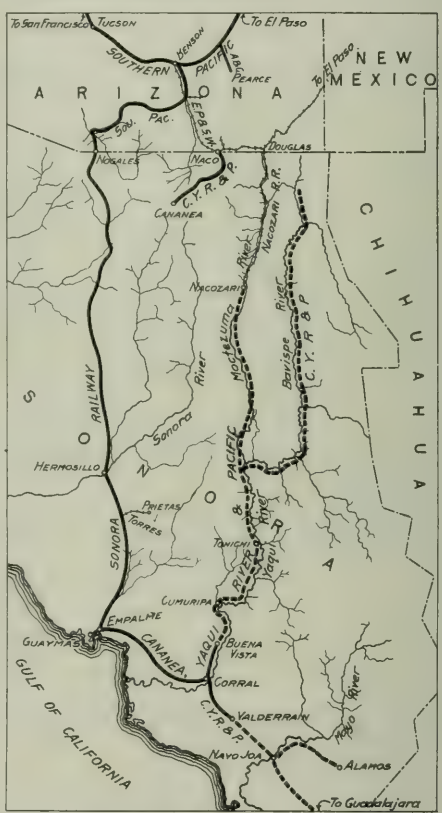
(To be continued.)

In France the rear car of a train which had halted at a station remained behind the station platform, and a lady in getting out broke one of her fingers. The courts have decided that the railroad is bound to bring the passenger to the station platform, and the lady has got a thousand dollars for her broken finger.

Southern Pacific Railroad Building in Sonora.

At the time of the reorganization of the Atchison, Topeka & Santa Fe the Sonora Railway was (July 15, 1898) leased to the Southern Pacific, which has since operated it. It runs from Nogales, Ariz., on the Arizona-Sonora boundary, south to the Mexican port of Guaymas on the Gulf of California, 262 miles. The Southern Pacific also has controlled since 1903 the Cananea, Yaqui River and Pacific, a 44-mile road from Naco, Ariz., on the Arizona-Mexico boundary, 60 miles east of Nogales, southeast to the copper camp of Cananea. Both these lines are shown on the accompanying map.

Within the last two years important extensions of Southern Pacific influence in northwestern Mexico have been determined on. The Mexican government has authorized the construction of a line from Guaymas southeast along the coast to Mazatlan, Sinaloa, thence southeast to Guadalajara, Jalisco, in all about 750 miles. This is a territory as yet untouched by railroads. The first part of this extension, which is being built by the Cananea, Yaqui River & Pacific company, is shown on the map. The line is now in operation from Guaymas southeast to Valderrain, 90 miles, and is under



Southern Pacific Lines in Sonora.

construction from that point to Alamos, 58 miles further. As shown by the map, Alamos is not to be on the main line of the Guadalajara extension which branches to the westward and nearer the coast at Navojoa, some 30 miles northwest of Alamos. The road is to be in operation to Alamos by October 1st.

The Cananea, Yaqui River & Pacific also has under construction a branch from the line of this extension at Corral, 64 miles south of Guaymas, north up the Yaqui river. This is already in operation to Buena Vista and is to be open for traffic as far as Tonichi by January 1, 1908. As shown, further extensions are projected, one up each principal arm of the Yaqui river, which when built may eventually be connected with the original Cananea, Yaqui River & Pacific line. This is a wild territory, the home of the Yaqui Indians, but rich in mineral resources.

The country from Empalme, the junction with the Sonora Railway near Guaymas, to the Yaqui river at Corral, is wild and sparsely inhabited. It, however, has soil fertile and well adapted to cultivation. Alamos is an old town and the country immediately around is rich in mineral in the mountainous part and the level part in a high state of cultivation.

Buhrer Concrete Ties.

The *Concrete Review* quotes Mr. Samuel Rockwell, Chief Engineer of the Lake Shore & Michigan Southern, to the effect that his road is using a tie designed by Mr. C. Buhrer, and that a number of these ties have been in slow track three or four years and will undoubtedly be there a great many years to come. Some were placed in fast track, which, however, pounded to pieces, and Mr. Rockwell believes that they are not suitable for tracks which carry a very heavy traffic at fast speed. On the other hand, he states that this should by no means condemn them for yard tracks, or any other tracks which carry their traffic, however heavy it may be, at a slow speed. Concrete ties have a great field on such tracks wherever wooden ties, on account of sharp curvature, or any other reason, fail to maintain gage, cut out rapidly, or are otherwise objectionable. Over 5,000 of these ties have been made, and 4,200 are in use, as follows:

Lake Shore & Michigan Southern Ry. (Elkhart Div., 1,000; Old Road, 1,003; Sandusky Div., 710; Chicago Div., 230)	2,943
Pennsylvania Lines	150
Lakeside and Marblehead Ry.	550
Sandusky City Water-Works track	120
Ann Arbor Ry.	77
Lake Erie & Western Ry.	24
Wabash Ry.	25
Chicago & North-Western Ry.	15
Total	4,204

Anti-Railroad Legislation.

A committee of railroad supply men appointed at an informal meeting at the Union League Club, Chicago, March 5, is circulating the following appeal, headed, "To the American Public—Business is Good; Shall it Continue?":

Fact 1. Business has been and is prosperous. There is apparently no commercial reason why we should not enjoy a continuance of such prosperity unless some unnecessary conditions intervene.

Fact 2. The National Government has been and is investigating the railroads. The state legislatures have pending 400 bills, none of which is for the benefit of the railroads, but every one of which is designed to reduce in some way the net earnings of the roads. Many village and town authorities are passing ordinances which interfere with the operation of the roads and reduce their revenues. The public press has given wide circulation to all of this agitation and in many instances approved the same.

Fact 3. The railroads are stopping all unnecessary expenditures for this year. For instance, one road has stopped construction on 700 miles of new track; another has cut its expenditures $5,000,000 and stopped work on 400 miles of track in addition. Many roads have issued instructions to use stocks on hand and not to buy anything for six months, except to meet great emergencies. Furthermore: Railroads generally have stopped all plans for expenditures for 1908. No new orders are now being placed by the roads for next year.

We, the undersigned, in view of the above facts, call public attention to the present situation. We are the nearest to the railroads, and, therefore, know the situation, and are the first to be affected. At present business is good on old orders, but we believe that business will be bad unless this agitation is stopped.

We know that if present conditions continue all classes of labor and every business interest will be injured. We know that every manufacturer, every jobber and every retailer in the United States does business directly, or indirectly, with railroads, or their officials and employees. We know that the railroad interest is, next to farming, the largest in the country. We know that when railroads begin to economize it seriously affects every other business. We know that under such conditions labor will suffer very greatly, and that men will be seeking employment.

We believe that now is the time to act, before the damage is done, and that every man who reads this should act. If 10 per cent. of the men in the United States would to-day write to the Governors of the states in which they live, and to their representatives in the state legislatures, stating that this agitation was injuring their business and that it must be stopped, it would be stopped. Every one of these public servants would listen, because every writer is a voter.

We do not object to the regulation of the railroads by the National Government in the proper manner, but we do object to going through a period of hard times similar to that between 1893 and 1897 in order to accomplish alleged railroad reform. The situation is serious. Immediate action is necessary or business will diminish; bank accounts will be reduced; profits will disappear; salaries will be cut; wages decreased; men discharged and thousands will be looking for work. Every laboring man, every business man, every professional man; in fact, every man, is and will be affected. He should act now.

LEGISLATIVE PROPOSALS REGARDING RAILROADS NOW BEFORE THE PUBLIC.

National Government.—A law has been passed, providing that railroad trainmen shall not work more than 16 hours continuously; that train despatchers shall not work more than 9 hours in any 24; that in day and night offices telegraph operators shall not work more than 9 hours in any 24, and in day offices not more than 13 hours in any 24. It is proposed to have the Interstate Commerce Commission make a valuation of the physical properties of the railroads with a view to reducing rates so that no line shall make more than what may be considered a fair profit upon its investment. Another proposition is to invest the Interstate Commerce Commission with authority to supervise the stock and bond issues of railways. It is also proposed to give the commission the power to require the installation of such block signal and other safety appliances as it may think proper.

Alabama.—The legislature has passed a bill reducing the maximum passenger fare to 2½ cents per mile. The house has passed a reciprocal demurrage bill. The senate has passed a bill requiring the issuance of interchangeable mileage. A new railroad commission with increased powers of regulation has been created.

Arkansas.—The legislature has passed, and Governor Little, as his last official act, signed a law making 2 cents per mile the maximum passenger fare.

California.—A reciprocal demurrage bill has been introduced in the senate, which provides that if the shipper applies to a railroad to provide him with cars within a specified time and the railroad fails to provide them within that time, the shipper may collect $25 per car for each day's delay.

Georgia.—A 2-cent passenger fare bill has been passed by the senate. A bill has been introduced in the house, creating a railroad commission with mandatory powers to fix rates.

Illinois.—There has been introduced a 2-cent maximum passenger fare bill, a bill reducing sleeping car rates, a reciprocal demurrage bill, and measures providing that railroads shall not increase their bonded indebtedness without the consent of the State Railroad and Warehouse Commission; prohibiting any railroad company or railroad official from owning stock in any concern doing business along the carrier's line; prohibiting corporations from transferring causes from state to federal courts, under penalty of forfeiture of their franchises; and making the rate of fare on a railroad within a city's limits 5 cents, the rate within the county or within 15 miles of a city terminal 10 cents, and up to a distance of 25 miles from the city terminal, 15 cents. Fire escapes on all passenger coaches are required by a bill introduced in the house.

Indiana.—A 2-cent passenger fare law has been enacted. A bill has passed the senate fixing the size of the crews on both freight and passenger trains. A reciprocal demurrage bill has been passed by the house.

Iowa.—The house has passed a bill requiring railroads to transport livestock at the rate of 18 miles an hour in trains of more than 20 cars, and at the rate of 12 miles an hour in trains of 20 cars or less. A 2-cent passenger fare bill has been passed by both houses. Reciprocal demurrage bills are pending in both houses. The state railroad commission has announced that it proposes to make a thorough investigation of freight rates with the view to extensive reductions.

Kansas.—The senate has passed a bill authorizing the railroad commissioners to designate terminal points within the state and to require the railroads to maintain terminals at these points for receiving shipments of freight. A bill is under consideration reducing the fare on sleeping cars 50 per cent. Both houses have passed a bill reducing rates on grain and grain products 15 per cent. and coal rates 18 per cent. The house has passed a 2-cent passenger fare bill.

Michigan.—Bills have been introduced providing for reciprocal demurrage and requiring the railroads to carry officers of the state government free at all times, and members of the legislature during sessions.

Minnesota.—A bill has been introduced requiring the railroad commission to put in force a distance tariff, the rates to remain in effect until overruled by the courts. Another bill requires the railroads to publish in each issue of all daily and weekly papers in all counties through which their lines run, tables showing the time of arrival and departure of trains and fixing the rate of payment for publication of these tables. The senate has appointed a committee to investigate and report on the cost and value of railroad property in the state and the operating expense of the several lines, despite the protest of the railroad commission that it already was performing the same task. The 2-cent passenger fare bills have passed both houses. The house has passed the reciprocal demurrage bill.

Missouri.—A 2-cent passenger fare law has been enacted. A bill requiring the railroads to provide separate cars for white and colored passengers has been passed by the senate. Both houses have passed a bill requiring all railroads doing business within the state to incorporate under its laws and prohibiting any foreign railroad from transferring any suit from a state to a federal court, if brought against a citizen of the state, without the written consent of the person against whom the suit is brought. Reciprocal demurrage bills have been introduced in both houses. The house has passed a bill providing for an eight-hour day for train despatchers and telegraph operators engaged in the operation of trains. Governor Folk has

sent to the legislature a special message urging the passage of a maximum freight rate law.

Montana.—A law has been passed greatly increasing the powers of the state railroad commission. It empowers the commission to establish rates of its own volition.

Nebraska.—The legislature has passed a 2-cent passenger fare bill and the Governor has allowed it to become a law without his signature. Reciprocal demurrage bills are pending in both houses. A bill making employers responsible for the injuries to their employees when the carelessness of a fellow servant helps to cause them has been passed by the senate. A bill has been introduced reducing the maximum freight rates on grain from 14 to 20 per cent. Another bill has been introduced reducing the rates on sleeping cars 30 per cent.

New Hampshire.—The house has passed a bill requiring every steam railroad operating within the state, "in consideration of its valuable franchise," to furnish free transportation to members, officers and employees of the legislature while it is in session and to all other state officials, except members of the supreme and superior courts and justices of the peace and notaries public.

New York.—A bill to compel every single track railroad in the state to double track its road has been introduced. A reciprocal demurrage bill has been passed.

North Carolina.—A bill has been passed limiting to 14 hours the period of continuous service of all persons concerned in the operation of trains. The senate has passed the 2½-cent passenger fare bill and the house has passed a 2-cent fare bill. A bill has been introduced in the house prescribing 2¼ cents as the maximum rate on all roads earning as much as $1,500 a mile.

North Dakota.—A bill has been introduced providing for a tax of 4 per cent. on the gross earnings of railroads.

Oklahoma.—The constitutional convention has adopted a provision prohibiting steam or electric trains from charging more than 2 cents per mile unless satisfactory proof be given the railroad commission that a reasonable income for investment cannot be earned at this rate of charge. The convention has also adopted provisions prohibiting the consolidation of railroad companies and forbidding railroad ownership of mines and other agencies of production.

Oregon.—A bill has been introduced in the house providing for the compulsory free transportation by railroads of all state, district and county officials. Other bills introduced call for the establishment of a railroad commission, the fixing of maximum freight rates, the levying of reciprocal demurrage and the imposition of a three per cent. tax on the gross earnings of railroads. The house has passed a bill prohibiting railroad trainmen from being kept continuously at work more than 10 hours.

Pennsylvania.—A senate bill provides for the creation of a railroad commission having extensive powers for the regulation of rail roads. Bills introduced in the house make railroad companies liable for loss by fire originating upon the right of way of the railroad or upon adjacent land when caused by sparks from a passing engine, and provide that the existence of fire shall be prima facie evidence that it was caused by the railroad. Another bill requires railroads to aid in extinguishing all fires within 100 ft. of their tracks. The house has passed a bill forbidding common carriers to have any interest in coal property or mining or manufacturing companies along their lines. A 2-cent passenger fare bill has been passed by the house.

South Carolina.—A bill has been introduced providing for interchangeable 2,000-mile mileage books. The house has passed a 2½-cent fare bill.

South Dakota.—Bills have been introduced for the following purposes, among others: To require all railroad, express, telegraph and telephone companies to reduce their rates 25 per cent.; to reduce the maximum passenger fare to 2 cents per mile; to require the assessment of all railroads at actual cash value; to levy reciprocal demurrage; to limit the working time of employees to 16 consecutive hours; to declare void all rules or contracts by which carriers seek to limit their common law liability; to regulate the size of train crews; to prohibit railroads from closing any station or removing any agent without permission of the state railroad commission; to require the installation of telephones in freight and passenger depots. Both houses have passed a reciprocal demurrage measure. A 2-cent passenger fare bill has been defeated and a 2½-cent passenger bill has been introduced.

Tennessee.—A 2-cent passenger fare bill is pending.

Texas.—A reciprocal demurrage bill and a bill reducing the maximum passenger fare to 2½ cents are pending.

Utah.—A bill has been introduced in the senate making railroads liable for any loss sustained by reason of their failure to immediately transport goods and merchandise to destination and imposing a fine of not less than $1,000 and not more than $10,000 if settlement is not made within 10 days after due notice of loss has been given.

West Virginia.—A 2-cent passenger fare bill has been passed by both houses, which applies to all lines more than 50 miles in length. A bill creating a railroad commission has been killed in the senate. A reciprocal demurrage bill which is pending fixes a penalty of $1 per day to be paid to shipper for every day over four which may elapse from the time he orders a car until it is set on the siding.

Wisconsin.—The railroad commission has made a rule reducing the maximum passenger fare on the Chicago & North-Western, the Chicago, St. Paul, Minneapolis & Omaha, and the Chicago & Milwaukee to 2½ cents per mile. The effect will be to make 2½ cents the maximum rate on all railroads within the state. Nevertheless, a bill providing for a 2-cent fare has been introduced in the legislature.

The following is a list of the states in which legislatures have been or will be in session this year, the time of their meeting and the limit of the number of days of their session. (From the *Daily News Almanac.*):

State or territory.	Date of meeting of legislature.	Limit of session.
Alabama	Jan., 1907.	50 days.
Arizona Territory	" "	60 "
Arkansas	" "	60 "
California	" "	60 "
Colorado	" "	90 "
Connecticut	" "	None.
Delaware	" "	None.
Florida	Apr., "	60 days.
Georgia	Nov., "	50 "
Idaho	Dec., "	60 "
Illinois	Jan., "	None.
Indiana	" "	60 days.
Iowa	" "	None.
Kansas	" "	40 days.
Maine	" "	None.
Massachusetts	" "	None.
Michigan	" "	None.
Minnesota	" "	90 days.
Missouri	" "	70 "
Montana	" "	60 "
Nebraska	" "	60 "
Nevada	" "	60 "
New Hampshire	" "	None.
New Jersey	" "	None.
New Mexico Territory	" "	60 days.
New York	" "	None.
North Carolina	" "	60 days.
Oklahoma Territory.*	" "	60 "
Oregon	" "	40 "
Pennsylvania	" "	None.
Rhode Island	" "	None.
South Carolina	Nov., "	None.
South Dakota	Jan., "	60 days.
Tennessee	" "	75 "
Texas	" "	90 "
Utah	" "	60 "
Virginia	Dec., "	90 "
Washington	Jan., "	60 "
West Virginia	" "	45 "
Wisconsin	" "	None.
Wyoming	" "	40 days.

*Constitutional convention.

German Comment on American Signaling.

Dr. Blum ("Doctor of Engineering"), who was delegated by the Prussian government to study American railroads, begins an article on our methods and appliances for securing safe working of our railroads as follows: "Signaling on North American railroads does not stand on the same plane as on German railroads, and although in certain particulars important results have been attained, the whole system of safety regulations is influenced unfavorably by the method of operation. While with us the whole train movement and switching service within a given district is subject to the orders of a single official, who is responsible therefor, and without whose will no movement can be made, in America there is no responsible trainmaster at a station whom all others have to obey. One can rather say in general, that every locomotive engineer, every yardmaster and switchman is responsible for himself, and that for the avoidance of accidents they must depend upon their conduct towards each other. But since the direction of a single head is lacking, and in that free country the feeling of obedience is not so developed as it is in Germany, as a rule everyone does what he considers right. For example, it several times occurred to me and my companions that we rode on an engine, not only at stations but on the open road, notice of the passage of which had not been signaled at all, and for whose safety no one but the engineman and the fireman took any precautions. It has even happened that we ran over lines of foreign railroads where the engineman depended on asking the track hands whether he could go on."

The city of Geneva has a bone to pick with Swiss State Railroads. The steamboats on Lake Geneva formerly made rates so low to landings on the lakes as to secure pretty much all the freight, greatly to the advantage of Geneva merchants. The State Railroads first endeavored to secure a share of the business by cutting rates. This proving unprofitable to both parties, they pooled the business with the steamboats, in consideration of an advance of the steamboat rates and agreed differences, just as ungodly corporation railroads have sometimes tried to do in America.

GENERAL NEWS SECTION

NOTES.

The Interstate Commerce Commission has ordered that after April 1 two copies of every interstate tariff must be sent to the Commission, instead of one copy, as heretofore.

The St. Louis & San Francisco is rebuilding 800 miles of telegraph lines at an expense of $250,000. On the principal divisions of the company's lines there will be five wires.

On March 23 the New York Central & Hudson River handled 31,440 cars, of which 22,021 were loaded. This is said to be 1,312 more loaded cars than the highest previous record of the road.

The railroads centering in Chicago are trying to agree to stop the practice of absorbing switching charges in that city, which costs them hundreds of thousands of dollars yearly. The eastern and western lines will hold a joint conference.

The New Hampshire legislature has passed a law prohibiting the issuance of free passes to members of the legislature or to state officers. The penalty against both giver and user may be from $100 to $1,000. The present mileage compensation of members of the legislature is abolished and a weekly allowance is made to members. The Governor is authorized to contract for railroad transportation of members and of public officers.

It is reported in Seattle that the northern transcontinental lines are to make a considerable increase in the rates on lumber from their western termini to St. Paul. The Great Northern has made more rigid its order forbidding the sending of its freight cars east from Minneapolis. Such cars must not be sent to elevators located on the roads leading to the East. None of the western lines permit their cars to go east of Minneapolis.

In Atlanta last week there was a meeting of the executive officers of 26 short railroads of Georgia, representing about one-quarter of the railroad mileage of the state, to discuss the conditions due to the anti-railroad agitation. They issued a statement to the people of Georgia, setting forth the present conditions, and appealing for more reasonable consideration. Some of the lines aver that they will be thrown into bankruptcy by any reduction.

The Pennsylvania is to establish a third receiving station for miscellaneous freight on the Brooklyn water front. There are now stations at the Williamsburg and Wallabout basin, and the new one is to be at the foot of 52d street, South Brooklyn, from which freight will be carried to the Jersey City terminal of the road. The regular New York rates will apply to shipments from this point. At present one barge a day is to be operated.

A press despatch from Omaha says that the movement of freight over the Union Pacific is now unobstructed. The main line has been congested for more than six months, but since the recent putting of 50 new locomotives in service the blockade has been raised. The railroads extending from Chicago and St. Louis eastward say that the movement of freight over their lines continues heavy, with little sign of abatement before navigation opens on the lakes.

The order issued by the State Railroad Commission of Kansas under the new law requires all roads in that state to place on sale on or before May 1 a 500-mile ticket to be sold at the rate of 2 cents a mile. The law makes a maximum rate of 3 cents for one-way tickets, and requires the roads to sell a 500-mile ticket at 2 cents a mile and a 2,000-mile interchangeable ticket at $50, with a refund of $9.50. The roads are so well pleased at having escaped a one-way maximum rate of 2 cents a mile that it is said they will comply with the order without opposition.

A ship broker of New Orleans complains to the Interstate Commerce Commission because the railroads entering that city make demurrage charges on freight handled by local exporters, which are grossly unjust, as compared with the treatment accorded export shipments billed through, on which no demurrage is charged. The railroads have lately cut down the free time allowance to local exporters from 20 days to 10 days. The railroads centering in New York City have given notice that the free storage time allowed on flour and certain other commodities is to be reduced from 10 to four days, and prominent flour dealers say that their business will be destroyed. It is not long since the free time was reduced from 20 days to 10 days.

Government Tariff Regulations.

The Interstate Commerce Commission has issued tariff circular No. 12-A concerning the filing of tariffs and condemning certain wrong practices. To make a tariff, without due notice, to cover a shipment diverted, because of a flood, is illegal. To make a tariff, without due notice, to correct a typographical error is also forbidden. If such practices were allowed it would open the way for law-breaking. The commission will act promptly on applications to authorize the use of rates on short notice where there is a real emergency.

The commission recommends that whenever, by reason of blockade, it becomes necessary to divert to the line of another carrier passengers or freight the carrier receiving such traffic shall be paid at regular tariff rates, except when the carrier receiving it is a participant in a joint tariff with the road diverting its traffic, in which case the settlement may be made in accordance therewith. If one carrier's train is sent over the line of another, tariff regulations must be applied, or, in their absence a compensation should be agreed upon.

The commission has decided that interstate tariffs, where used to make interstate rates, by adding together two or more local rates, must be posted and be filed with the commission. Announcement is made that owing to the peculiar nature of the traffic, circuses and other show outfits may be transported on tariffs filed with the commission only one day preceding and not posted.

Regulations are issued applying to misrouting. The carrier must have the shipper choose either an all-rail or rail and water route, where possible. In the absence of specific through routing by shipper, the commission makes it the duty of the agent of the carrier to route shipment over the cheapest reasonable route known to him of the class designated and over which he has rates which he can lawfully use. If a foreign car is available, which must be sent over a particular line or tour over which a higher rate obtains, the agent must give the shipper the choice of paying the higher rate or waiting for another car.

In closing its remarks on this subject, the commission says: "Shippers must bear in mind that there is a limit beyond which an agent of a carrier could not reasonably be expected to know as to terminal delivery or local rates at distant points, and on lines of distant roads to or with which he has no specific joint through rates. Consignors and consignees should co-operate with agents of carriers in avoiding misunderstandings and errors in routing, and must expect to bear some responsibility in connection therewith."

Provision is also made for the refund of overcharge caused by misrouting.

The Commission will soon issue a pamphlet containing a compilation of its rulings in Tariff Circulars 1-A to 12-A, inclusive, revised to date of issue, and including such additional rulings as may then be ready.

Injunctions Against Rate Reductions.

The principal railroads of Alabama have applied to the United States Circuit Court for injunctions against the enforcement of rate laws recently passed in that state, namely, the General Classification act, in which commodities are classified and rates fixed on 107 commodities; the act reducing the passenger fare from three cents two and a half cents, and the act making the rates that existed, of every class and kind, on January 1 last, the maximum rates. It is alleged that the rates allowed in the measures complained of would be confiscatory. The Louisville & Nashville asserts that under the proposed laws its loss would be $432,000 a year. The court will hear the suit on March 30. The Federal Court at Jackson, Miss., on the petition of the Louisville & Nashville, has issued a temporary injunction against the enforcement of the order of the Mississippi Railroad Commission requiring interchangeable mileage books to be sold at the rate of 2 cents a mile.

This action of the railroads in Alabama and Mississippi is said to be the first step in a general movement to resist all of the rate reductions recently ordered in the states south of Ohio and east of Mississippi.

A New Metal Preservative.

Flexible Compound, made by the Flexible Compound Company, 3607 Haverford avenue, Philadelphia, Pa., is an oil product, which can either be mixed with paints to give them greater toughness and elasticity or can be used itself to form a surface on which to apply paint. It is non-inflammable and water-proof. Metal coated with the compound has been immersed in 30 per cent. solutions of sulphuric and nitric acids for 24 hours without showing any effect. Iron or steel structures from which paint has begun to peel, or on which rust has started, are treated with the compound as follows: The rust or paint is scraped off and one or two coats of the preparation applied, the liquid being thin enough to work into the smallest crevice; it then hardens into a flexible elastic skin on which a paint made by mixing pigment ground in oil with a thinning mixture

composed of half compound and half linseed oil is applied. It is claimed that this covering is so elastic as to remain intact at joints in spite of the contraction of the metal in cold weather, and that it has an exceptionally long life. The Flexible Compound Co. had an exhibit at the Maintenance of Way convention in Chicago last week.

Decision in Axle-Light Suit.

A decision in the suit of the Consolidated Railway Electric Lighting & Equipment Co. against the Adams & Westlake Co., seeking to restrain the latter company from infringing patent No. 740,982 issued to Patrick Kennedy and held by the complainant company, relating to the outside suspension of dynamos to car trucks in electric car-lighting equipment, was rendered on March 15 by Judge Kohlsaat, of the Circuit Court of the United States for the Northern District of Illinois, Eastern division. Following are extracts from the court's finding:

The claims of the Kennedy patent in substance "call for a dynamo mounted upon an adjustable pivot and supported within removably attached cradle irons, held in position by lugs resting upon the end truck-beam and the rear cross-bar of a bracket-frame provided for that purpose, together with means for keeping the driving belt taut."

"It appears from the evidence that on one occasion defendant's witness, Newbold, at the request of the Pennsylvania Railroad, made one of its cradles removable without dismembering the bracket frame, but aside from this instance no removable cradle has been manufactured by defendant. The Newbold patent excludes the idea of a removable cradle."

"In view of the fact that defendant did on one occasion employ a lighting device, which included all the elements of the patent in suit, and the further fact that, while its cradle is not, *per se*, adjustable, it yet is so constructed that it readily lends itself to such a construction, it should be restrained from exploiting any car-lighting device which employs a removable cradle in combination with the other elements of the patent in suit."

"An injunction may issue restraining defendant from manufacturing, using or selling the device of the patent in suit, limited as above set out."

New York Central Officers Indicted for Manslaughter.

The grand jury in New York City March 27 returned three indictments as a result of its investigation into the derailment near Williamsbridge, N. Y., Feb. 16. One of the indictments is against the railroad company, one is against Ira A. McCormack, General Superintendent of the Electric division, and the third against Alfred H. Smith, Vice-President. All three indictments charge manslaughter in the second degree. Judge Rosalsky fixed bail in the cases of Smith and McCormack at $10,000, which was furnished. The indictments contained the names of 46 witnesses, and the specific crime charged is criminal negligence resulting in the death of Clara L. Hudson, one of the 24 victims of the wreck. Accompanying the indictments was a long presentment, which was not read but was placed upon record. It recommends that the State Railroad Commission take charge of the operation of trains and regulate them.

The Early Anthracite Coal Business.

In 1856 what is now known as the Delaware, Lackawanna & Western Railroad was completed from Scranton to Hampton Junction, N. J., connecting with the Morris & Essex Railroad, and then coal was shipped to reach the city of New York and other markets, which the Delaware & Hudson Canal Co. and Pennsylvania Coal Co. had held for a long time. The Pennsylvania Coal Co. commenced shipping on the Delaware & Hudson Canal in 1851. The Lackawanna Company had a hard struggle to get its coal accepted by the public, for while it was equally good, the officials of the Delaware & Hudson Co. and the Pennsylvania Coal Co. spared no efforts to enable them to hold the market; at times the quantity of coal mined was such that during the summer months when the Delaware & Hudson Co. could send their coals to market by canal, there would be dull market due to the overproduction; moreover, it was the custom of the Delaware & Hudson Co. to sell much of its coal on time; the Delaware, Lackawanna & Western Co., though sending its coal daily by railroad, found it difficult to market it, and for some years after it commenced shipping east it carried on monthly sales by auction, and would sell 50,000 to 100,000 tons in lots, I think, of not less than 100 tons; at times prices went down to $2.50 or $3 per ton for stove and larger sizes, and these sales had a tendency to partially fix the prices of coal for a month; but the balance of the production for the month usually brought from 10 to 20 per cent. more, and the Delaware & Hudson Co. and Pennsylvania Coal Co. would probably average that much more than the auction sales.

These auction sales were carried on for a few years, and the Delaware, Lackawanna & Western Co.'s coal gradually became known in the east, and having the western market by reason of railroad connection with the Erie road at Great Bend, its trade increased quite rapidly, so that in a few years its coal stood as well in the markets as that of any other shippers; it has now advanced to the second or third place as to quantity of production.—*Wm. H. Richmond in Mines and Minerals.*

"Hogging."

The former head of one of the great railroad brotherhoods told me that while he was at the head of his order one of the hardest things he had to do was to try to keep his men, as he very emphatically expressed it, "from hogging it all"; he was speaking then of times when men were abundant and work not so much so. "There are," he said, "plenty of engineers and trainmen who will go on duty and stay on for 24 hours at a stretch, simply to earn overtime money; and this when very often there are extra men waiting about for a chance to earn a day's wage."

He added this: "No man is in full control of his faculties working under such conditions. I can remember that very well myself as a fireman, when we were on for long hours it was a part of my business from time to time to turn a hose into the engineer's face to freshen him up and keep him awake. When I turned engineer the same thing was done to me. It is next to impossible to keep awake in any other way."—*Carl Snyder in Everybody's Magazine.*

New Signal Rules in India.

In the new General Railroad Rules issued by the Government of India fixed signals are divided primarily into "stop" and "warning" signals. The description and functions of a stop signal are not altered, except that the rules recognize the arrangement in which the arm is pivoted near its center on a bracket projecting from the post, and stands vertical, or nearly so in the "off" position; an arrangement designed to prevent the counterweight being outbalanced by snow adhering to the arm.

The "warner" has a fishtailed end to the arm, and red and green spectacles working with it, but always has a second lamp 6 to 7 ft. above its own, whether there be a stop signal above it or not, and the use of warning signals is, as a rule, confined to stations which are interlocked. When the warner is on a post by itself, a *fixed green* light is always shown at night 6 to 7 ft. above its own spectacle; when the signal shows red, it means "proceed cautiously"; and when green, "all right." In these definitions, the term "distant signal" has entirely disappeared: what has hitherto been so-called fulfilled different functions under different conditions. A "warner" by day is easily distinguished by the fishtail; at night it always has the *appearance* of being below a stop signal (a position frequently occupied by a distant signal) whether there actually is a stop signal there or not. It is to be used as a rule only at stations which are interlocked, though there is no definition in the rules as to the extent or nature of the interlocking required. The only other condition regarding its working which we can find is that it is never to be taken off for a train that is booked to stop, or for one that has to be stopped out of course.

Dr. Waddell Honored by Russia.

Dr. J. A. L. Waddell, Consulting Engineer, of the firm of Waddell & Harrington, Kansas City, Mo., has recently received the beneficent order established not long since by the Grand Duchess Olga, sister of the Czar of Russia. The order is conferred in recognition of Dr. Waddell's services as principal engineer of the projected Trans-Alaska-Siberian Railroad, an enterprise which is considered by the Russian Government to be of great value to the Empire, and which has, consequently, received large grants of land in Siberia. The order has been conferred upon only about 30 eminent men, among them being Monsieur de Lobel, the promoter of the railroad.

The Boss Grievers.

I have been told over and over again of such an occurrence as this: "When a man is disciplined, an engineer or a flagman, it is not at all an uncommon procedure for a committee of the union to appear and say: 'We should like to inquire why you happen to single out this man. You know very well that the offense for which he is charged is common enough on your road. Do you pick on him because he happens to be prominent in local No. 99? We want that man reinstated and full pay for all the days which he has been under suspension.'"

The alternative is not a strike, but if the demand is not complied with it will happen that when any differences arise, the men will say: "We are ready to deal with your road but not with Manager A, or Superintendent B, who is against our union." The result is very frequently the removal of the offending manager or superintendent, and the substitution of a more tactful and compliant man. Otherwise the road is pretty sure to have trouble.

I do not for one moment suggest that the higher officials of the railroad union encourage this sort of thing, nor that they are neces-

sarily cognizant of it, but it would be surprising if they were wholly ignorant of it. It is obvious that discipline in such circumstances is next to impossible.—*Carl Snyder in Everybody's Magazine.*

TRADE CATALOGUES.

Southern Railway.—The "Land of the Sky" is the title of an attractive pamphlet issued by the passenger traffic department of the Southern Railway. It describes the plateau lying between the Blue Ridge mountains in western North Carolina, and the Iron, Smoky and Anaka ranges in eastern Tennessee. Something is said about Asheville, Hot Springs, Henderson and other resorts in the region. The letter press is alluring and the scenic views are well selected and artistically reproduced.

Storage Batteries.—Catalogue S of the Westinghouse Machine Co., East Pittsburg, Pa., is devoted to storage batteries for stationary service. The construction of these batteries is gone into at some length, and reasons given for their long life and efficiency. The pamphlet illustrates different styles whose eight-hour discharge ranges from five-eighths of an ampere to 1,480 amperes. Measurements, weights and prices of each style and size are given.

Coaling Stations, Water Tanks, Etc.—Bulletin 11 of the Roberts & Schaeffer Co., Chicago, gives half-tone views from photographs of locomotive coaling stations, cinder and sand stations and water tanks built by the company for various railroads throughout the country; also coal washers and complete mining plants. Some of the installations have been described in the *Railroad Gazette;* references to these are given in the bulletin.

Stone Crusher.—The Contractors' Supply & Equipment Co., Chicago, has issued a catalogue of the Symons rock crushers made by Smith & Post Co., Milwaukee, Wis., for which the former company is selling agent. The Symons is a gyratory crusher; the catalogue describes in detail its structural features and advantages. The illustrations are half-tone engravings and the letter-press is in two colors.

Bond Between Concrete and Steel.—The Expanded Metal & Corrugated Bar Co., St. Louis, Mo., has issued as a bulletin the paper on "Tests of Bond Between Concrete and Steel," read by T. L. Condron before the Western Society of Engineers, December 5, 1906, and reprinted in the *Railroad Gazette* of January 18, 1907.

Vertical Engines.—The B. F. Sturtevant Company, Hyde Park, Mass., has issued a second edition of bulletin No. 125, describing the company's class V S 5 vertical engines. These engines are built in many different sizes varying from 6 h.p. to 85 h.p. The bulletin is illustrated with half-tones and line drawings, and gives full dimensions of each size.

Cordage.—The Samson Cordage Works, Boston, Mass., sends a catalogue of its solid braided rope and cord. Different grades of these are made in sizes up to 1⅛ in. in diameter. Cords made for special work include train signal cords and trolley cords, for which the company also makes couplings, splice blocks, snaps and other fittings.

Direct-Current Motors.—The Allis-Chalmers Company, Milwaukee, Wis., sends a folder describing type K direct-current motors, which it builds for all classes of individual drive where either a constant or variable speed direct-current motor is required.

Graphite.—The March number of *Graphite*, issued by the Joseph Dixon Crucible Company, Jersey City, N. J., contains the first chapter of an article on "Feeding Graphite for Lubricating Purposes."

The Steam Shovel News for March gives its usual interesting information concerning excavation and other dirt-moving, contract and steam shovel work throughout the country.

Manufacturing and Business.

S. F. Bowser & Co., Ft. Wayne, Ind., have opened a Chicago office at 210 Fisher Building, with Jas. W. Runyan, Assistant General Manager, in charge.

W. L. Garland has been appointed General Agent of the Safety Car Heating & Lighting Company at Philadelphia, Pa., succeeding B. V. H. Johnson, resigned.

The Davenport Locomotive Works, Davenport, Iowa, has increased its capital stock from $300,000 to $1,000,000. The proceeds will be used for improvements.

D. E. Cain, formerly Assistant to the Vice-President, of the Denver & Rio Grande, is now Manager of the Dearborn Drug & Chemical Works, Denver, Colo.

Wm. C. McMillan, late President of the Michigan Malleable Iron Co., whose death was announced last week, was also President of the Detroit Seamless Steel Tubes Co.

The office of the Manager of Sales of the Western district of the Pressed Steel Car Co. has been removed from the Fisher Building, Chicago, to the Old Colony Building.

W. D. McMahon, formerly Assistant Manager of the Michigan Malleable Iron Co., Detroit, Mich., has been made Manager of the Belle City Malleable Iron Co., Racine, Wis.

On April 1 the machinery sales department of the Quincy, Manchester, Sargent Co. will be removed from Plainfield, N. J., to the new West street building, 90 West street, New York City.

E. M. McIlvain, formerly President of the Bethlehem Steel Company, has been elected President and General Manager of the Robins Conveying Belt Company, Park Row Building, New York.

Magnus Hellstrom, C.E., care A. Hansson, Linnegatan 12, Stockholm, Sweden, desires all the catalogues and literature available on the subject of earth and stone handling machinery, as well as concrete construction machinery and machinery for digging a small canal.

Robert C. Shaal, formerly with the General Storage Battery Company, New York, has been appointed sales engineer of the Bliss Electric Car Lighting Company, with office at the company's New York office, Night and Day Bank Building, Fifth avenue and Forty-fourth street.

The Patterson-Sargent Co., New York, through its Chicago representative, M. R. Stowell, entertained at a "Nobrac" dinner at the Chicago Athletic Club, March 18, a number of the members of the American Railway Engineering and Maintenance of Way Association who were attending the convention in Chicago last week.

The Central Inspection Bureau, New York, has orders from the Blackwood Coal & Coke Co. and from the Parral & Durango Railroad for the inspection of a number of cars to be built at the Middletown Car Works. The bureau has opened offices in the Majestic Building, Detroit, Mich., in charge of J. F. McGregor, District Manager.

Edward Denegre, Mechanical Engineer of McCord & Company, Chicago, died on March 15. He was 51 years old. He was formerly a railroad man, beginning on the Pennsylvania in 1876 as an apprentice, and serving successively thereafter on the Burlington, the Wabash and the Northern Pacific. He left the last named road to go to the Standard Car Truck Co., Chicago, and in 1898 became Mechanical Engineer of McCord & Company.

The Northern Engineering Works, Detroit, Mich., maker of cranes, is adding to its plant an erecting building for electric crane trolleys, about 50 ft. x 100 ft., one-story high, served by a 10-ton electric traveling "Northern" crane, and a two-story building for a tool room and store room, 50 ft. x 50 ft. The buildings are brick and steel with saw-tooth roofs, and are nearly done. The additions will allow more rapid handling of the business and will considerably increase the capacity of the plant.

The Stewart Iron Works Co., Cincinnati, Ohio, maker of fences and iron work, including wire and iron window guards, wickets, gates and miscellaneous iron work for park improvements, reports orders filled recently for the Illinois Central, the Chicago & North-Western, the Big Four, the Cincinnati, Hamilton & Dayton, the Southern, the Atlantic Coast Line, the Erie, the Philadelphia & Reading, the New York Central & Hudson River, the Pennsylvania Lines East, the Pennsylvania Lines West, the Louisville & Nashville and the Chesapeake & Ohio.

The Warren Electrical Manufacturing Company, Sandusky, Ohio, has bought the plant and good will of the Warren Electric Manufacturing Company of that city. In addition to the "Warren" alternator, it will make a full line of revolving-field type generators, also a.c. and d.c. motors, transformers, etc. The officers of the new company are: Millard H. Nason, President, also President of the Brilliant Electric Co., Cleveland, Ohio; Frank Warren, Secretary, hitherto Secretary of the Warren Electric Mfg. Co., and Norman L. Hayden, General Manager, formerly President of the Hayden & Derby Mfg. Co., New York, and now General Manager of the N. L. Hayden, Mfg. Co., Columbus, Ohio.

Two large Allis-Chalmers direct-current generators are to be installed in the new extension to the Boston Elevated's Lincoln wharf station, on Atlantic avenue. In this station is generated the larger portion of the current used for operating the elevated railway division and the cars through the East Boston tunnel. The generators will have a capacity of 2,700 k.w., 600 volts, and operate at a speed of 75 r.p.m., and will be driven by vertical cross compound engines. The Allis-Chalmers Company also has a contract,

duration not stated, for supplying air-brake equipment for all of the 4,000 cars on the street and interurban electric lines controlled by the New York, New Haven & Hartford.

Iron and Steel.

The Carnegie Steel Company has orders for about 750,000 tons of rails for 1907 delivery, including light rails and rails for export.

The Michigan Central is reported in the market for 3,000 tons of bridge material, and the Boston & Maine and Central of New Jersey are also negotiating for fabricated steel.

The United States Steel Corporation last week received orders for 20,000 tons of rails, including 3,000 tons for the Nevada Northern, 3,000 tons for the Lehigh Valley, and 14,000 tons for various other roads.

OBITUARY NOTICES.

E. J. Yard, Chief Engineer of the Denver & Rio Grande, died on March 23.

R. H. Rutherford, Master Mechanic of the Mexican Central at Aguascalientes, died suddenly of pneumonia on March 15.

William H. Lewis, formerly Master Mechanic of the Delaware, Lackawanna & Western, died at his home in Hoboken, N. J., on March 20. Mr. Lewis was born in 1828 at Quaker Ford, Glamorganshire, Wales. He began railroad work in 1849 as a machinist on the Beaver Meadow Railroad, now part of the Lehigh Valley. He was locomotive engineer and foreman of shops of the Hudson River Railroad (now part of the New York Central) at Greenbush, N. Y., from 1854 to 1871. He then went to the Delaware, Lackawanna & Western, where he served as Master Mechanic until 1899.

General Joseph F. Boyd, Purchasing Agent of the Cumberland Valley, died of paralysis on March 23. General Boyd was 74 years old. He began railroad work in 1853 in the office of the Master of Transportation of the Bellefontaine & Indiana, now part of the Big Four, and the next year was made General Freight and Ticket Agent of that road and of the Bellefontaine Railway. In 1860 he went to the Louisville & Nashville with the same title, which position he left to serve in the Civil War. He was for some months in 1865 Superintendent of the United States Military Railroad for the department of North Carolina. At the end of the war he resigned from the service, having been made Brevet Brigadier General, and returned to the Louisville & Nashville as Auditor and General Passenger Agent. In 1867 he went to the Memphis & Ohio, now part of the L. & N., and four years later was made Superintendent of the St. Louis & Southeastern, also now part of the Louisville & Nashville. In 1873 he was appointed Superintendent of the Cumberland Valley, where he remained until he was appointed Purchasing Agent in January, 1903.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Air Brake Association.

The fourteenth annual convention of the Air-Brake Association will be held in Columbus, Ohio, on May 14, one month later than the regular time. The chairman of the Committee on Entertainment is S. D. Hutchins, 1132 Columbus Savings and Trust Building, Columbus. The convention headquarters will be at the Great Southern Hotel, corner of High and Main streets. The Secretary of the Association is F. M. Nellis, 53 State street, Boston, Mass.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Aberdeen & Rockfish.—J. W. Phillips has been appointed Auditor, with office at Aberdeen, N. C., succeeding G. P. Bourdelat.

Chicago, Rock Island & Pacific.—A. S. Dodge, Assistant to the Third Vice-President, has resigned.

Cincinnati, New Orleans & Texas Pacific.—Alexander Telford, Purchasing Agent, has been appointed Assistant Secretary, succeeding J. W. Wood, resigned.

Grand Trunk.—See Great Northern.

Great Northern.—F. H. McGuigan, Fourth Vice-President of the Grand Trunk, has been elected to the new office of First Vice-President of the Great Northern.

Long Island.—Franklin B. Lord has been elected a Director, succeeding James H. Hyde, resigned.

Missouri & North Arkansas.—D. R. Francis has been elected Chairman of the Board.

Nevada Northern.—J. H. Underwood, chief clerk in the office of the Auditor of the Colorado Midland, has been appointed Auditor of the Nevada Northern.

New York, Philadelphia & Norfolk.—Henry W. Biddle has been elected a Director, succeeding A. J. Cassatt, deceased.

Tavares & Gulf.—W. M. Brittain has been elected Vice-President and General Manager, with office at Clermont, Fla.

Operating Officers.

Boston & Albany.—J. B. Stewart, General Superintendent, has been given leave of absence on account of ill health, and his duties will be performed by W. J. Fripp, recently appointed Assistant General Superintendent.

Central of Georgia.—C. T. Airey, Assistant General Freight Agent, has been appointed to the new office of General Freight Traffic Manager, effective April 1.

Chicago, Rock Island & Pacific.—W. S. Tinsman, General Superintendent of the Southwestern district, has been appointed Assistant General Manager, with office at Chicago. A. E. Sweet, Assistant to the Second Vice-President, succeeds Mr. Tinsman, with office at Topeka, Kan.

Chihuahua & Pacific.—C. L. Graves, General Manager, has resigned to go into other business.

Cleveland, Cincinnati, Chicago & St. Louis.—J. R. Cavanagh, Superintendent of Car Service, has been appointed to the new office of Superintendent of Transportation, effective April 1.

Denver & Rio Grande.—See Rio Grande Western.

El Paso & Southwestern.—George F. Hawks, General Superintendent of the Houston & Texas Central, the Houston, East & West Texas, and the Houston & Shreveport, has been appointed to the new office of General Superintendent of the El Paso & Southwestern, with office at El Paso, Tex., effective April 1. Mr. Hawks was born at Kirkland, Ohio, on August 28, 1857, and was educated at the Rockville, Ind., high school. He began railroad work in 1874 as a brakeman on the Logansport, Crawfordsville & Southwestern, now part of the Vandalia; he served as a brakeman on the Wabash, and later as conductor on the Pekin, Lincoln & Decatur, the Chicago, Peoria & Southwestern, the Canadian Pacific and the Atchison, Topeka & Santa Fe, until 1890; he was then made Trainmaster of the Panhandle division of the last named road, and served for six years in this position on various divisions. In 1897 he went to the Mexican Central as train inspector, and was appointed Superintendent of the San Luis division of that road in 1898; he was transferred to the Mexico division in 1900, but after a year resigned on account of ill health. He soon went to the Southern Pacific as Trainmaster of the Texas & New Orleans, now the Louisiana Western. He was made Assistant Superintendent of the Louisiana lines in 1902, and Superintendent of the El Paso division of the Galveston, Harrisburg & San Antonio in 1903. The next year he was made Superintendent of the Texas & New Orleans and the Galveston, Houston & Northern. In the spring of 1905, he was appointed to the position which he is now about to leave to go to the El Paso & Southwestern.



George F. Hawks.

Galveston, Harrisburg & San Antonio.—See Houston & Texas Central.

Houston & Shreveport.—See Houston & Texas Central.

Houston & Texas Central.—G. Radetzki, Superintendent of the Galveston, Harrisburg & San Antonio at Victoria, Tex., has been appointed General Superintendent of the Houston & Texas Central, of the Houston, East & West Texas, and of the Houston & Shreveport, with office at Houston, Tex., effective April 1, succeeding G. F. Hawks, resigned to go to the El Paso & Southwestern.

Houston, East & West Texas.—See Houston & Texas Central.

Missouri, Kansas & Texas.—See St. Louis Southwestern.

Mobile, Jackson & Kansas City.—J. G. Glazier, Superintendent of the Mobile division, has resigned. C. F. Morgan, Trainmaster at New Albany, Miss., has been appointed Superintendent of the New Albany division.

New Orleans Terminal.—R. B. Fowler, Superintendent, has been appointed General Manager.

Pennsylvania.—Hereafter the Lines East will be operated in five grand divisions instead of four. The new grand division is the Western Pennsylvania, and it includes the Pittsburg division, the Western Pennsylvania division and the Monongahela division, all heretofore part of the Pennsylvania Railroad grand division, and also that part of the Allegheny division of the Buffalo and Allegheny Valley grand division running from Pittsburg to Kiskiminetas Junction. The names of the following grand divisions have been changed: Pennsylvania Railroad grand division to Eastern Pennsylvania grand division; United Railroads of New Jersey grand division to New Jersey grand division; Philadelphia & Erie Railroad grand division to Erie grand division. The territory of the Western division of the Erie grand division has been extended to include the line heretofore constituting the Middle division. S. C. Long, Superintendent of the Pittsburg division, has been appointed General Superintendent of the Western Pennsylvania grand division. R. T. Morrow, Superintendent of the Western Pennsylvania division, succeeds Mr. Long. Andrew Keiser, Assistant Superintendent of the Pittsburg division, succeeds Mr. Morrow. D. C. Stewart, Superintendent of Telegraph, succeeds Mr. Keiser. J. B. Fisher, Freight Trainmaster of the old Middle division, succeeds Mr. Stewart.

Rio Grande Western.—W. A. Whitney, Superintendent of Transportation of the Denver & Rio Grande, has been appointed Superintendent of the Rio Grande Western, succeeding George Geiger, resigned. H. J. Roth has been appointed Assistant Superintendent at Salt Lake City, succeeding E. H. Holden.

St. Louis Southwestern.—J. W. Maxwell, Assistant General Manager of the Missouri, Kansas & Texas, has been appointed General Superintendent of the St. Louis Southwestern, with office at Tyler, Tex., succeeding W. E. Green, resigned to go to another company.

Traffic Officers.

Chicago & Eastern Illinois.—E. J. Knickerbocker, Coal Traffic Manager, has been appointed to the new office of Assistant General Freight Agent.

Engineering and Rolling Stock Officers.

Chicago, Rock Island & Pacific.—W. J. Tollerton, Superintendent of Motive Power at Topeka, Kan., has been appointed to the new office of Assistant General Superintendent of Motive Power.

Cincinnati, New Orleans & Texas Pacific.—See Norfolk & Southern.

Norfolk & Southern.—J. W. Stewart, Chief Engineer of Construction, having resigned to go to another company, the duties of Chief Engineer will, after April 1, be performed by C. O. Haines, Vice-President, whose office is at Raleigh, N. C. All reports heretofore made to the Chief Engineer will be made to the Principal Assistant Engineer. T. W. Cothran has been appointed Principal Assistant Engineer, with office at Raleigh, N. C. W. P. Marshall has been appointed Division Engineer at Wilson, N. C. C. C. Fitzgerald, Division Engineer of the Cincinnati, New Orleans & Texas Pacific at Somerset, Ky., has been appointed Division Engineer of the N. & S. at Washington, N. C.

Purchasing Agents.

Cincinnati, New Orleans & Texas Pacific.—See this company under Executive, Financial and Legal Officers.

LOCOMOTIVE BUILDING.

The Mobile & Ohio, it is reported, is figuring on 40 locomotives.

The Boston & Albany, it is reported, is figuring on 20 locomotives.

The Nicaragua Government Railways will shortly be in the market for several locomotives.

The Andine Railway, Rio Cuarto, Cordoba, Argentine, will shortly be in the market for several locomotives.

The Mexico, Oaxaca & Yucatan, 10 Wall street, New York, is about to order four second-hand locomotives for construction work.

The Council City & Solomon River will shortly be in the market for locomotives, which will be ordered through A. D. Keep, Hanover National Bank Building, New York.

The Pennsylvania has ordered from its Juniata shops 20 class H6b consolidation (2-8-0) type locomotives; 20 class B8 switching locomotives, and six class E2d Atlantic (4-4-2) type locomotives.

The Silviera Sugar Company is about to order some locomotives for its Cuban plantation. The contract will be placed through Czarnikow, MacDougall & Company, Limited, 115 Wall street, New York.

The Temiskaming & Northern Ontario, as reported in the *Railroad Gazette* of March 22, has ordered from the Locomotive & Machine Co., of Montreal, six simple 10-wheel freight locomotives. The specifications are as follows:

Weight on drivers	112,000 lbs.
Total weight	144,000 "
Diameter of cylinders	19 in.
Stroke of pistons	24 "
Diameter of drivers	57 "
Type of boiler	Extended wagon top
Working steam pressure	180 lbs.
Heating surface, total	1,780 sq. ft.
Tubes, number	239
" material and maker	Mannesman steel.
" outside diameter	2 in.
" length	13 ft. 2 5-16 "
Firebox, length	103 "
Firebox, width	42 "
Grate area	30 sq. ft.
Tank capacity for water	5,000 Imp. gals.
Coal capacity	10 tons

Special Equipment.

Air brakes	Westinghouse
Bell ringer	Pneumatic
Boiler lagging	Carey's magnesia lagging
Brake-beams	Simplex
Couplers	Tower
Headlights	Pyle electric
Injector	Ohio
Journal bearings	Canadian Bronze Co.
Piston rod packings	U. S. Metallic
Valve rod packings	U. S. Metallic
Safety valve	Coale encased
Sanding device	Wilson pneumatic
Sight-feed lubricators	Detroit Bull's-eye
Steam heat equipment	Consolidated

CAR BUILDING.

The Nicaragua Government Railways will shortly be in the market for several cars.

The Pittsburg & Lake Erie, it is reported, is asking prices on some passenger equipment.

The Fort Smith Lumber Co., Adona, Ark., is said to be in the market for some logging cars.

The Andine Railway, Rio Cuarto, Cordoba, Argentine, will shortly be in the market for several cars.

The Illinois Central is in the market for two dining cars, and is also said to be in the market for 15 day coaches.

The Mexico, Oaxaca & Yucatan, 10 Wall street, New York, is about to order about 250 cars for construction work.

The Georgia Machine & Equipment Co., Atlanta, Ga., it is reported, is in the market for six standard second-hand flat cars.

The Pennsylvania is believed to have ordered 150 steel passenger cars, and to be about to build some steel passenger cars at Altoona.

The Council City & Solomon River will shortly be in the market for several cars, which will be ordered through A. D. Keep, Hanover National Bank Building, New York.

The New York, Chicago & St. Louis, as reported in the *Railroad Gazette* of January 4, has ordered five coaches and six baggage cars from the American Car & Foundry Co.

The Silviera Sugar Company is about to order 100 cars for its Cuban plantation. The contract will be placed through Czarnikow, MacDougall & Co., Limited, 115 Wall street, New York.

The Boston & Maine, according to press despatches, is having built four parlor cars, one combination parlor and baggage car, six dining cars, 20 vestibule cars and 30 coaches by the Pullman Company, and 12 caboose cars by the Laconia Car Company.

The Chicago, Indianapolis & Louisville has ordered 300 wooden flat cars and 200 box cars of 80,000 lbs. capacity from the Haskell & Barker Car Co., and three baggage cars from the American Car & Foundry Co., and will build ten cabooses at its Lafayette shops.

The Seaboard Air Line, as reported in the *Railroad Gazette* of March 22, has ordered 50 Hart convertible cars of 80,000 lbs. capacity from the Rodger Ballast Car Company. These cars will measure 34 ft. 2 in. long, 8 ft. 8 in. wide and 4 ft. high, inside measurements, and 36 ft. long, 10 ft. 2⅜ in. wide and 8 ft. 2¼ in. high, over all. Bodies and underframes will be of wood. The special equipment includes: Westinghouse brakes, Tower couplers, Farlow draft rigging and Symington journal boxes.

The Norfolk & Western, as reported in the *Railroad Gazette* of March 22, has ordered from its Roanoke, Va., shops 243 40-ton flat cars. These cars will weigh 31,000 lbs., and will measure 40 ft. long, 9 ft. 5 in. wide and 4 ft. 3½ in. high, over all. Bodies and underframes will be of wood. The special equipment includes:

Bolsters	Cast steel
Brake beams	Norfolk & Western deck beam
Brakes	Westinghouse
Brasses	Ajax Plastic Bronze
Draft rigging	Butler
Dust guards	Wood
Springs	Union Spring & Mfg. Co.
Trucks	Barber

The Brooklyn Rapid Transit, as reported in the *Railroad Gazette* of March 15, has ordered through the Transit Development Company from the J. G. Brill Co. 100 semi-convertible street railway passenger motor cars, to be built at Elizabeth, N. J., and from the Laconia Car Co. and the Jewett Car Co. 100 semi-convertible motor cars for elevated service, for October, November and December delivery, half of the order being given to each company. The surface cars will weigh 33,000 lbs. and will seat 38 passengers; they will measure 27 ft. 3¾ in. long, 7 ft. ½ in. wide, and 8 ft. 1⅜ in. high, inside measurements, and 38 ft. 3¾ in. long, 8 ft. ½ in. wide and 8 ft. 11¾ in. high, over all. Bodies and underframes will be of wood. The elevated cars will weigh about 69,000 lbs., and will seat 54 passengers; they will measure 39 ft. 5 in. long, 7 ft. 6 in. wide and 8 ft. 3⅝ in. high, inside measurements, and 48 ft. 11 in. long, 8 ft. 7 in. wide and 9 ft. 4½ in. high, over all. The bodies will be of wood with steel in corners and double posts, and the underframes will be of pressed steel. The special equipment for the above cars is as follows:

	Surface.	Elevated.
Bolsters, body	Built-up bar steel.	Pressed steel.
Bolsters, trailing truck	.....	Steel plate truss.
Brake-shoes	Am. Brake-Shoe & Fdy.	
Brakes	Bklyn Hgts R.R. stand.	Inside hung.
Couplers	.....	Van Dorn automatic.
Curtain fixtures	Acme open car cable.	Curtain Supply Co.
Curtain material	Pantasote.	Pantasote.
Door fastenings	.....	Coburn tracks and sheaves.
Dust guards	Wood.	Wood.
Headlights	Dayton incandescent.	Eureka arc.
Heating system	Consol. Car Htg. Co.	Consolidated Panel electric heaters.
Platforms	Vestibule, without sides	
Roofs	Monitor.	Monitor.
Seats	Heywood Bros. and Wakefield Co. rattan covered.	
Trucks	Standard Motor Truck Co.	
Wheels	.....	Schoen steel.

RAILROAD STRUCTURES.

Alexandria, La.—An agreement has been made to build a brick and stone passenger station for the joint use of the Texas & Pacific, the St. Louis, Iron Mountain & Southern, and the St. Louis, Watkins & Gulf. Work is to be started within six months.

Chicago, Ill.—The Chicago & North-Western is to put up a bridge over the Chicago river at Kinzie street to be one of the heaviest of its kind, at a cost of $200,000. The total weight will be 1,300,000 lbs., though the total length will be only 170 ft., and the width at the central trusses 30 ft. It will be operated by two electric motors of 50 h.p. each. Work is to be begun at once.

Garden City, Kan.—The Atchison, Topeka & Santa Fe, it is said, will put up a new station here to cost $20,000.

Indianapolis, Ind.—The Evansville & South Indiana Traction Company wants bids April 15 for putting up a two-story brick passenger and freight station; also for putting up car barns at Princeton, Ind.

Kankakee, Ill.—The Chicago, Indianapolis & Southern will build a new shop here to cost $100,000.

Los Angeles, Cal.—The Southern Pacific, it is said, has plans ready for a new arcade station to cost $250,000 to be built during the present year.

Memphis, Tenn.—The freight house of the Illinois Central at Shelby and Calhoun streets, together with 25 loaded and 60 empty freight cars, was destroyed by fire March 21. The estimated loss is $65,000.

New Orleans, La.—President C. C. Harvey, of the New Orleans Terminal Company, announces that bids will be called for at once for the construction of a passenger station at Canal and Basin streets, and that as soon as the contract is awarded the work will begin. The station is to cost $200,000.

New York, N. Y.—Two bills are before Governor Hughes for approval. One is to extend the temporary Brooklyn Bridge terminal structure into City Hall Park and the other authorizes the construction of the permanent loop terminal station on the site at Park Row and Centre street. Mayor McClellan has signed both measures in behalf of the city, and it is expected that Governor Hughes will sign them also. Bridge Commissioner Stevenson says that within two weeks after the Governor signs the bills he will be ready to let the contract for the temporary structure into City Hall Park, and a week later he will be ready to let the first contract for the construction of the permanent loop station.

Norwalk, Ohio.—The Wabash and the Wheeling & Lake Erie, it is reported, have decided to enlarge the shops here. The new work will begin shortly. The proposed new shops at Brewster may not be built for a year or so, as the improvements at Norwalk will enable the company to care for all shop work on the Wheeling & Lake Erie and a portion of the Wabash-Pittsburg terminal.

Orange, Tex.—The Southern Pacific is negotiating with residents of this place to secure land for its proposed passenger station here.

St. John, N. B.—Bids are wanted April 1, by W. Downie, General Superintendent Atlantic division of the Canadian Pacific, for building concrete abutments and piers as follows: Two abutments, Fredericton branch, Russiadornis, N. B.; four abutments, Tobique branch, Licford, N. B.; two abutments, Aroostook branch, Fort Fairfield, Maine; two abutments and one pier, Edmunston branch, Grand River, N. B.; two abutments and three piers, Edmunston branch, Aroostook Junction, N. B.; two abutments and three piers, Edmunston branch, Grand Falls, N. B.

Springfield, Mass.—The Boston & Albany is planning to put up a new roundhouse here.

Superior, Wis.—The Northern Pacific, it is said, has plans made to double-track the railroad bridge between Superior and Duluth, and make other improvements at a cost of $500,000.

Syracuse, Kan.—The Atchison, Topeka & Santa Fe, it is said, will put up a new station here to cost $65,000.

Winnipeg, Man.—The Bridge Commissioner has reached an agreement with the Canadian Pacific for the construction of an overhead bridge to cost $70,000. The proposed structure, with approaches, will be 2,175 ft. long.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Alabama Northwestern.—Under this name a company is reported being organized to build from Gadsden, Ala., northwest to Tuscumbia and Sheffield, 110 miles.

Atchison, Topeka & Santa Fe.—According to reports, this company has given a contract to McCabe & Steen, for work on its proposed connecting line from Texico, N. Mex., south to Brownwood, Tex. Work, it is said, will be started near Coleman in April.

Auburn, Mechanics Falls & Norway (Electric).—A bill is before the Maine Legislature to permit a company under this name to buy and consolidate lines centering in Bangor, Augusta, Lewiston, Bath and Brunswick. John R. Graham, of Bangor, is the chief promoter.

Bessemer & Lake Erie.—Improvements to cost over $1,500,000 have been begun. Of this sum, $80,000 is to be used in enlarging the Greenville yards, and $300,000 for additions to the shops at the same place. Over 12 miles of second track will be laid, and 140,000 steel ties will be used for new track and renewals.

Boston & Maine.—This company, which proposes to double-track its road from Johnsonville, N. Y., southwest to Troy, 16 miles, has notified the State Railroad Commission that it proposes to abolish 19 grade crossings between these two points, and has asked the commission to determine in what manner the highways at these crossings shall cross the railroad.

California Midland.—A meeting is to be held April 5 by this company to issue stock to secure funds for building its proposed line from Marysville, Cal., east via Grass Valley to Nevada City, with a diverging line south to Auburn, Cal., a total of 55 miles. J. Martin is President and H. Malloch, Secretary.

Canadian Northern.—Premier Pugsley has announced in the legislature that the Government was prepared to assist this company to build a line down the valley of the St. John river by guaranteeing four per cent. bonds to the extent of $15,000 a mile. A bill to that effect may be laid before the legislature during the present session. As proposed, the line will be 132 miles long.

Canadian Pacific.—An official statement of the work to be carried out by this company this year, for which appropriations have been made, shows a total length of 958 miles of new railroad, including a large number of western branches and extensions. The principal work includes the completion of the Toronto-Sudbury line from Craighurst to Sudbury, Ont., 173 miles, and the extension of the Pheasant Hills branch to a junction with the Wetaskiwin branch, completing a through connection between the Calgary and Edmonton

line and the main line. In addition to the new lines about 326 miles of double-tracking remains to be done between Winnipeg and Fort William. This is to be finished; also 108 miles between St. Anne and Smiths Falls, Ont.

Central of Oregon.—This company, which is building an extension from Union, Ore., northwest to La Grande, 45 miles, and which completed about seven miles last year, has bought a large quantity of rails, to be laid on its line from Union to Cove, and beyond that point to La Grande. Grading work is now under way on this section.

Chattanooga, Waycross & Jacksonville.—Under this name a company is being organized to build a line from Waycross, Ga., north to Eastman, on the Southern Railway. The promoters include: John M. Cox, D. Lott, S. W. Hitch, J. S. Williams, W. B. Ellington, M. L. Moore, James Knox and Darren Lott, all of Waycross.

Chicago, Burlington & Quincy.—Plans for double-tracking the balance of this company's line between Kansas City and St. Joseph have been made. The line now has a double track between St. Joseph and Rushville, 15 miles, and between Beverly and Walrond, 13 miles. The second track for the remaining 32 miles will probably be laid this year.

Cincinnati Intersecting.—Application has been made for a charter to build a belt line around Cincinnati, Ohio. The estimated cost of the right-of-way is $800,000.

Cleveland & Sharon Traction.—To comply with the laws of Pennsylvania, which do not permit street railway companies to carry freight, this company has changed its plans to enter Sharon, Pa., from Orangeville. Engineers have been at work for some time securing another route. The plan is to run southeast from Orangeville through Brookfield township, and connect with the Mahoning & Shenango Valley, over which a traffic arrangement will be made for connection with Sharon. This will eliminate the heavy grades on the old route.

Consolidated Railway (N. Y., N. H. & H.).—Plans have been announced for the building of trolley lines from Great Barrington, Mass., to South Egremont, and to Canaan, Conn. The line from Great Barrington to Canaan will closely parallel the Berkshire division of the New Haven.

Davenport & Burlington Interurban.—Organized in Iowa with $250,000 capital to build an electric line from Davenport, Ia., to Burlington, along the west shore of the Mississippi river. C. G. Hipwell, T. Dougherty and A. E. Carroll, all of Davenport, are interested.

Erie.—The Directors have decided to stop work for the present on two new lines on which work has been under way in New York State. Under present conditions, the subsidiary companies doing the work are unable to dispose of their securities on favorable terms. The two lines are the Guymard cut-off, which is being built by the Erie & Jersey between Mount Hope and Highland Mills, 42 miles, and the low-grade single track line from Cuba on the Allegheny division to Hunts on the Buffalo division, 33 miles, which is being built by the Genesee River Railroad.

El Paso & Southwestern.—According to reports, the El Paso & Southwestern, which runs from El Paso, Tex., to Benson, Ariz., with a branch to Nacozari, state of Sonora, Mex., is to be extended from the last named point to Guaymas. Surveys were made sometime ago, and the right of way is now being cleared. The proposed extension will be about 300 miles long. The Sonora Railway now runs from Nogalez to Guaymas.

Erie & Jersey. See Erie.

Genesee River. See Erie.

Georgia Roads.—A company is being organized to build a line from Athens, Ga., northeast via Hartwell to Anderson, S. C., about 70 miles. The promoters include: Mayor Dorsey, W. L. Hodges, J. N. Webb, J. C. Cooper, J. White and G. C. Thomas, of Athens.

Grand Trunk Pacific.—Reports are current that this company is planning to build a line north from its proposed western terminus at Prince Rupert, B. C., via Skagway and other Alaska points into the Yukon district, with a branch to Juneau.

Huron & Ontario (Electric).—This company will let contracts about April 1 for building its proposed line between Toronto and Owen Sound. Surveys made and right of way partly secured. H. W. Middlemest, Toronto, Chief Engineer.

Illinois, Iowa & Minnesota.—Work will shortly be started, it is said, on an extension of this road from its northern terminus at Rockford, Ill., northeast to Milwaukee, Wis., about 90 miles. An extension is also projected from the southern terminus at Momence to Gary.

Lake Charles & Northern.—See Southern Pacific.

Louisiana Roads.—The City Council of New Iberia is negotiating with a committee from St. Martinville to build a line from New Iberia, La., to Port Barre, 35 miles, where a connection can be made with the Opelousas & Gulf. Preliminary surveys are to be made at once.

Maine Roads (Electric).—Bills have been introduced in the legislature to authorize the building of electric lines as follows: From Sanford, in York County, north via Parsonsfield to Hiram, 30 miles; Bethel northeast to Rumford Falls, 15 miles; Camden northwest to Liberty, 18 miles; Camden north to Belfast, 15 miles; Auburn west via Mechanic Falls, thence northwest to Norway, 20 miles; Lewiston south via Gray to Portland, 30 miles; Lisbon south via Durham to Freeport, 12 miles; Bangor southeast to a number of points in Hancock County; Ellsworth southeast to Bar Harbor on Mount Desert Island, 18 miles; on Peak Island; Danforth north via Houlton thence east to Woodstock, N. B., 50 miles; Presque Isle to Washburn; Presque Isle northeast via Fort Fairfield, thence east to Andover, N. B., 20 miles; Ellsworth east to Sullivan, 20 miles, and Ellsworth southwest to Castine, 22 miles.

Marengo & Midland (Electric).—Incorporated in Iowa with a capital of $25,000, and office at Marengo. The company proposes to build electric lines north and south from Marengo, Ia., and also one east to Iowa City. W. E. Hibbs, H. Gods, H. H. Brimmer, W. J. Sayers and others are interested.

Mineola, Roslyn & Port Washington Traction.—A charter has been granted this company by the Nassau County (New York) Board of Supervisors, to build an electric line from the Long Island tracks at Main street, Mineola, via Roslyn to Port Washington, and thence along the Shore road. Work must be started within 60 days, and the entire line completed within six months. George Stanley, of Cleveland, Ohio, and other capitalists of that city are interested in the project. Additional franchises have been asked for lines to important towns on the south side of Long Island, making a total of about 100 miles.

Mobile, Jackson & Kansas City.—According to reports, this company is planning to build two extensions; one from its present southern terminus at Mobile southwest to New Orleans, and another from Middleton, Tenn., north to Joppa, Ill., or to Paducah, Ky. President Robinson is quoted as saying that the extensions will be built and connections made with the Frisco and with the Rock Island.

Mono Lake.—This narrow gage road, 32 miles long, in Mingo County, Cal., has been sold, it is reported, to the Brock Syndicate of Philadelphia, together with a large tract of timber land. The new owners are to make the line standard gage and build a connection with the Tonopah & Goldfield.

Montana Railroads.—A company is being organized by New York, Chicago, Helena and Butte capitalists to build an electric line from Helena, Mont., southwest to Butte, 55 miles, at a cost of about $3,000,000. Power is to be secured from the Missouri river at Helena.

New York, New Haven & Hartford.—This company has bought the Poughkeepsie & Eastern, running from Poughkeepsie, N. Y., northeast 40 miles to Boston Corners, where it connects with the Harlem division of the New York Central. The road was owned by the late Russell Sage. It is parallel to a line of the Central New England, controlled by the New Haven, and is valuable chiefly for its terminal lands and rights in Poughkeepsie. The road has been operated at a deficit for some years and is in need of considerable improvement.

Negotiations are actively under way between this company and the officials of the city of Springfield, Mass., whereby the lands on which the railroad enters Springfield on the east side of the Connecticut river will be sold to the city of Springfield and the tracks transferred to the west side of the river. Work is to be begun immediately, building a new line west of the river from Warehouse Point northward to Springfield, 12 miles. The land acquired by the city is to be made into a river-front park, largely at the expense of two public-spirited citizens. When the change is made trains will run all the way from Hartford to Springfield on the west side of the river. The railroad will build a new bridge over the Connecticut river at Springfield.

New York Subways.—The Rapid Transit Board is planning to ask shortly for bids for the proposed subways on Seventh, Eighth and Lexington avenues.

Bids will be asked for early in April for the second section from Canal to Broome streets of the proposed bridge subway loop projected to connect the Brooklyn bridge with the Williamsburg bridge, in the Borough of Manhattan.

Ocean & Northern.—Application has been made for a charter under this name by a company with $1,000,000 capital, to build a line from the harbor of Ellsworth, Me., or Winter Harbor, north

35 or 40 miles to Plantation No. 33. Incorporators include: E. H. Greeley, L. A. McGowan, J. A. Peters, H. W. Cushman and H. M. Hall, of Ellsworth, and B. E. Tracy, of Winter Harbor.

Oklahoma & Golden City.—Residents of Jefferson City and of Golden City, Mo., are organizing a company under this name, to build a line from Jefferson City, Mo., southwest to Pawhusa, Okla., about 270 miles, with a branch from the main line at Climax Springs in Camden County, Mo., south to Springfield, 67 miles. The project has been under consideration for a number of years, and the promoters announce that they have arranged with eastern capitalists to finance the road. Contracts for surveys have been let.

Oregon Roads.—Plans are being made for building a line from Holdman, Ore., to Columbia, about 15 miles, and eventually to extend south via Helix to Pendleton. E. W. McComas and G. A. Hartman, of Pendleton, are securing the right of way.

Orford Mountain.—The road is now completed from Rockland, Que., on the St. Francis river, near Brome, to Mansonville, on the Vermont border, about 70 miles, across the counties of Shefford and Brome. It is expected that the completed road will be opened for through traffic next week. The road connects with the Grand Trunk and the Canadian Pacific at its northern end, and with the Canadian Pacific and the Boston & Maine at its southern terminus.

Owensboro & Rockport Terminal & Bridge Company.—Organized in Owensboro, Ky., with $1,000,000 capital to build a line from Owensboro north to Rockport, Ind., where connection is to be made with the Southern. There will have to be a bridge over the Ohio river. A. S. Kennedy, of Rockport, is President, and E. T. Franks, First Vice-President; F. A. Ames, Second Vice-President; J. H. Parrish, Treasurer, and J. F. Cox, Secretary, all of Owensboro, Ky.

Portland & Rumford Falls Railroad.—This company, a subsidiary of the Portland & Rumford Falls Railway, is asking permission to build from Poland, Me., south to the coast at Falmouth and at Portland, about 30 miles.

Poughkeepsie & Eastern.—See New York, New Haven & Hartford.

Richmond & Hamilton Interurban.—Organized to build an electric line from Richmond, Ind., southeast to Hamilton, Ohio, 40 miles. The project, it is said, has been financed, and rights of way are being secured. Henry Duhme, of Wyoming, Ohio, is the chief promoter. Cincinnati capitalists, including Attorney Caldwell, are also interested in the project.

St. Mary's & Western Ontario.—Contracts have been let for building between St. Mary's and Embro, Ont., as follows: Rails, Dominion Steel Co., Sydney, C. B.; grading, ballasting, cement work, etc., J. E. Webb, Toronto; ties and telegraph poles, Victoria Harbor & Lumber Co., Toronto. (Mar. 15, p. 396.)

Seaboard Air Line.—This company has secured trackage rights over the Southern from Atlanta to Macon, Ga., which will give a new and more direct route between Atlanta and Savannah, Ga. The present freight route of the Seaboard from Birmingham, Ala., Chattanooga and other points in the central south is through Atlanta and Columbia to Savannah, 425 miles. By the new route over the Southern between Atlanta and Macon, 88 miles, thence over the Macon, Dublin & Savannah, 92 miles, owned by the Seaboard, to Vidalia, then over the Seaboard to Savannah, 82 miles, making the total 262 miles, against 425 by the present route, and 295 miles over the Central of Georgia. In return the Seaboard grants to the Southern traffic arrangements to use the Seaboard's tracks from Macon to Savannah.

Southern.—See Seaboard Air Line.

Southern Pacific.—The Lake Charles & Northern, which was organized to carry out the work of the Louisiana & Pacific, formerly part of the Long-Bell Lumber Company's system of logging roads in Louisiana, is extending the line to connect De Ridder, on the Kansas City Southern, with Lake Charles, 44 miles. The narrow gage logging road, which is included in the above, extends from De Ridder to the Calcasieu river, about five miles north of Lake Charles. The line is being made standard gage and extended to Lake Charles.

Temiskaming & Northern Ontario.—The Ontario Government has under consideration the question of building a branch line from Cobalt, Ont., to Sudbury. Preliminary surveys are being made. A private company has applied for a charter to build between these two points, but action on this application will be deferred until it is determined whether the government will build the line or not.

Tonopah & Goldfield.—This company, which is extending its road from Goldfield, Nev., to Bullfrog, is planning to build a branch line from Tonopah to the Silver Peak gold fields, about 20 miles.

Union Pacific.—This company is planning to lay this summer about 260 miles of second main track on its main line between Omaha, Neb., and Green River, Wyo. According to Vice-President Mohler, work is under way on four new tracks between Omaha and South Omaha. Double-track work between Julesburg, Neb., and Cheyenne, Wyo., will be delayed in order to finish the work at other points where traffic is heavier.

Wabash.—This company, the Pere Marquette and the Detroit Council Grade Separation Committee have agreed upon the plans for grade separation work between Twelfth street and the city limits, to cost $1,250,000.

Wyandotte & Lawrence.—Incorporated in Kansas with $510,000 capital to build from Lawrence, Kan., northeast via the counties of Douglas, Johnson, Leavenworth and Wyandotte to Kansas City, 38 miles. The directors include: J. E. Wherrell, B. Schnierle, F. K. Schuepbach, E. Y. Blum and H. C. Downs, all of Kansas City, Kan.

RAILROAD CORPORATION NEWS.

Bangor & Aroostook.—This company has sold to a syndicate headed by Brown Bros., New York, $1,000,000 5 per cent. bonds of branch lines; $800,000 5 per cent., 30-year Northern Maine Seaport bonds, and $900,000 serial equipment trust notes. (Nov. 2, 1906, p. 124.)

Boston & Philadelphia Steamship Co.—See New York, New Haven & Hartford.

Deepwater Railway.—A meeting of the stockholders of this company has been called for April 22, to vote on a proposition to merge the company with the Tidewater Railway. The Deepwater is building the West Virginia portion of the line. The Virginia Railway was recently incorporated to take over both these companies.

Erie.—For retrenchment in construction work in New York State, see Railroad Construction columns.

Kansas City, Mexico & Orient.—This company recently sold $1,500,000 bonds. Between 600 and 700 miles of road are now finished, and it is expected that by the end of the current year 1,200 miles will be completed.

Kansas City Southern.—Gross earnings for February, 1907, were $726,988, an increase of $59,658; net earnings, $308,933, an increase of $131,071. Gross earnings for the eight months ended February 28, 1907, were $5,900,217, an increase of $954,752; net earnings $2,377,156, an increase of $1,101,772.

Merchants & Miners' Transportation Co.—See New York, New Haven & Hartford.

New York, New Haven & Hartford.—The following details have been announced regarding the community of interest established between the New York, New Haven & Hartford and the Merchants & Miners' Transportation Co.: The railroad has agreed to exchange $2,000,000 par value of its stock for $2,500,000 par value of the capital stock of the steamship company. A special meeting of the stockholders of the last named company will be called to approve this transaction, to authorize an increase of $3,000,000 in the capital stock, and to authorize an issue of $3,250,000 4 per cent. debenture bonds. The bonds, it is understood, are to be given in exchange for the Boston & Philadelphia Steamship Co.; of the new stock, $2,500,000 is to go to the New Haven and $500,000 is to be distributed to the present stockholders of the steamship company. (March 15, p. 378.)

The New Haven has bought the Poughkeepsie & Eastern from the estate of the late Russell Sage for a price said to be $400,000. The road runs from Poughkeepsie to Boston Corners, about 40 miles. It parallels the Central New England for about 20 miles from Poughkeepsie, and has terminals in Poughkeepsie, which will be valuable to the New Haven in connection with the rebuilding of the Poughkeepsie bridge.

Philippine Railroad.—The War Department will, about July 1, ask bids for $1,000,000 4 per cent. bonds of the Philippine Railroad, which is being built on the island of Cebu. The Government does not guarantee the bonds, but they will have the same standing as other Philippine Government bonds, in that they can be deposited as security for public moneys in the treasury.

Poughkeepsie & Eastern.—See New York, New Haven & Hartford.

Terre Haute, Indianapolis & Eastern Traction.—This company has been incorporated by Philadelphia interests with $25,000,000 stock and $10,000,000 bonds as a holding company for the following electric lines in Indiana: The Indianapolis & Northwestern, the Indianapolis Western, the Indianapolis Coal Traction Co., the Indianapolis & Martinsville, the Indianapolis & Eastern, and the Richmond Street & Interurban.

Tidewater Railway.—See Deepwater Railway.

Virginia Railway.—See Deepwater Railway.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns OUR OWN opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Competition in the Far Northwest 469
- College Men on the Pennsylvania 469
- Enginemen Complaining of Good Discipline 469
- An Active Railroad Commission 470
- Railroad Stocks in the Market 470
- Interstate Commerce Commission as a Conciliator 472
- Surprise Checking on the Pennsylvania .. 472

ILLUSTRATED:
- Interlocking at Hampton Court Junction 476
- Special Agents of the Interstate Commerce Commission. 479
- Progress of Washington Union Station ... 483
- Track Deformations and Their Prevention 485
- The Lower Colorado River and the Salton Basin 489

CONTRIBUTIONS:
- The Columbia Bridge 472
- Spike Pressures on Curves 473
- The Profitable Weight and Speed of Freight Trains. 473
- American Railroads Not Overcapitalized. 474
- An Imaginary Lobby 475

MISCELLANEOUS:
- Laws for Railroad Safety in Indiana 477
- Federal Laws Challenged 478
- Bridges on St. Paul's Pacific Extension. 479
- Government Report on the Block System. 479
- Milk in Tank Cars (Note) 484

GENERAL NEWS SECTION:
- Notes 493
- Meetings and Announcements 495
- Elections and Appointments 495
- Locomotive Building 498
- Car Building 498
- Railroad Structures 498
- Railroad Construction 499
- Railroad Corporation News 500

VOL. XLII., No. 14. FRIDAY, APRIL 5, 1907.

An interesting development of Hill-Harriman competition in the far Northwest, in which the Canadian Pacific is involved, has come about during the past week, if a despatch from Ottawa is correct. According to this report the Canadian Pacific has made an agreement with the Oregon Railroad & Navigation Company for trackage rights over the Harriman line from Spokane, Wash., to Portland, Oregon. This seems liks an absurd report until it is remembered that the Spokane International, a new road from Yahk, B. C., on the Canadian Pacific's Crows Nest Pass branch, southwest to Spokane, was built under Canadian Pacific auspices and brings that company into Spokane, giving it, with the Minneapolis, St. Paul & Sault Ste. Marie, a chance to compete with the Great Northern and Northern Pacific for through business from Spokane to and from St. Paul and Minneapolis. The reported arrangement for running rights to Portland would open that important Pacific coast city also to Canadian Pacific competition on through business. If the Harriman lines have made such an arrangement with the Canadian road, it seems likely that the contract stipulates that it be used only on through business to and from points on the Canadian Pacific's lines east of Spokane, all of which, without exception, are out of the territory of the Harriman lines, but at many of which the Hill lines actively compete with the Canadian Pacific. It is not likely that, even for the sake of injuring its great rivals, the Harriman line would bring it about that the local business between Portland and Spokane should be divided among three instead of two competitors. The effect of such a traffic agreement on the Hill lines can, in the end, hardly be a serious one, for as soon as the Portland & Seattle—the new low grade line from Spokane down the Columbia river to Portland—is finished, Mr. Hill will be able to hold entire control over rates in that territory. No other road is going to be able to carry traffic as cheaply as this new line, with a maximum grade of 22 ft. to the mile eastbound between Portland and Spokane.

The Pennsylvania Railroad has this week created a new grand division, the Western Pennsylvania, comprising nearly all of the coke region, most of the coal region and all of the Pittsburg mill district, tributary to the eastern lines. This was the western end of the Pennsylvania Railroad grand division, which is now divided into the Western Pennsylvania and Eastern Pennsylvania grand divisions. The announcement of the changes in officials caused by this territorial reorganization includes 16 men advanced to higher positions. It is noteworthy that of this number nine are college or university graduates, the list including two graduates of Lehigh, two of Lafayette, one of the Massachusetts Institute of Technology, one of Georgetown University and Stevens Institute of Technology, one of the University of Pennsylvania, one of Princeton and one of Yale and Rensselaer Polytechnic Institute. The new General Superintendent, his successor as Superintendent of the Pittsburg division, the Principal Assistant Engineer of the new Western Pennsylvania grand division, the new Superintendent of Motive Power of the Erie grand division (Philadelphia & Erie) and the Northern Central, the new Superintendent of the Middle and Western divisions and of the Alleghany division, the Principal Assistant Engineer of the new Eastern Pennsylvania grand division, the Superintendent of the Pennsylvania, New York & Long Island Railroad, and the new Principal Assistant Engineer of the Philadelphia, Baltimore & Washington are all college graduates. Two new Superintendents, an Assistant Superintendent, a Superintendent of Telegraph and the Superintendent of Motive Power of the new Western Pennsylvania grand division are not college men. This high proportion of college men in a list of promotions which happen to be announced together, shows the exceedingly important place which is being taken on the Pennsylvania by the man with a university training. It is noteworthy, however, that all of the new operating officers who worked up through positions in the operating department proper began without such advantages. The Pennsylvania has not applied its plans of training young college men for official positions to the operating department as such. The four new college-bred superintendents in this list began, without exception, in the engineering department. The Pennsylvania's success in developing college men into valuable officers has been too often favorably commented on in the *Railroad Gazette* to make repetition necessary. The road is probably better operated than any other railroad in the country and, at the same time, the proportion of college men in its service is larger than on any other line.

A representative of the Brotherhood of Locomotive Engineers has written a letter protesting against the law proposed in New York State empowering the railroad commission to establish standards of fitness for railroad employees. He thinks that the matter should be left to the railroads themselves; that the roads must

be as anxious as any one to have competent men. This engineer manifests the same spirit as his brothers who have so many times protested against every move made by railroad officers to do away with the dangers due to color blindness and myopia—a spirit due to a deplorably common form of mental and moral myopia. The agitation of the past year has awakened men's minds to the extent that we now see railroad officers sitting up and taking notice, in a way that they never did before. One of them (Mr. Shonts) announces in advance the purpose of his company to comply with the wishes of the people of the state of New York as expressed in the proposed new railroad law. But the employees, who are all the time asking for some law or other, begin to complain the moment that any law proposes to touch them. Governor Hughes has good reason, no doubt, for desiring to establish standards of fitness for enginemen independent of the railroads themselves, for railroad officers have publicly complained that the employees' brotherhoods force the maintenance of low standards. No one can tell whether the Governor will succeed in his purpose to establish in the state of New York a strong commission of high minded men, or whether such a commission—having to look after gas, electric lights, trolley picnics and "car-ahead" grievers—will be able usefully to regulate engine running and the management of block signals; but it is high time that somebody did something. The railroads are, indeed, anxious to have efficient enginemen, but anxiety is not the thing needed. The anxious railroad superintendent would greatly promote the safety of his trains and the prosperity of his company by forgetting his anxiety and practicing foresight and courage. Officers who, like the late Alfred Walter, fearlessly carry out rational rules for the efficient management of the road, in spite of cowards above or secret intriguers below, have no time for anxiety. When grievance committees coerce superintendents into retaining poor men on fast trains, a state standard of efficiency may be a useful thing, in spite of its defects and in spite of the mischievous possibilities of governmental participation in the details of management. When a man like Mr. Kruttschnitt, whose discipline is warmly praised by many observers, comes out and calls for public investigation of defects in train operation, it is fair to conclude that the alleged demoralizing influence of brotherhood committees is not an imaginary evil.

AN ACTIVE RAILROAD COMMISSION.

The State Railroad Commission of Indiana, composed of Messrs. Union B. Hunt, C. V. McAdams and William J. Wood, is one of the newest bodies of that kind, but it is also one of the most efficient, if we may judge by the strong report which it has made on three recent train accidents. Of this report, dealing with the collisions at Woodville and Fowler and the powder explosion at Sandford we give an abstract in this issue.

On the explosion the report is exhaustive, as, of course, it should be when the cause is left undiscovered. All possible clews seem to have been followed up but no cause can even be guessed. The report as published is defective in not giving names of witnesses or a summary of testimony; neither does it give authority for all of the positions taken on technical questions. It depends for its authority too much on the word of the commissioners themselves. Still, it is so terse and clear that that word will be readily accepted by the public.

On the collisions also the commissioners ask the public to take their word, and some of the things said show that they have not explored the subject of train management with sufficient thoroughness. They speak of the "excellence" of the block system without showing wherein its excellence consists. They accept the railroad officers' denial that violations of rules are winked at, but do not seem to have found out what the officers' eyes actually were doing when they are alleged to have been shut. The commissioners "spent much time" in trying to decide whether the Standard Code of Train Rules is or is not the infallible preventive of accidents which some seem to believe that it is, without discovering that they were being led on a useless path—without seeing that on every railroad the first and most pressing question in this matter is that of securing obedience to rules that are known to be perfect. Still, as we have said, the report is a strong one. The commission has reached sound conclusions and we must not find too much fault with its processes.

A chief excellence of the report lies in its close adherence to primary essentials. The problem of reforming American railroad train service is complex and difficult, and a lack of thoroughness or even actual mistakes may be forgiven an administrative body if there is a determination to tackle the big end of the problem first. The present report goes right to the heart of the trouble. Employees must be familiar with the rules. The supervising officers should "acquaint themselves with the individual capacity of the men," and should hold examinations repeatedly until this is accomplished. The value of this last recommendation is questionable, for there may be much waste of energy in re-examining experienced men once a year—as is suggested by the record of Engineman George Lamb, referred to by the commission; but the examinations will not necessarily be harmful. The "convention" to be held by the commission annually to "jack up" the discipline of the roads is also unlikely to be of any tangible benefit; but it may do good by stirring waters which otherwise would be stagnant. There is great need everywhere of improved training of men, and almost any means to this end is to be commended.

The recommendation that the block system be installed is not only sound, but is clinched by the statement that the roads can afford it. Some roads enjoying good incomes are reminded that others in the state, with poorer incomes, have used it for years. The basis of earnings proposed—$5,000 per mile per year—was raised by the Legislature to $7,500. The lower limit was reasonable, we think; but both are loose standards. A far more equitable rule would be to take the business of each division of a road by itself, for a busy road with a large mileage of thin branches might escape the law when another busy line without branches would have to comply. This is only a temporary question, however. The block system is suitable on thin lines as well as on heavier ones, and in most cases can be made equally economical, for the block sections can be lengthened to correspond with the longer time intervals between trains.

The commissioners are also very clear on certain details, as, for example, the bad arrangement of switch and signal lights at Fowler, but in modesty their recommendation goes even farther than the polite, dignified and indirect suggestions of the British Board of Trade inspectors. Where signal lights are so situated that an engineman cannot see them when running at "service speed" in a fog, as is declared to be the case at Fowler, the only possible position for a state railroad commission to take is that high speeds should be forbidden. The commissioners are to be commended for making prominent Engineman Lamb's testimony. The brotherhood leader who claims that men have a hard time trying to obey rules is not wholly wrong, for many are so shortsighted as to really believe that they are bound to try to please short sighted trainmasters who by "suggestion"—to use a medico-psychological term—tempt runners to take risks. But brotherhood spokesmen, like some company spokesmen, often have no perspective. It is impossible to tell whether they represent 2 per cent. or 90 per cent. of their constituents, in their description of conditions.

Three recommendations of the commission have not taken form in legislation: (1) to forbid the employment of persons under 21 years in the telegraph service; (2) that the railroads should not grant the demand of the public for unreasonably high speed, and (3) that as there have been many derailments, and much overcapitalization of railroads, and earnings are now large, the railroads should appropriate more money to improve their roads and equipment. The first of these is justified, and the report succinctly states the reason for it. The other two are brief and inconclusive and are not supported either by facts or arguments; and it is not clear why they were allowed to mar an otherwise good report.

RAILROAD STOCKS IN THE MARKET.

To the average man with some money to invest, who believes in railroads and in the railroad business, but has neither time nor inclination to become intimately familiar with the ways of Wall Street, the problem of the desirability of railroad securities as investments at market prices is often one of considerable interest. If, above all other considerations, security of the amount invested is desired, the funds will be invested in bonds of the highest class. Laying aside from consideration this class of investment, yet without attempting to look at the subject at all from the standpoint of the average stock market speculator, it is interesting to consider, even if in a very elementary way, the opportunities which railroad stocks offer for profitable investment. This is because stocks are as a rule more attractive to the average business man who can afford the risk of loss of part of his principal as the price of the opportunity to share in the growth and prosperity of the country as reflected in the increasing price of railroad shares. By this we do not refer to buying on margin or anything else than outright purchase of

such securities; but even entirely from an investment standpoint, the speculative element must always be considered. In the first place one of the chief advantages of railroad stocks is that they can always be sold on short notice, in other words, that there is always a market for them; and as the necessity of selling is always a possibility, the price at which they can be sold, in comparison with the price at which they were bought, is always potentially of large importance in such investments. But even assuming that stocks are held permanently as steady investments, the price paid is of supreme importance, since it determines the rate of return which is received on the original investment.

It is clear that the stock market does frequently present opportunities for profitable investment in railroad stocks, and in a certain degree, the man who is too busy and, we believe, too wise to follow the stock market day by day has an advantage over the practiced speculator. This is because Wall Street reacts on itself, so that the man who is in close touch with it sometimes loses his sense of proportion in regard to those things with which he is most familiar. More than this, the man who buys outright for investment always has an advantage over the speculator whose purchases are made with borrowed money, and are, therefore, dependent to a large degree on the money market. Periodically, usually through a combination of these two factors, a wave of pessimism, reflected by large declines in the market prices of railroad securities, sweeps over the Wall Street market and for some reason, apparently good, is accepted by the larger part of the financial community. Once started, such a trend of thought sometimes becomes for the time being an article of settled faith. The very facts which a few weeks before were urged as most important arguments for higher prices are turned about and held to be reasons for still further declines. The country may be prosperous and business at a high level, but for the time being nothing appeals to Wall Street but the dark side of the picture. As a result the prices of railroad stocks go to levels at which they prove later to have been most attractive purchases. Yet so insistent is the Street on disaster that, although at the time prices are low it is pointed out that stocks are selling far below their probable investment value, securities are sold in large amounts in expectation of still lower prices. Finally the tide is turned, often by some one striking event and sometimes with great rapidity the market advances to a higher level of prices.

At times like these—and, of course, we realize perfectly the difficulty of telling at the time when precisely such a condition exists—come the opportunities for men whose chief interests are outside the stock market, but who have strong faith in the ultimate prosperity of the country and the country's railroads, to buy railroad stocks at a price which usually turns out to be highly profitable. It is, of course, too much to expect of human intelligence or good luck that a man will be able to buy at the bottom or sell at the top. The point to be made is that there come opportunities when professionals are disorganized and pessimism rules the market when a man with faith in the future and a reasonable knowledge of the railroad situation has an opportunity to invest his money with strong likelihood of an increase in value of his investment. It must always be remembered in this connection that it is the man who buys his stock outright who, short of a reduction of dividends, need not be worried from day to day over the course of the market. It matters little to him whether his stock for the time being is selling 10 points higher or lower than his purchase price so long as the regular dividends are being paid, for in general when he owns stock outright he can wait until a favorable time to sell.

The stock market has recently been reflecting an unusually severe wave of pessimism. Three weeks ago came a drop in the market quotations of railroad stocks more precipitate than the declines during most of the memorable panics in the history of the stock exchange and, since it followed a long downward movement of prices, more cumulative in its effects. This was followed by recoveries, but on Monday of last week another decline brought prices in most cases below the low records made on March 14th. The severity of the drop in prices can be realized from the fact that most stocks sold at lower prices than at any time since 1903, and in many cases lower than for six or seven years. This is even more true if changes in dividend rates be disregarded by making the comparison from the standpoint of the investor exclusively, that is, on the basis of income yield. In other words, in spite of the remarkable and unprecedented prosperity of the whole country during the past two years, in spite of the tremendous earnings of the railroads, and in spite of spendings out of earnings for extraordinary additions and betterments to railroad lines and equipment far larger than ever before known, it has within the fortnight cost less to obtain a partnership interest in the ownership of the country's most successful railroads than at any time for from three to seven years; the longer period, it will be observed, going back to the days when many great railroad properties had only lately emerged from reorganization or bankruptcy.

There are a number of causes which have contributed to this remarkable state of affairs. Natural reaction from an abnormally high period, stimulated by extreme tightness of the money market due to unparalleled demand for new capital in all productive enterprises, doubtless heads the list. But many other contributory causes, playing into the hands of the professional manipulators, must be added. Chief of them is "high finance," or rather the disclosures of it, which have resulted in destroying popular faith in some of our most prominent railroad financiers, and, as a necessary consequence, in railroad securities. The misuse of trust funds laid bare by the insurance investigation a year or more ago, the manner and matter of the Southern and Union Pacific dividend declarations last August, the retiring of Stuyvesant Fish as President of the Illinois Central, and, in a way, the Great Northern's ore land distribution (though this is a remarkable example of the way in which Mr. Hill shares property, much of which he might have held for himself, with his stockholders), and last, and probably most important of all, facts brought out in the Harriman investigation—examples all of the utter ignorance and helplessness of the small stockholder, as compared with interests in control of a property who may or may not act as real trustees—have overthrown the confidence of the average investor. He has come to feel, and there are, unfortunately, only too many happenings which justify the opinion, that the stock market is a crooked gambling game, with prices shot up or slid down at will by a few men who owe their power to the fact that they are trustees for other people's property. It is this sense of helplessness as against powerful manipulators, this belief in the unfairness of those who at the same time control and profit by price factors, that has for the moment turned the stomach of the public against railroad investments.

Distrust of the prices quoted by Wall street for its wares has lately been proved to be well justified. Last November there were repeated predictions that an era of larger railroad dividends was at hand. A new high level of prosperity had been reached, which was already, and in the future would be still more, reflected in largely increased dividends. The event which especially called forth this view was the declaration in August of a dividend at the rate of 5 per cent. on Southern Pacific common, which had previously received no return, and 10 per cent. on Union Pacific, which had been receiving 6 per cent. Not long afterward the Atchison dividend was increased from 4 to 5 per cent. and the Pennsylvania rate of distribution from 6 to 7 per cent. There were also increases in the dividend rates on the stock of four of the Vanderbilt roads—the Lake Shore payment from 8 to 12 per cent., the Michigan Central from 4 to 6 per cent., the Pittsburg & Lake Erie from 10 to 12 per cent., and the New York Central from 5 to 6 per cent. The fiscal year ended June 30, 1905, was, when it closed, the most prosperous which the country had ever seen. When to the high records then made were added the tremendous increases in earnings shown by nearly all companies during the 1906 fiscal year, with crops of all kinds the largest in the country's history, the iron business at the top notch of prosperity and orders for new railroad equipment at higher figures than ever before known, there was held to be every reason for even higher prices for railroad stocks. There was high record piled on high record, with the result that the country stood at a point unknown before in evidences of prosperity. It had advanced so far that it was argued that in spite of the fact that most railroad stocks were selling at or near the highest prices ever recorded, they were cheap in view of their immense possibilities in the future.

The course of prices during the last three months has shown how false was this view, at least so far as market values were concerned. With utter disregard of the country's teeming prosperity, the prices of railroad stocks, particularly those of which most in the way of higher prices was expected, fell swiftly to the lowest levels for years. No receiverships were announced, no payments were passed, no dividends reduced. On the contrary, on the very day of the most panic declines, a weak road, not unfamiliar with receiverships—the Toledo, St. Louis & Western—announced its first dividend. This week the Kansas City Southern followed suit, and the Atchison, before ever completing a year's payment at the new 5 per cent. rate, established 6 per cent. as its annual rate of payment.

It is true that there are a number of unfavorable things about the immediate future of railroad properties. The hostility of public

opinion against the railroads as transportation companies, due to unjust practices in their operation similar to those already mentioned in financial management, has been shown in the great number of legislative measures proposed and passed against railroads during the present sessions of the state legislatures. This railroad legislation, added to the distrust by the public of high finance methods, makes it for the moment impossible for the railroads to get, at anything like usual rates, money with which to carry out the tremendous improvements which are necessary in order to efficiently handle the immense traffic which is being offered. Either funds are being secured on short term notes at extravagantly high rates of interest or, more generally, improvements are being postponed. Besides this, most of the new laws passed by the state legislatures will, for a time at least, threaten net income, which is already being reduced by higher cost of all kinds of labor and materials with no corresponding increase in receipts. It is even probable that not far ahead is a period of some let-up in business activity.

Yet from the present investigation of railroad problems there is sure to result a better understanding between people and railroads. No laws which permanently take away value from railroads will, even if passed, be likely to stand. Even a let-up in business undertakings would have its advantages as a pause in the most prosperous period in the country's history. At present prices, railroad stocks discount most unfavorable developments which might come. It is, of course, possible that prices may soon go as low again or lower than they did last month; nevertheless, when it is possible to buy stocks like Illinois Central; New York Central; Chicago, Milwaukee & St. Paul; Pennsylvania; Baltimore & Ohio and Union Pacific at prices returning from 5 to 7 per cent. on the investment, is it not reasonable to suppose that this represents an opportunity of the sort we have described, to place money at a favorable rate of return with the further good possibility of increase in value of capital over a period of a few years? From the standpoint of the investor whom we are considering, as a general principle, the time to buy is when there has been a long decline in prices and pessimism is rampant. Present opportunities for investment can hardly fail to appeal to the man who forms his own opinions and looks forward beyond the immediate future.

The Interstate Commerce Commission, having the power to be more absolute, appears to be becoming more conciliatory; or, at least, its conciliatory efforts seem to be more successful. With a law framed in the unruly spirit of 1906, the Commission's acts reflect the spirit of 1870, when Charles Francis Adams laid down the principle that persuasion was better than force. Can it be that the law is used by the Commission as a "big stick"? Last week the railroads in the Indiana-Illinois bituminous coal field announced a 10 to 15 per cent. advance in rates to Chicago on coal, but a protest to the Commission resulted in a prompt change of mind on the part of the roads, following "suggestions" from the Commission. This week another "suggestion" from the Commission has resulted in postponing an increase of rates on grain from April 1 to May 1. While this is only a postponement, some think that by May 1 the roads may decide not to make the advance. The Commission's announcement says: "Carriers in Western Trunk Line, Central Freight Association and Eastern Trunk Line territories having filed with the Commission tariffs increasing their rates on eastbound grain and grain products, to become effective on or about April 1, and it appearing to the Commission that the conditions and circumstances warranted a suggestion to these carriers that the date upon which the increased rates would become effective should be temporarily postponed, and such suggestion having been made by the Commission and cheerfully and cordially met and accepted by the carriers, the Commission has issued an order granting such carriers permission to at once post and file, effective April 1, 1907, amendments postponing the date of the taking effect of the proposed advances in rates on grain and grain products to May 1, leaving the present rates in effect until that date, and on that date canceling the present rates and making the advanced rates effective." With everything so harmonious, it will perhaps be unkind to suggest that this revocation of tariffs which have been posted for two or three weeks may work injustice to somebody, for "what is the constitution between friends?"—but it is probably true, now as in the past, that every technicality that can be seized by a lawyer as a basis for a test case, will be thus seized, sooner or later, if the opportunity continues.

The Pennsylvania Railroad announces that in the last three months 97 surprise signal tests have been made on the road, and that in that time 2,252 trains have been tested and 97 per cent. of the enginemen have complied with the rules of the company, while the 3 per cent., who are deficient, brought their trains to a stop, but not until after passing the signals. In the three months many men have been suspended for from 2 to 42 days each for infraction of rules, it is said. Of the 180 trains tested on the main line recently 98 per cent. obeyed the rules absolutely. Tests made on the New York division, where trains are operated so frequently and many on high-speed schedules, give a perfect record. These tests are made on all divisions, and the records show a constant decrease in the percentage of those not obeying implicitly all rules. Surprise tests have been found to be the best method of keeping the enginemen always on the lookout for anything unusual. The cheering feature of this official statement is that there is a constantly decreasing percentage of disobedience. Three failures in a hundred is a high percentage, and, if there were not a promise of improvement, would be discouraging. This is not a "slap" at the Pennsylvania, for its neighbors would do no better, probably; many roads' records would be worse. All railroad theory demands that every division shall show as good discipline as the best division—which, in the case of this Pennsylvania report, would be 100 per cent. Why are we so slow in bringing our practice up to the theory? Some superintendents will say that editors are mere doctrinaires; these three runners out of a hundred did not do anything dangerous; they only ran past a signal a few rods, probably. But the hard fact is that doctrine is at the basis of practice. Those who sneer at the doctrinaire almost invariably follow theory themselves as long as their courage holds out. Davy Crockett (in the play) reminds us that a huntsman must not only be able to hit the game, but—if he is a Crockett and worthy of the name—must put the bullet in the rabbit's eye. Huntsmen with a lower than the Crockett standard will never accomplish the best that is in them. Enginemen who wish to be worthy of the high encomiums which they so often receive should see that the nose of the pilot *never* goes beyond the stop signal. That ideal will carry them to the top of the list much faster than will a reputation for saving a few seconds now and then, by running the risk of using, without leave, a few hundred feet of the clear track that can be seen beyond the signal.

CONTRIBUTIONS

The Columbia Bridge.

Philadelphia, March 20, 1907.

To the Editor of the Railroad Gazette:

In his article entitled "The First Railroad Owned and Operated by a Government," in the *Railroad Gazette*, August 24, 1906, Mr. C. H. Caruthers says:

"An inclined plane was used for a time at Columbia, and another at Philadelphia, opposite Peters Island, about where the Columbia bridge now stands."

Of course Mr. Caruthers does not mean to state that the inclined plane stood "where the Columbia bridge now stands," i.e.,



The Viaduct Near Peters' Island.*

spanning the Schuylkill river, but it may be worth while to mention that the inclined plane (which was then far to the northwest, beyond the city limits) extended from the western end of the old Peters Island bridge up to the power house, which must have stood not far from the present Belmont mansion, the Colonial residence of Judge Peters, where Washington frequently visited.

Most of the way the plane was in shallow excavation, by means of which the line is still distinctly traceable. The upper half of it is now occupied by a portion of the line of the Fairmount Park trolley system. In a letter to the Philadelphia *Public Ledger*, under date of September 16, 1886, Mr. W. Hasell Wilson says: "The Schuylkill bridge was designed by Major John Wilson, Chief Engineer, and the construction was superintended by W. Hasell Wilson, Principal Assistant Engineer, and Frederick Erdman, Bridge Inspector. Mr. John C. Trautwine was Assistant Engineer in charge of graduation and track laying."

Mr. Caruthers says: "From Hollidaysburg west a portion of the road at least was laid on stone blocks instead of wooden ties, and within a very few years a number of these blocks still re-

*From a copy of the *Journal of the Franklin Institute* for August, 1834, kindly furnished us by Mr. Trautwine.

mained in place and were occasionally sketched by artists in their summer rambles through the picturesque scenery of the neighborhood." These stone blocks were used also on portions of the line in the vicinity of Philadelphia. As late as 1876, they were still to be seen, bearing the rust marks of the rails, on the line of the Belmont inclined plane; and, within the last half dozen years, I saw a fine stretch of them on a straight piece of line, about a hundred yards long, crossing a level bit of ground near the present Narberth station of the Pennsylvania Railroad. This was on the portion of the line connecting the head of the Belmont plane with the present line at Ardmore. Numerous short pieces of this line may still be traced.

JOHN C. TRAUTWINE, JR.

Spike Pressures on Curves.

Iowa City, Ia., March 30, 1907.

To the Editor of the Railroad Gazette:

The interesting attempt to determine the rail pressures against the outer spikes of a railroad curve seems to omit one item that must certainly have some influence on the result, and also to neglect certain facts that seem to disprove the conclusion though not the method of attack.

Omitting the fact that the action of the wheels on the curve is totally unknown and theoretically unknowable, the possible experiment may increase knowledge of this intricate matter, and assuming that the method of solution given in the *Railroad Gazette* of March 15 and 22 is correct so far as it goes, does it not fail to consider that before the spike may have its full pressure the rail must bend? Is it fair to say that a given short section of the rail is a solid, inelastic block, free from the rest of the rail, transmitting to the spike whatever lateral pressure there may be less the friction on the tie plate? Are the tie, spikes, plate and rail so rigidly joined that the full lateral pressure can come on the spike without the slightest give of the rail? And if they are, and the results of the computations made for the Harlem curve are correct, how is it that hundreds of spikes without tie plates, strained every day by pressures equal to and exceeding those found for the Harlem curve, are not driven daily out of place by the crushing of the wood behind them? Far less pressure than the shearing strength of the spike, when there is no tie plate, will push the rail over so far as to clear the head of the inside spike (see *The Transit* for 1905), and there would be several trains off the track daily, the country over, if the pressures indicated by the Harlem curve discussion actually occur.

It is not meant to assert that the discussion is incorrect for the pressure coming on the rail—it is probably as nearly correct as our knowledge of the conditions will permit—but to suggest that this pressure never reaches the spike, and that this is proven by the fact that trains all over the country are run at excessive speeds and stay on the track when the theory of the Harlem discussion would indicate that they should leave the track owing to the crushing of the wood behind the spike.

With a shouldered tie plate, moreover, it is unquestionable but that whatever pressure does finally reach the spikes is divided among all the spikes of the plate, whether two or three. This consideration indicates the value of the shouldered plate, and the discussion also seems to indicate the value of the plate with cross lugs as compared with those having longitudinal ribs, as was pointed out in *The Transit* of 1905.

WM. G. RAYMOND.

The Profitable Weight and Speed of Freight Trains.

Pittsburg, Pa., April 1, 1907.

To the Editor of the Railroad Gazette:

Noting Mr. Wild's criticism of February 20 (published in your issue of March 29) of my communication of February 8, wherein Mr. Wild suggests that, on the basis of my figures, a reduction of 30 per cent. in the trainload would make practicable an increase in speed of from 10 to 20 miles per hour; and Mr. Wild is willing to accept this situation and reasons that this would still show a profit of some $5,000 for the lighter load.

If Mr. Wild will kindly refer to table showing the operating statistics on the low-class and high-class traffic lines, he will find that a reduction of 30 per cent. in the average trainload would reduce the trainload on the low-class traffic line from 610 tons to 427 tons. This 30 per cent. reduction in the average trainload would have the effect of increasing the freight train mileage 43 per cent., also reducing the net earnings from $2,993,111 to $1,196,855. Necessarily, this reduction in net earnings would be transferred to operating expenses, increasing operating expenses from $4,793,979 to $6,590,235, thereby raising the operating ratio from 61.56 per cent. to 84.6 per cent., which Mr. Wild will probably agree would hardly be a satisfactory operating showing, and this simply goes to prove that the class of tonnage handled by a railroad is an important factor in determining the speed at which the railroad can afford to transport the tonnage.

Mr. Wild says:

"It is noted that Mr. Henderson's scale of reduction for increased speed does not agree with Mr. Worthington's. As to this the layman can only exclaim: 'Who shall decide when doctors disagree?'"

Let us see what the difference was between Mr. Henderson's figures for train resistance and those made by me, to ascertain just what logic there is to such a criticism:

	Speed in miles per hr.					
Level resistance, lbs. per ton.	10.	15.	20.	25.	30.	35.
Mr. Henderson's scale	5 9	6 9	7	9	10	11
Mr. Worthington's scale	4 8	5 8	7	9	11	13

As will be seen, the difference is slightly greater at speeds of 30 and 35 miles per hour, which were not involved in this calculation, and all railroad men who have given the train resistance question any study know that there are several formulæ for train resistance, all made from seemingly reliable data, yet a difference in weather conditions and rolling frictional resistance at the time the tests are made will usually make a difference in the results obtained in dynamometer car tests, but the difference between Mr. Henderson and myself respecting this matter is so slight as to be inappreciable, and this difference would not be apparent in the calculation which Mr. Wild attempts to make. I wish further to add that I have checked over the table prepared by Mr. Henderson in his article, and I find that it is not based upon pure theory, but apparently is deduced from average results in actual railroad practice.

Mr. Wild further says:

"There appears to be something radically wrong with the comparison that Mr. Worthington makes of a low-class with a high-class traffic line, inasmuch as he shows the high-class line actually with a lower revenue per ton mile than the low-class line. No wonder the ratio of expenses to earnings of the high-class line is much higher, considering that it undertakes to do a high-class business at a very low-class rate."

This comment, coming from a railroad statistician, rather surprises me, as my communication of February 8 draws attention to this and explains that the reason why the earnings per ton mile on the high-class line were 3½ per cent. lower than on the low-class line was because the average distance hauled was 250 miles on the high-class traffic line, as against about 124 miles on the low-class traffic line. I also called attention to the fact, however, that the high-class traffic line received over $1.28 for each ton carried, while the low-class traffic line received slightly less than 66 cents for each ton carried. These figures also appear in the operating table comparing the low with the high-class traffic line, and it seems strange that Mr. Wild should get the impression that the high-class traffic line was carrying its business at a very low-class rate, as the figures plainly show the reverse to be the case.

Mr. Wild further asks:

"Am I wrong in saying that an increase of 50 per cent. in the inclusive speed with which cars are handled for a decrease of 30 per cent. in the number of cars handled would have the permanent result of placing 20 per cent. or one-fifth more cars at the disposal of shippers over what are now available at Mr. Worthington's speed of nine miles an hour or thereabouts?"

If there was nothing to interfere with getting the full benefit of the additional five miles per hour in average speed, this reasoning would be good, but the trouble is that the difference between the nine miles and the fifteen miles per hour is spent at meeting and passing points, because of congestion incident to moving a large number of trains. Therefore, the reduction in the trainload of 30 per cent. to gain this additional speed would mean an increase of 43 per cent. in the train miles, thereby naturally increasing the number of meeting and passing points, which under present traffic conditions consume 40 per cent. of the total time between terminals, and the effect of the increase of 43 per cent. in the train miles to handle a given volume of tonnage would be to increase the ratio of delayed time to total time to such an extent as to nullify the benefit which would be derived from handling the trains at higher speed while actually in motion, and the operating results obtained from an experiment of this kind would simply be disastrous to the management that would undertake to handle its business in such an extravagant manner.

Please understand that I am not taking the position that engines on some railroads are not overloaded, because I have known many such cases, but where the tonnage rating system on a railroad is based on time and load—which is the basis used on the roads with which I have been identified—and where engines in dead freight train service are rated at 80 per cent. of the calculated engine ratings, enabling an average speed of fifteen miles per hour actual running time, which is the case on the low-class traffic line, my contention is that a uniform reduction of trainloads on the railroads generally would be wrong, because in the two cases which I cited of the low-class and the high-class traffic lines, the operating conditions and the average revenue received per ton on both these lines control the speed at which it is profitable for the railroad to handle its business, and the only way in which it can be determined whether the locomotives on any particular railroad are being overloaded to such an extent as to interfere with expeditious movement, or a movement

that can be said to be economical, is to take up and analyze all the conditions affecting the operations of the particular railroad selected.

I am still of the opinion, since the annual reports of the railroads of this country show at the present time an average daily mileage from their car equipment varying from 12 miles per car per day on single track roads moving low-class traffic to as high as 38 miles per car on roads with second, third and fourth tracks and handling high-class traffic, that this means that the equipment of the railroads of the country is moving less than 20 per cent. of the time, and while there is no doubt much good work can be done in carefully checking up and correcting delays in transit, yet it would seem that far more good could be accomplished by also checking and following up the delay which the equipment is suffering during the other 80 per cent. of the time. It is not my purpose to charge this entire 80 per cent. idle time up to the shippers, because much of the delay embraced within the 80 per cent. may properly be charged to delay at terminal yards and delay on the part of railroads in spotting cars on spur tracks at industries, and delay in gathering up the loads from industry tracks. It is probably not unfair to assume, however, that some considerable delay is occasioned by the shipper in unloading the cars and reloading them again for outbound movement.

B. A. WORTHINGTON.

American Railroads Not Overcapitalized.

New York, March 28, 1907.

To the Editor of the Railroad Gazette:

The railroads of the United States are being attacked by adverse legislation, either planned or passed in every one of the 46 states of the Union. Some of this legislation will be confiscatory in its results. Much of it is unnecessary, ill-advised and harmful and some of it is proper and will be of use. All of it, however, has had the effect of undermining the credit of the railroads to such an extent that, for lack of money, necessary railroad work is being stopped or slowed up all over the country and the railroads who are doing any large amount of work have been forced to raise the money for it by short time notes at extremely high interest rates.

The railroads, almost without exception, should make large expenditures for additional cars, engines, terminals, second, third and fourth tracks, sidings and signals to properly and above all safely handle the existing enormous business and to prevent the curtailment of the general business of the country, due to the failure of the railroads to properly care for and handle it.

This necessary work of improvement or railroad betterment can only be carried on by such action on the part of the federal government or the various states as will restore confidence in railroad securities. The people of the United States are under great obligations to their railroads. The energy, push, ability and foresight of the American railroads has done more to develop the country than any and all other means, and this same energy has pushed the building of the railroads of the United States up to a point where there is one mile of railroad for each 381 people.

Year.	Population, U. S. census.	Miles of railroad.	Population to each mile of railroad.
1820	9,633,822	0	9,633,822
1830	12,866,020	23	559,392
1840	17,069,453	2,818	6,057
1850	23,191,876	9,021	2,571
1860	31,443,321	30,626	1,026
1870	38,558,371	52,922	728
1880	50,155,783	93,262	537
1890	62,622,250	166,703	375
1900	76,303,387	194,262	392
1905	83,143,000	218,101	381

Thoroughly to appreciate what this enormous growth of railroad mileage means, it should be compared with the railroad mileage in some of the principal countries of the world.

Country.	Miles of railroad.	People to each mile of railroad.	Sq. miles to one mile of railroad.
France	24,500	1,590	8.46
Brazil	12,370	1,158	260.16
Austria-Hungary	26,901	1,789	9.70
Belgium	4,337	1,631	2.62
China	3,500	119,714	1,143.00
German Empire	33,423	1,813	6.25
Italy	9,943	3,266	11.12
Japan	4,496	9,844	36.17
Russian Empire	38,045	3,548	220.24
Spain	8,206	2,267	23.90
United Kingdom	22,847	1,821	5.29
United States	218,101	381	13.61

These figures show clearly and positively that in the United States railroad building has pushed forward to a point where there is almost five times as much railroad mileage per capita or to where there is only one-fifth the number of people to support each mile of railroad, that there is in any of the great countries of the world. Surely had this not been the case, the country could not have grown to its great place among the nations of the world. With such a showing, is it right, fair or wise that the American railroads be punished, criticized and condemned because they have not had the time or money to double, triple, four-track and block signal their lines and to separate the grades of the highways and streets from those of the railroads? The present course of the people and their representatives in destroying the credit or the money raising ability of the railroads and thus preventing or postponing for years this necessary work is most unwise.

As the English railroads, those of England, Scotland, Ireland and Wales, called the United Kingdom, are constantly cited to aid in criticizing and condemning the railroads of this country, the following comparisons are most interesting:

	United States.	United Kingdom.
Population	83,143,000	41,605,177
Area, square miles	2,970,038	120,979
Population per square mile	27	343
Miles of railroad	218,101	22,847
Area, square miles to each mile of railroad	13.61	5.29
Population to each mile of railroad.	381	1,821
Per cent. of railroad single tracked.	92.2 pr ct.	44.4 pr ct.
" " " double tracked	7.8 "	55.5 "
" " " treble tracked	0.74 "	5.2 "
" " " qudrpled trkd.	0.55 "	4.25 "
" side track to miles of road	32.1 "	60.2 "
No. railroad employees	1,382,196	581,664
Per mile of railroad	6.37	24.5
Per cent. of railroad employees to total population	1.66 pr ct.	1.39 pr ct.
Total stock capital	$6,554,557,051	$3,983,025,312
" stock capital per mile railroad	$31,301	$174,334
" bonds or other obligations...	$7,250,701,070	$2,264,215,241
" bonds or other obligations per mile of railroad	$34,625	$99,103
" stock, bonds & other obligatns	$13,805,258,121	$6,247,240,553
Per mile of railroad	$65,926	$273,437
" gross earnings pr mile, yearly	$10,611	$24,199
" gross earnings, yearly	$1,314,380,959	$552,896,063
" passenger earnings, yearly...	$472,694,732	$196,051,249
" freight earnings, yearly	$1,450,772,832	$274,724,438
" No. passengers carried, yearly	738,834,667	1,332,246,780
" tons freight handled, yearly..	784,920,188	461,139,023
Average number of train-miles per mile of railroad	4,761	17,548
Total miles made by passenger and freight trains, yearly	1,038,441,430	400,923,198
Total No. employees killed, 1905...	3,361	393
" " passengers " 1905...	537	109
" " other prsns " 1905...	5,805	551
" " all persons " 1905...	9,703	1,053

These figures show that 92.2 per cent. of the railroads of the United States is single track, while only 44.4 per cent. of the railroads of the United Kingdom is single track. Also that relatively the railroads of the United Kingdom have seven times as much second, third and fourth tracks and nearly double as much side track as the railroads of the United Kingdom. Without question, these additional facilities add largely to the safety of operation. However, they cost money and without credit are hard to get. The railroads of the United Kingdom have about four times as many employees per mile and 1.7 times as many per $1,000 gross earnings as the American railroads. The pay of their employees, however is greatly less.

One of the chief criticisms of the railroads of this country is that their finances are not handled in the conservative manner of the railroads of the United Kingdom, and it is claimed that our railroads have over-issued their securities and that their capital is largely water.

The above comparisons show that the railroads of the United Kingdom have issued about five times as much stock and three times as many bonds per mile as the railroads of this country, and that the total average capital issued against each mile of the railroads of the United States is $65,926, while the total average capital issued against each mile of the railroads of the United Kingdom is $273,437, or nearly 4.15 times as much.

There is no question that in this country there have been a number of cases of overcapitalization. The railroads as a whole, however, are not overcapitalized and could not be duplicated to-day at anything like their present capitalization; the conservatively managed railroads of the United Kingdom having issued over four times as much capital per mile as the railroads of this country. If the operation of the railroads of the United States is not as safe as those of the United Kingdom, and this unfortunately is clearly shown in the above comparison showing the large loss of life on the American railroads, and if the service of the American railroads is not satisfactory, the movement slow and the car supply inadequate, how much better it would be for the people of the United States were their political representatives to join with the railroads of the country in restoring confidence and credit to the railroad securities so that all necessary betterments in tracks, facilities, equipment, signals and other needed improvements may be promptly made with money obtained at a fair rate of interest, and if these conditions are followed out there is no question but that then the American railroad will do for the future what it has done for the past, that is, aid to a greater extent the building up and growth of these United States than any and all other causes.

As the increase in railroad capital necessary to meet the wants of the country will be enormous, as is indicated by the statements of railroad presidents and as implied by a comparison of capital with that of the English railroads, great care should be taken on the part of the government to exercise such control over increases in capital as will prevent the possibility of fraud.

If the government so limits and surrounds the issuance of additional railroad capital with conditions hard or difficult to meet, and conditions as to cost or rate of interest, only the more prosperous of the railroads will be able to obtain capital, and only they

will be able to continue the proper development of their properties. The railroads most needing additional facilities and improvements will be debarred from obtaining capital and will remain largely in their present crude and unfinished conditions.

The question of the control of railroad capital is one of such vast and far-reaching importance that it should only be handled with the greatest care after the most thorough study and consideration.

The good sense of the people of the United States can always be trusted and with just a little more light on the railroad question they, the people, will straighten it out by the purchase for investment of all the very good things on the market in the railroad security line and with the great public more generally interested in railroad investment, legislation largely for the political advancement of its proposers will become quite unpopular, and only such laws as will advance the public and railroad interests will be passed.

The railroads of the United States have little to fear from adverse legislation and are to-day, as they have been in the past, one of the most desirable and safe forms of investment.

C. S. SIMS,
Assistant to the President, Erie Railroad.

An Imaginary Lobby.

Washington, D. C., March 27, 1907.

To the Editor of the Railroad Gazette:

Half-truths; exaggerations; jumbled chronology, to make things totally unrelated seem related; rarely, whole prevarications; these constitute the gentle art of the muck-raker. Thus, keeping just within the line which separates innuendo from tort, he has turned slander into a trade and his publishers have discovered that that which barely evades the law of libel may be commercially profitable. An article entitled "The Railroad Lobby" in the current number of a magazine, which I will not advertise, seems well to illustrate this method. It starts with the untruth that "the greatest single special interest in the nation is the railroad interest," a misrepresentation of which even a muck-raker would not be guilty if he paused to consider how easily accessible are the data which prove that the farms of the United States are worth twice as much as their railroads and that the annual revenue of the former industry is at least three times that of the latter. From this appropriately ignorant beginning the article proceeds to a description of an alleged railroad lobby, said to be located in Washington, which, as a mere feat of the imagination, deserves a high place in the ranks of American fiction. The series of misrepresentations is too long to permit the separate correction of each of them, but a few typical examples may be examined. Thus it is asserted that a "branch" of the alleged railroad lobby was quartered, while the Hepburn rate bill was being perfected, in Vice-President Fairbanks' room in the Capitol, but the room described was never the room of the Vice-President, his room being in a widely different location, and it was not, during any part of the time alluded to, under the control of Mr. Fairbanks. Neither the room described nor any other room at the Capitol was ever used for any such purpose as that alleged. The facts were that the immense labor of compiling and digesting the testimony gathered during the investigations of the Senate Committee on Interstate Commerce required the temporary employment of a force so much greater than that ordinarily maintained that additional room was absolutely necessary. Under these circumstances the Secretary of the Senate, temporarily assigned to the Committee, for the use of its regular and temporary employees, the adjoining rooms on both sides of that which it ordinarily occupies. These rooms were never used by anyone not in the employ of the Committee or for any purpose except the prosecution of the work assigned to the Committee by a resolution of the Senate, the assignment was only during the recess of the Senate, one of the extra rooms was surrendered long before the session began and the other was given up within a few days of the opening of the session. It is alleged, however, that the whole investigation was "only a part of the campaign" of the "lobby" and that the Committee, being "entirely friendly to the railroads" lent its aid by calling "a host of witnesses to be quoted to the public against the wisdom and policy of such legislation," as the proposed rate law. This of a Committee which reported the Hepburn bill without amendment and whose Chairman and members, with a single exception, voted for the law now on the statute book. But such a view is ridiculously out of accord with the actual course of the investigation. Professor Frank H. Dixon, head of the School of Commerce, of Dartmouth University, writing for the Quarterly Journal of Economics of November, 1906, said of this investigation:

> "This Committee held sessions lasting until May 23, in which railroad representatives, shippers, government officials and students of the question were given an opportunity to be heard. Their report, with appendices, in five volumes, together with the Digest, prepared by Messrs. Adams and Newcomb, is the most valuable source of material in existence on the present problem of railroad control in the United States."

This carefully considered appraisement of the work of the Committee ought to be a sufficient answer to the slanderous misrepresentation of the acts of men of great legislative responsibility by any mere newspaper correspondent or hack-writer for sensational magazines. The reputation of Professor Henry C. Adams, statistician in charge of the statistics and accounts, reported to the Interstate Commerce Commission, head of the Department of Economics of the University of Michigan, and for years a conspicuous advocate of even more radical rate legislation than that proposed by President Roosevelt, is an equally adequate refutation of the silly charge that the "Digest" which he signed and helped to prepare was designed "to show the fallacy of rate-legislation." The further accusation directed against Professor Adams, in this imaginative description of the so-called "lobby," is that he rendered only "trifling assistance" in the preparation of this "Digest." The records show that Professor Adams gave a large part of the summer, practically the whole fall and the early part of the winter to this work, for which he was compensated under a special appropriation which had the approval of both branches of Congress, that he was constantly in communication with the co-author of the "Digest," and that much of the work was performed under his direction in the offices of the Interstate Commerce Commission. He personally prepared a large portion of the text and every word in it was repeatedly gone over by him and has his sanction as well as that of his associate in this work.

The same veracious chronicler of the fictitious "lobby" asserts that "scores of shippers, carefully selected from the ranks of those who were enjoying special favors from the railroads," were brought forward to oppose the legislation. The truth is that every shipper who took this view testified that he was not receiving such favors, and there is practically no suggestion in the whole record that such favors were being granted to anyone, while men like Messrs. Bacon and Cowan, advocates of the bill, declared that rebates were not paid or in issue. He also declares that Governor Cummins, of Iowa, was the "only person appearing before the Committee to present the side of the people as a whole," although the Committee heard Hon. Martin A. Knapp, Chairman of the Interstate Commerce Commission, and his colleagues, Hon. Judson C. Clements, Hon. Francis M. Cockrell, Hon. Joseph W. Fifer and Hon. Charles A. Prouty. If these gentlemen do not represent the "people as a whole," it would be interesting to know whom they do represent. Among other witnesses who would resent the intimation that they appeared to plead for special interests are Mr. Brooks Adams, of Quincy, Mass.; Professor William Z. Ripley, of Harvard University; Hon. Charles F. Staples, Railroad and Warehouse Commissioner of Minnesota; Hon. R. Hudson Burr, member of the Railroad Commission of Florida; Professor Hugo R. Meyer, of the University of Chicago; Mr. T. G. Bush, recently named by President Roosevelt to help administer the Industrial Peace Fund created with the proceeds of the Nobel prize, and Hon. Francis G. Newlands, Senator from Nevada. The Committee published long statements by Attorney-General Moody, President Hadley, of Yale University, and others. As a matter of fact Governor Cummins appeared, not as the representative of the "people as a whole," but, as he carefully stated to the Committee, as the special representative of the "Iowa State Manufacturers' Association." The author of the article under review further volunteers his "personal testimony" to the effect that Governor Cummins was treated with scant courtesy by the Committee. Yet the record shows that the Governor began by expressing gratitude for "the kindness of the Committee," which suspended receiving the testimony of President Ramsey, of the Wabash Railroad, and delayed receiving further testimony from Mr. E. P. Bacon, the representative of the organized advocates of the pending bill, in order to accord him an immediate hearing and that he concluded by saying that he cared to speak no longer "except to express my thanks for the patient and courteous way in which the members of the Committee have listened to my statements." Another statement wholly inconsistent with the facts is that Senator Crane assumed that the "elaborate and learned speech" *in favor* of the Hepburn bill, delivered by a certain Senator, had been prepared by an opponent of the measure and, on this rather wild assumption proceeded, in open Senate, "for the amusement of his colleagues," to use "every device to lure" the speaker into an extemporaneous debate, which, it is thus insinuated, would have exposed his lack of information on the subject he was discussing. The Congressional Record shows that, although the speech in question was repeatedly interrupted by running debates with other Senators, there was not a single interruption by Senator Crane. Those who are acquainted with the extreme distaste for debate of the distinguished and exceptionally able and influential Massachusetts Senator and know how rarely he obtains the floor for any purpose will rather pity the stupidity of this particular misstatement.

The foregoing illustrations of careless or wilful mendacity have been given merely to typify the general unreliability of the whole article. In point of fact no such organization as its author describes does or could exist, but, as a negative is difficult to prove, the fact is best established by showing the ignorance or absence

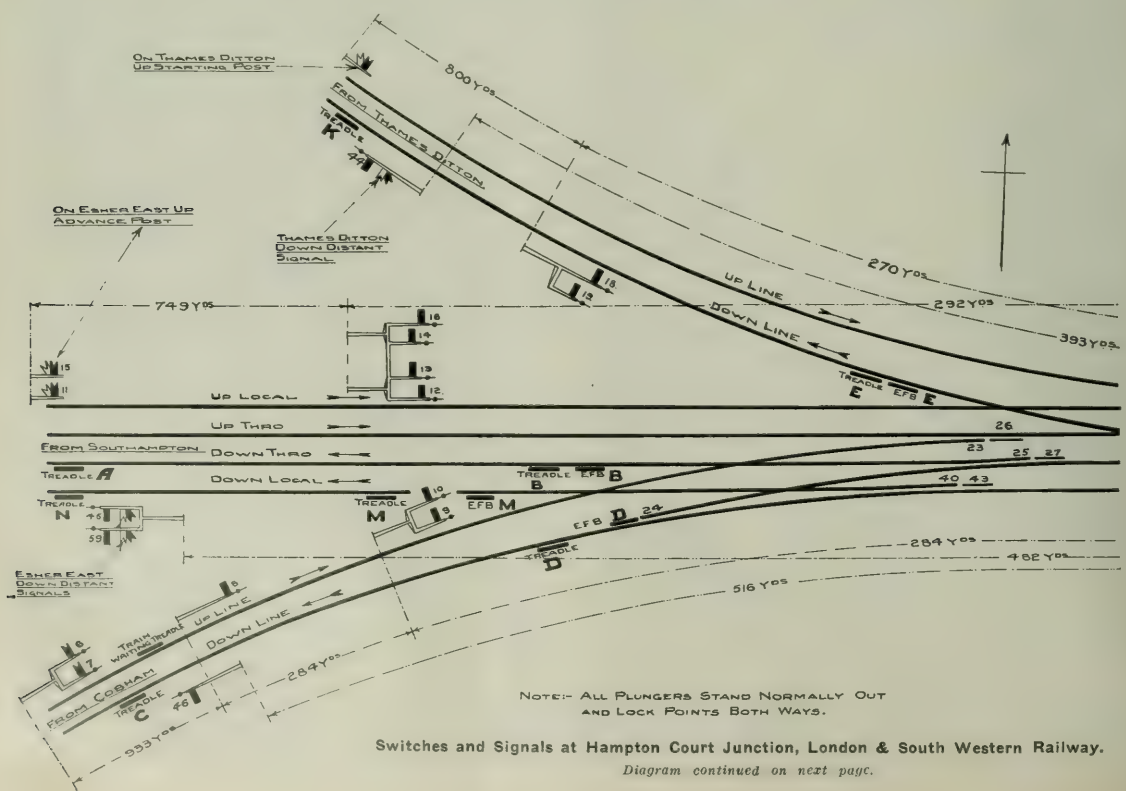
of veracity of the author as it appears in the details of his elaborate fiction. Legislation, at Washington or elsewhere, is not to be controlled or influenced, except adversely to those attempting it, by such ridiculous methods as those imagined by this superficial and prejudiced observer and no such fatuous and futile effort was ever made or ever will be made by men of the intellectual strength of those who hold high places in the administration of the American railway system. The contest over the Hepburn rate law was one of the greatest in the annals of American legislation. It brought forth what is generally acknowledged to have been the ablest debate that the Senate has known since the Civil War and it obtained for the public at large a broader knowledge concerning the transportation business of the country than it had ever enjoyed. The railroad owners and managers, who were deeply concerned at the outset, by the apparent threat against the properties they own and administer were neither recreant in their duty to their industry or to their larger obligations as citizens, nor over-assertive in claiming the right to be heard as citizens, as administrators of a great national industry and, even, as property owners. The most advanced and courageous among them, including the great and lamented statesman and patriot who was then at the head of the Southern Railway, and whose recent death constitutes a loss to the Nation and to the South which is irreparable, spoke, from the faith that was in them and for what they believed to be the common good, from every available platform and through every proper agency. Representing thirteen billions of capital; 5,000,000 wage-earners and their dependents; many millions of investors and wives and children of investors, and a large part of the holdings of savings, fiduciary, insurance and guarantee companies the validity of the investments of which is the basis of interests held by more than half of the population of the country; they dared not remain silent. They had special knowledge of the great industry that was attacked, they had spent their lives in learning the transportation needs of the people, and only moral cowardice could have induced them to withhold their advice in this emergency. But they were not alone in their protest against the proposed legislation. Louder even than their voices rose those of the great business, shipping and manufacturing interests of the country. In spite of the systematic organization of every disaffected interest which went on for years and the persistent proselyting of the Interstate Commerce Commission, hungry for more power, it is not too much to assert that 90 per cent. of the traffic movement of the country, represented by those actually paying the freight bills, was strongly opposed to the original proposal of the President as embodied in the Esch-Townsend bill. This protest was not ineffective. It is to the lasting credit of the shippers, railroad men and students of transportation, who saw clearly and worked patriotically that the proposed control of relative rates, as among competing markets, sources of supply and ports of importation or exportation, was eliminated and the right of every citizen, shipper, community or railroad corporation to its "day in court" was preserved. No "railroad lobby" in the sense in which the term is used by the writer in question, could have done these things, no such "lobby" attempted to do them or anything else in connection with the bill. They were only possible to sincere men earnestly working for that in the justice and wisdom of which they fully believed and then only when great and conscientious statesmen held the keys of legislation and steadfastly refused to be driven from the path of duty by the prejudiced clamor of space-writers, the noise of demagogues, or the pressure of honest but mistaken opponents of the industrial methods and laws under which American progress has been possible. The law is imperfect in many respects, but in so much as it is better than the friendless and abandoned Esch-Townsend bill or the original Hepburn bill, which until it was amended in fundamental particulars had no supporter among either the conservatives or radicals of the Senate; the improvement is wholly due to those shippers, statesmen, railroad officers and students whom the particular muck-raker whose work is under discussion hastens in delight to condemn.

JUSTICE.

Interlocking at Hampton Court Junction, England.

At Hampton Court Junction, England, on the London & South Western, there is an interesting installation of switches and signals which are interlocked mechanically and also locked and interlocked according to an elaborate arrangement, by electric locking, in connection with the station-to-station locking of the "lock-and-block" system. Mr. Arthur H. Johnson, telegraph engineer and superintendent in the Engineer's department of the road, has sent us the drawings and description herewith given. Mr. Johnson says:

In reading the published proceedings of the Railway Signal Association I notice that electrical point locking has been discussed. There appears to be a general impression in America that the British railways have done very little in this direction, which is strange, considering the number of American railroad men who have gone the rounds in this country. The fact is, electrical route locking is applied wherever the controlled manual system is in use. Having



Note:- All Plungers Stand Normally Out and Lock Points Both Ways.

Switches and Signals at Hampton Court Junction, London & South Western Railway.

Diagram continued on next page.

been asked by an old friend in New York to send particulars, I have pleasure in enclosing a diagram of Hampton Court Junction, together with an electrical locking sheet. I do not send the mechanical locking sheet, as that does not differ materially from the American method.

E. F. B. stands for "electrical fouling bar," a bar longer than the car wheel base, and arranged to open a circuit while a train is passing over it. Rear home signal No. 8 with "train waiting" indication is applied owing to "up" trains being worked when necessary from cabin in rear on the "section clear—junction blocked" rule. Trains are not accepted simultaneously on the Thames Ditton and up local lines. The block plungers for these lines, it will be noticed, interlock with points 33 and therefore with each other.

It will be seen by the locking sheet that a train standing at one of the four "Down" advance signals holds the block plunger locked until one of the facing points in its rear is reversed to turn an oncoming train to another line.

If there should be four trains (one at each "advance") then both down through and down local block plungers stand locked.

Hampton Court Junction is no exception, for this is the usual method of dealing with a junction operated under the lock and block.

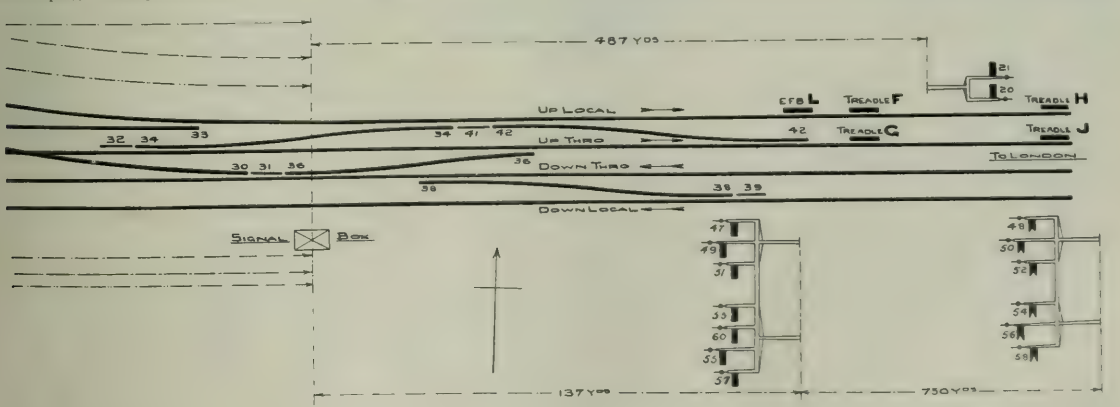
Table of Electrical Interlocking at Hampton Court Junction.

Work.	Released by.	Locking.
8		Plunger to Claygate.
9 to pull.	(Preceded by plunger to Claygate)	9, 12, 14, 19, until 20 used.
9 to replace.	Treadle G	
10 to pull.	(Preceded by plunger to Claygate)	10, 13, 16, 18, until 21 used.
10 to replace.	Treadle F	
12 to pull.	(Preceded by up through plunger)	9, 12, 14, 19, until 20 used.
12 to replace.	Treadle G	
13 to pull.	(Preceded by up through plunger)	10, 13, 16, 18, until 21 used.
13 to replace.	Treadle F	
14 to pull.	(Preceded by up local plunger)	9, 12, 14, 19, until 20 used.
14 to replace.	Treadle G	
16 to pull.	(Preceded by up local plunger)	10, 13, 16, 18, until 21 used.
16 to replace.	Treadle F	
18 to pull.	(Preceded by plunger to Thames Ditton)	10, 13, 16, 18, until 21 used.
18 to replace.	Treadle F	
19 to pull.	(Preceded by plunger to Thames Ditton)	9, 12, 14, 19, until 20 used.
19 to replace.	Treadle G	
20 to pull.	Surbiton west up through plunger.	20.
20 to replace.	Treadle J	
21 to pull.	Surbiton west up local plunger	21.
21 to replace.	Treadle H	
23		Up through plunger.
30		Up thro' & up local plunger.
33		Thames Ditton plunger.
33 normal		Up local plunger.
34		Thames Ditton plunger.
36		Up thro' & up local plunger
38		Down through plunger.
42	Fouling bar L being "clear"	Up through plunger.
44 to pull.	Thames Ditton down plunger	44.
44 to replace.	Treadle K	
45 to pull.	Esher, east, down through plunger	45.
45 to replace.	Treadle A	
46 to pull.	Claygate down plunger	46.
46 to replace.	Treadle C	
47 to pull.	(Preceded by down through plngr)	47, 53 (30 when replaced) until 44 used. Down through plunger until 44 used or 30 replaced.
47 to replace.	Treadle and bar E	
49 to pull.	(Preceded by down through plngr)	49, 60 until 45 used. Down through plunger until 45 used or 30 pulled or 25 replaced.
49 to replace.	Treadle and bar B	
51 to pull.	(Preceded by down through plngr)	51, 57 until 46 used. Down through plunger until 46 used or 25 or 30 pulled. Down local plunger until 46 used or 40 or 38 pulled.
51 to replace.	Treadle and bar D	
53 to pull.	(Preceded by down local plunger).	47, 53 (30 when replaced) until 44 used. Down through plunger until 44 used or 30 replaced. Down local plunger until 44 used or 30 replaced.
53 to replace.	Treadle and bar E	
55 to pull.	(Preceded by down local plunger).	55 until 59 used. Down local plunger until 59 used or 40 replaced or 38 pulled.
55 to replace.	Treadle and bar M	
57 to pull	(Preceded by down local plunger)	51, 57 until 46 used. Down local plunger until 46 used or 40 or 38 pulled.
57 to replace.	Treadle and bar D	
59 to pull.	Esher, east, down local plunger	59.
59 to replace.	Treadle N	
60 to pull	(Preceded by down local plunger).	49, 60 until 45 used. Down local plunger until 45 used or 30 pulled, or 38 replaced. Down through plunger until 45 used or 30 pulled or 25 replaced.
60 to replace.	Treadle and bar B	
Down thro' plunger		36, 38 until 47 or 49 or 51 used.
Up local plngr.		33 over until 14 or 16 used
Plunger to Thames Dit'n		32, 34 until 18 or 19 used.
Fouling bar:		
B		Disconnects treadle B
D		Disconnects treadle D.
E		Disconnects treadle E.
L		42.
M		Disconnects treadle M.
Special.	8 Fitted with "TRAIN WAITING" gear.	

Laws for Railroad Safety in Indiana.

The Railroad Commission of Indiana, having been directed by the legislature of the state to make special investigations of the train accidents which occurred at Fowler and Sandford on January 19th, has carried out the instructions and has made a report of 31 pages giving the facts and its findings thereon; and this not only for these two accidents, but also for the collision of November 12 at Woodville on the Baltimore & Ohio. In connection with the report the commission has sent to the legislature drafts of two laws, one to improve the discipline on the railroads of the state and for other purposes, and another to require the establishment of the block system by July 1, 1909, on all railroads earning $7,500 per mile per year. These laws were passed by the legislature on March 8. Below we give an abstract of the report.

The Woodville collision, which was reported in the *Railroad Gazette* of November 16, December 7 and February 1, was between a westbound passenger train and an eastbound freight, and was caused by the failure of the engineman of the passenger train to give a proper whistle signal to notify the freight, which was standing on a side track, that a second section of the passenger was following. The present report gives few particulars beyond what we have published. The passenger passed the freight at 60 miles an hour. Concerning the whistle the evidence is conflicting; the commission finds the probable fact to be that the engineman of the passenger did give some sort of a blast but those men of the freight who heard it say that they understood it as a whistle for the road crossing. The passenger runner was at fault also for not having his green lights burning and for not stopping to get a response from the freight. Two miles beyond this point he stopped his train and relighted his green lights, but said nothing to the operator there about having



Hampton Court Junction—Continuation of Diagram on Preceding Page.

failed to receive a response to his whistle signal. The commissioners find that by its last annual report the Baltimore & Ohio earned per mile $14,000 gross and $5,000 net and, therefore,

"a fair telegraph block system can be installed upon this line in this state at an expense not exceeding the reasonable capacity and ability of this company to pay out of its earnings for one year. The evidence also shows that if the block system had been installed on this line this accident could not have occurred without a violation of the rules and regulations which are now accepted as the best security from accidents of this kind. This line is one of the principal trunk lines crossing the state and has a very dense traffic over a single line where the accident happened. No reasonable excuse has been given why this line could not have long since been protected by the block system. Other lines in this state having less income per mile and a less dense traffic have been so protected for several years, and the commission is strongly of the opinion that the Chicago division of this line in this state should be immediately equipped with a substantial block system."

At Fowler the telegraph block system was in operation; "an excellent system," says the commission, "but one which does not prevent accidents unless the rules are carefully observed." In this case, the passenger train, eastbound, No. 38, is recorded as having made up 3½ minutes in the 6½ miles from Earl Park to Fowler, so that it was probably running 65 to 70 miles an hour. It passed the red light at the station at high speed at 2.15 a.m. and a half minute later collided with westbound freight train No. 95, which was entering the side track. The operator had an order directing the passenger train to wait until 2.17 a.m., by which time the freight would have cleared the main track. The freight had the same order and, being inferior to the passenger train, should have cleared the main track at 2.12 a.m. This it did not do, and the commission finds that judging by the time that they left Swanington the conductor and engineman deliberately used a part of the five minutes.

That the block signal showed red, the operator had good corroborative evidence in the word of the town policeman, who was in the office. Just as the train approached, noticing that it was coming at high speed, Operator Thomas called loudly to the policeman to look at the position of the ropes governing his two signals, eastbound and westbound; and both were in the stop position, where they had been ever since the policeman had entered the office. The train passed a second later, and the policeman went outside to assure himself that the signal light showed red. The policeman testified that the fog was so dense that he could see a switch light only about 100 ft. away. It appears that the engineman of the passenger train was still in the hospital and had not testified.

The commission finds the block signals and switch signals at Fowler "unfortunately located." An engineman approaching from the west finds, first, a switch with a light 19 ft. 3 in. high; then, 100 ft. farther, a switch 7 ft. high; then, 500 ft. farther, the semaphore, 41 ft. 5 in. high, and 25 ft. 8 in. to the left of the track; then, 250 ft. farther, a switch 18 ft. 3 in. high. The semaphore is made high because west of the station there are some trees on the north side of the track, and the line approaching from that direction is descending. On a clear night the light of the lamp can be seen a mile west of the station. On approaching the trees the engineman apparently has the semaphore hidden from him for a short distance; and, in case of dense fog, it is questionable whether he can see it at all when running at anything like service speed.

The commission evidently has heard some criticism of the train order rules and, it is stated, has given much time to examining them; but is not prepared to say that the standard code is not satisfactory.

The commission finds that telegraph operators, in charge of the very vital function of train operation, are in most instances less than 21 years of age, and many of them as young as 17 and 18. The commission

"received expert evidence on the capacity of boys of the ages mentioned to properly discharge the responsibilities which their positions as telegraph operators entail. Eminent specialists gave it as their opinion that neither the mental nor bodily development at those ages fitted the boy for long hours of service, accuracy of judgment or conception of responsibility. The demands of nature are such in boys of those years that they are frequently found asleep at their post of duty, which is an unwarrantable hazard in railroad operation."

Railroad officers appearing before the commission strenuously denied that they wink at violation of the five minute clearance or of other rules. One engineman, apparently a chairman of a brotherhood committee, declared that not only are the rules violated, but an engineman who strictly obeys them "would be regarded by the other men as a sissy and a grandmother." The commissioners, however, do not accept this opinion; on the contrary they quote Mr. George Lamb, an engineman of this road (the Cleveland, Cincinnati, Chicago & St. Louis), who has "a splendid record of 43 years without censure, suspension or dismissal," to the effect that safety is and always has been of first consideration with him and that he had often found it necessary on dark and foggy nights, instead of attempting to make up time, to stop his train and go to the tower or block station for orders; that in such instances he very often reached his point of destination late and that instead of being censured therefor was commended by his superintendent for exercising proper care.

The commission therefore finds that while a majority of employees are careful, the facts compel the conclusion that many do not strictly obey the rules.

The accident at Sandford, 20 hours after Fowler, and also on the C., C., C. & St. L., was the destruction of a passenger train by the explosion of a car of black powder in a freight train on a side track, the explosion occurring at the moment when the engine of the passenger train passed the powder car. The powder came from Concord Junction, Mass., through Canada over the Grand Trunk Railway. The powder was loaded according to the regulations of the American Railway Association, which are like those of the United States Army, and the car passed under the inspection of the conductor three times between Indianapolis and Sandford, a distance of about eighty miles. The freight had been passed by several heavy passenger trains at high speed. Rain had been falling that night and a very strong wind was blowing from the southwest. The passenger train was not using steam and the brakes had not been applied. The gas tanks of the passenger cars were found after the explosion not exploded, but with all connections broken off. Chemical analyses failed to show traces in the wreck of any explosive more powerful than black powder. The condition of the wreck and of the ground after the explosion gave no evidence of high explosives. If the Pintsch gas had escaped from its tanks before the explosion the high wind would have blown it away from the freight car. There is an oil pipe line a little west of the point of the wreck, but the freight conductor had crossed it with his lighted lantern after the freight stopped, and the engine of the passenger train had not arrived at the pipe line at the time the explosion occurred. A man living five miles from the scene of the explosion thinks that he saw a meteor moving laterally through the sky a few seconds before the explosion, but the commission concludes that he was deceived by the light of the explosion in the sky, this light having traveled the five miles instantly, while the sound took 25 seconds to reach the observer. No person in the vicinity of Sandford observed any electrical disturbance. The commission investigated also the possible action of noiseless electric currents, but concludes that if there had been any such, the steel rails of the track and the telegraph wires would have been pretty sure to carry it to the ground without disturbing the car of powder. After examining the matters here noted, and all other possible evidence and theories, the commission concludes that while it is improbable that any person was in the car of powder, there is more consistency in that supposition, and that such person or persons caused the explosion, than in any other supposition. Parts of two unidentified human bodies were found in a field a thousand feet from the car, but these may have been passengers, or trespassers riding on the baggage car, or may have been pedestrians. Tramps would not be likely to enter a cleated car when other cars in the train were easier to enter.

The first law recommended requires that railroads shall "publish" printed rules, shall examine employees on the rules every six months for a year and a half, and then every year; and violation of this section is a misdemeanor, liable to fine of $200; that the railroad commission shall call a convention of railroad officers every year to consider the railroad accidents that have taken place during the year, with a view to seeing what shall be done for prevention; that any officer or employee engaged in train operation being or becoming intoxicated while on duty shall be guilty of a misdemeanor and liable to $500 fine; that the railroad commission, finding that an accident has been due to violation of the lawful rules, may, if the violation is flagrant or due to intoxication, report the guilty person for prosecution; that copies of this law must be posted in cabooses, depots, etc. The law requiring the block system applies only to roads operated by steam power. The commission may extend the time for one year and may exempt branch lines where it shall be made to appear that no reasonable necessity for the block system exists. The penalty for violation of the block system law will be $1,000 a week.

Federal Laws Challenged.

The Ann Arbor Railroad, which has been sued for $200 penalty for violations of the safety appliance laws, has filed in the Federal court at Toledo a demurrer proposing to challenge the constitutionality of the law. The New York Central has appealed to the Supreme Court of the United States the suit in which it was lately fined $108,000 for paying rebates. The company charges 101 errors. It is declared that the act is void because it goes beyond the power given Congress to regulate interstate commerce, particularly that it imputes to the corporation power to commit an act with criminal intent; that it is an unreasonable regulation of commerce in making the corporation criminally liable for the acts of its employees; that inflicting punishment upon both the

company and its employee for the same act is in effect double punishment; that it subjects the innocent holders of the company's stock to punishment, and that the sentences are cumulative.

Special Agents of the Interstate Commerce Commission.

The Interstate Commerce Commission, in pursuance of its recent decision that most of the public sessions of the whole Commission shall be held in Washington, has appointed four special agents to represent the Commission in other cities—Messrs. M. S. Decker, L. M. Walter, P. J. Farrell and J. H. Marble. Portraits of these gentlemen are given herewith.* The special agents are to hold hearings in such places as the Commission may appoint, and will have no definitely assigned territory. The idea of appointing resident agents in Chicago and other cities appears to have been abandoned—if, indeed, it has ever been seriously entertained.

Martin S. Decker was born in Rosendale, Ulster County, New York, and began his business life as a clerk in the County Court of Ulster County. He was Clerk of the County and Circuit Courts at Kingston and in other such offices until 1887, when he went to Washington as Docket Clerk for the Interstate Commerce Commission. This was when the Commission was first organized under the original act. In 1893 he was appointed Assistant Secretary of the Commission, and has held this office ever since. He is well versed in the law of transportation and railroad regulation, having done much of the work in many of the important cases that have come before the Commission during the past fifteen years.



M. S. Decker.



L. M. Walter.



J. H. Marble.



P. J. Farrell.

Luther Mason Walter, of Kentucky, was born March 2, 1877, and admitted to the Bar April 20, 1898. He worked in the United States Census Office two years and a half, and then for a year was a member of the Board of Pension Appeals. He resigned this place in August, 1903, to accept the position of Law Clerk with the Interstate Commerce Commission. His work has been largely in connection with prosecutions to recover penalties for violations of the Federal Safety Appliance laws. He received the degree of Master of Laws in 1902 and D. C. L. in 1903. In 1904 Columbian University (now George Washington University) made him Master of Diplomacy.

P. J. Farrell, of Newport, Vt., was born May 10, 1861, and admitted to practice in all the courts of Vermont in 1887 as attorney at law and solicitor in chancery. In April, 1906, he was admitted to practice in the Supreme Court of the United States. Mr. Farrell was in the railroad service several years, beginning with the Connecticut & Passumpsic Rivers road in 1880. He was station agent, conductor, clerk in general freight office and train despatcher. He was subsequently a railway postal clerk, and in 1888 he was promoted to be chief clerk of railway mail service, with headquarters at Boston. In 1889 he resigned this place and became law partner of Hon. Charles A. Prouty, now Interstate Commerce Commissioner. He practised law at Portland, Ore., and Newport, Vt., until 1901, when he entered the employ of the Interstate Commerce Commission, where he has acted as attorney in cases before the Commission and in the courts.

John H. Marble, of San Francisco, Cal., was born in 1869 at Ashland, Neb., and was educated in the public schools of Nebraska and South Dakota and the University of Nebraska. He was for several years engaged in printing and in newspaper work in South Dakota, Wyoming and San Francisco, and was admitted to the Bar by the Supreme Court of California in 1902. After four years in general practice at San Francisco he came to the Interstate Commerce Commission in July, 1906, beginning as confidential clerk.

*Photographs by Harris & Ewing.

Bridges on the St. Paul's Pacific Extension.

The contract for the superstructure for the Columbia river bridge of the Pacific coast extension of the Chicago, Milwaukee & St. Paul was let last week to the Pennsylvania Steel Company. It was for 15 spans, weighing 4,600 tons. Work is under way on the substructure, and it is the present expectation to have it ready for the steel work by the first of next year. The superstructure will be erected by company forces, and the bridge will probably be ready for service within a year from the present time. The McClintic-Marshall Construction Co., Pittsburg, Pa., was awarded the contract for six truss spans for the section between Tacoma and Seattle. These bridges are expected to be ready by fall. The three crossings of the Yellowstone river respectively at Terry, and each side of Miles City, Mont., 12 spans in all, each 270 ft. long, aggregating 6,700 tons, were let to the American Bridge Co. They are being built entirely by company forces, the substructures now being under way, and they will be done about the first of the year.

The Missouri river bridge near the eastern end of the line, at Mobridge, S. Dak., as has previously been noted in these columns, was awarded to the Pennsylvania Steel Co. for the superstructure. There are three 425-ft. spans, weighing 4,000 tons. Contracts for girder spans of various lengths, approximating to 1,500 tons each, have been let to the Wisconsin Bridge & Iron Co. and the Milwaukee Bridge & Iron Co., Milwaukee, Wis. Twelve of these are for Musselshell river crossings, three for the Jefferson river, five for the Little Missouri and the remainder for various streams in Montana and North Dakota.

This new line of the Chicago, Milwaukee & St. Paul was described briefly in the *Railroad Gazette* of September 21 and December 14, 1906.

Government Report on the Block System.*

That part of the Interstate Commerce Commission's report on block signals which embraced its conclusions, the mileage table and the chapter on automatic stops, was published in the *Railroad Gazette* of March 1, page 277. Below we give parts omitted at that time.

HISTORY.

The term "block system" is used to designate the method or process whereby, by the use of the telegraph, telephone or electric bells, or by automatic apparatus, each train on a railroad is forbidden to pass a certain point (the entrance of a block section) until the last preceding train on the same track has passed beyond

*Report sent to Congress Feb. 23, 1907.

a certain point farther on (the end of that section). No train enters a block section except and until its engineman sees on the signal post an "all right" signal.

Without the block system, protection from rear collisions depends on the maintenance of a time interval at stations and on elaborate instructions for the use and observance of red flags (or lanterns), torpedoes and fusees, which instructions are often hard to enforce.

Protection from butting collisions (on single-track lines) depends on the exercise, on the part of enginemen and conductors, of most intelligent and unceasing vigilance in the observance and execution of intricate rules and written orders, and on the exercise of the utmost care by the train despatcher, who, by the use of the telegraph, regulates the movements of those trains—on the more important single-track roads a large proportion of the whole—for which the time-table does not prescribe meeting points, which includes all trains when running behind time.

With automatic signals, the passage of the wheels of the train along the track actuates and controls the signals. No signalman is required, and the signals may be fixed anywhere along the line, not necessarily at stations.

The block system as first used in this country, and as now used on thousands of miles of railroad—that is, the "telegraph" block system—is very simple. The agent or operator at a given station sees that a signal indicating "stop," one for trains in each direction, is displayed so as to be seen by the engineman of any train approaching and running in that direction; and this signal is displayed continuously until the attendant operator or signalman has been informed from the next station beyond that the last preceding train on that track has arrived at the said next station, and has either passed on or has been set off on a siding, clear of the main track. This stop signal may be a very simple device so that, with properly instructed station attendants, the necessary first cost of the system is very small.

The introduction of the block system has been slow because under favorable circumstances the old system has done well. With a sufficiently long-time interval between trains at each station, and with rigidly enforced regulations concerning rates of speed and for "flagging back" in case of delay (every delay shortens the time interval between the delayed train and the one following it), trains may be run with a considerable degree of safety by time-table alone, and it is not necessary to have all of the stations constantly manned by a telegrapher. This being so, American railroads, most of them with stations not very near together, were reluctant to increase their expenses even a moderate percentage. With stations far apart, the block system would have required, especially at night, when the small stations were ordinarily closed, many additional telegraphers. The Pennsylvania Railroad was for years the only road using man-operated block signals.*

Not until about 1885 was the manual system used systematically elsewhere, except on a few miles of the New York Central & Hudson River, where the "controlled manual" block system was introduced, from England, about 1882.

Automatic block signals were invented in America and have been developed on American railroads. Although man-operated block signals had been used for some years on English railroads, with their denser traffic, more frequent stations, and lower expenses for attendants, automatic block signals found more pronounced favor in this country; and the Eastern Railroad of Massachusetts (now the Boston & Maine) had 16 miles of its line near Boston equipped with automatic signals in 1871. Other New England roads followed, so that by 1878 there were automatic signals on a considerable mileage in the vicinity of Boston. In the next year, 1879, the track circuit, a radical improvement, was introduced on 10 miles of the Fitchburg Railroad, near Boston; and from that time automatic signals made steady though rather slow progress. Though there was not in this system the cost of additional station attendants, as in non-automatic block signals, the cost of installation of apparatus and fixtures was high, as was also the cost of inspection and maintenance; therefore, only companies enjoying a heavy and profitable traffic deemed it wise to equip their lines with automatic signals.

Except on a few lines, block signals were introduced only where the dense traffic compelled an improvement on the old system. For many years some roads which had made considerable investment in automatic block signals continued to maintain their time-interval rules, using the signals as an auxiliary protection. On a few roads, however, far-seeing and discriminating managers who saw that the potential value of the space-interval principle was greater than appeared from the cold calculations based on volume of traffic and on the earnings or expenses for single years, introduced the telegraph block system on lines where the volume of traffic did not compel its introduction. That is to say, the trains were not so frequent as to require a shortening of the time interval to increase the capacity of the road. Some of these managers were, indeed, impelled to make this change because of large expenses due to the damages caused by collisions.

One of the most significant things in connection with the progress of the block system during the past few years has been its use on long lines of single-track railroad. On lines of this kind its use is now so general that the propriety of adopting the system for lines of any grade may be looked upon as a generally accepted principle. There are not wanting managers who had delayed the introduction of the system until it could be shown by statistics that the added expense would be warranted and have found such statistics only in connection with a long list of killed and injured passengers, the victims of a collision.

COST.

Like many other items in the operation of a railroad, the cost of the block system is a somewhat indefinite quantity. Few roads have introduced the system in such a way as to keep its cost separate from other expenses. Except on a new line, the significant item is the excess of cost above what was paid for train protection under the old system. Usually the first cost of introducing the telegraph block system is confined to one additional telegraph wire, say $30 per mile, and a signal, say $75 or less, at each station. On many lines the train-order signal already in use for train despatching has been made to serve satisfactorily as a block signal. The real financial burden, if any there be, is in the additional telegraph operators required, making a permanent increase in the pay rolls. On one road on which the telegraph operators already in service managed the block signals, the increased expense for wages of operators (for additional operators) was less than 5 per cent. There are numerous examples similar to this. The cost of an additional telegraph wire is too small to receive special consideration.

On the other hand, a road which erects signal cabins specially for block signals, and employs signalmen independent of its existing telegraph service, will expend $500 each for the cabins and from $1,200 to $1,500 yearly for wages, fuel and maintenance at each. With block stations three miles apart, these items would thus aggregate $16,666 and $40,000 to $50,000, respectively, for 100 miles of line. Whether the stations are three miles apart, or more or less, depends, of course, on the volume of traffic and the required frequency of trains; so that no universal rule can be laid down.

The cost of the electric apparatus for "controlled manual" has been looked upon by most roads as unwarranted. Only roads with heavy earnings are using it. The "average" road acts on the theory that with competent signalmen the "control" is unnecessary. The justification of this position depends on the results; and results may not be visible until after a term of years, for the reason that signalmen not fully competent may work for years without causing a collision.

In considering the installation of automatic block signals, the first financial question is the original cost of the signals, apparatus, fittings, and appliances. The cost of maintenance, while a considerable item, is decidedly smaller than the cost of operation of the non-automatic systems, in which the item of wages is large. Automatic block signals have involved expenditures of from $1,500 to $3,000 a mile of double-track road, the precise figure varying according to the type of signal the number of outlying switches to be connected, and the frequency of the signals or length of the block sections. The maintenance of these signals costs variously from $75 to $125 per signal per year. Until within two or three years automatic signals have not been introduced except on lines of considerable traffic, where the necessity for running the passenger trains closely following one another was considered pressing. One important exception to this statement is the case of the Cincinnati, New Orleans & Texas Pacific Railway, which has used these signals on its single-track line for long distances for 10 years or more. At the present time this road has about 300 miles of single track alone equipped with automatic signals. During the past year or two the Southern Pacific has taken similar action—has ordered automatic block signals for hundreds of miles of single-track lines.

That but few other roads have adopted automatic signals except on very short lengths of single-track line—the reason that the two roads just mentioned are exceptional—appears to be based on the fact that for single-track lines the automatic system does not

*The first block signaling in America appears to have been on the line between Kensington (Philadelphia), Pa., and Trenton, N.J., in 1863 or 1864. This statement is based on the testimony of the late Robert Stewart, who was superintendent of telegraph of that road at or about that time. The space interval was adopted after the occurrence of a disastrous rear collision of eastbound extra trains at night carrying soldiers from the seat of war to New York and New England. The block system was extended northward from Trenton to New Brunswick some time in 1864. The earliest date of which an authentic record has been found is Nov. 12, 1869, which appears on a circular issued by F. Wolcott Jackson, general superintendent of the New Jersey Railroad (Jersey City to New Brunswick), and dated at Jersey City, N. J., giving the rules under which the space interval was to be maintained. The circular is signed also by R. Stewart, superintendent of telegraph. The block system was put in effect from Frankford Junction westward to Mantua (West Philadelphia) in 1870. In 1872 the Pennsylvania Railroad took control of all these lines, and at that time a length of 90 miles was being worked by the block system. In a statement made by Mr. Ashbel Welsh, in 1866, he speaks of the block system as having been in use for a year between Jersey City and New Brunswick. The block signals consisted of banners in boxes, some of which have been in use until within a few years and may be familiar to the reader. The box stood on a post, and red flannel banners were dropped in front of a white surface or white light for the stop indication. On some of the boxes there were hoods to prevent impairment of the engineman's view by the rays of the sun reflected from the glass which covered the opening in the front of the box and protected the banner from the weather.

afford all of the safeguards that are needed. Notwithstanding a full equipment of signals it is necessary to continue in force the time-table rules regarding the meeting of trains and train despatchers' authority and oversight to provide for the meeting of extra trains and of regular trains when behind time.

One or two companies have introduced automatic signals on single-track lines where the telegraph block system has been in use and is continued in use. This is to facilitate movements where it is necessary that a considerable number of trains, usually freight trains, must follow one another in the same direction at short intervals. The telegraph block system is worked with facility only between meeting points; that is to say, between block stations fixed at the sidetracks where trains can meet and pass. These are usually three miles or more apart, while by the introduction of the automatic signals provision can be made for the protection of trains running in the same direction much less than three miles apart.

Where trains are so frequent that a time interval of five minutes or more cannot be tolerated, the automatic system is now generally deemed the only suitable system, because where trains must follow one another as closely as once in five minutes the block signals must be not over two miles apart; and with this interval the cost of the manual block system would be very high.

From a humanitarian standpoint the block system is to be regarded simply as a safeguard against collisions of trains, but it is much more than that, for it is an effective means of increasing the capacity of a railroad. On lines where the traffic is dense or even moderately active, the use of the block system permits the running of trains near together at full speed. The running of successive trains within two minutes of one another may be safely permitted under a properly operated block system; whereas, in the operation of lines where the block system is not used, it is necessary to maintain a time interval of from five to ten minutes between trains except where the speed is very low, as in the case of some freight trains. The block system thus increases the capacity of the road and serves, in some degree, to postpone the day when additional main tracks must be built at great expense. This is a fact that must be taken into consideration in any proper estimate of cost.

SAFETY.

The broad question of the safety of the block system needs no discussion, but it will be proper to consider somewhat more in detail the relative merits of the different systems, considering each by itself and in comparison with the other systems. It is obvious that the system generally, whether telegraph or automatic, is safer than the time interval and despatcher system, because fewer collisions occur under it. Nearly all of the large railroad companies have adopted it to a considerable extent, and they are putting it in use on additional lines year by year. Whatever may be their conclusion as to the precise measure of economy, they do this avowedly to promote the safety of the lives and limbs of passengers and trainmen.

The block system provides that each engineman may, with perfect safety, start and run his train by the sole authority of a visible signal, fixed on a post at the side of the road, which gives him the exclusive right to the track for a given distance (to the next block signal) without limitation as to the time to be spent in getting there, or the speed. The system provides all necessary security against collision, with no question about the importance of the train, or the priority of any other train. So far as safety is concerned, all trains are of the same class.

Without the block system, the right of a train to proceed depends on the class of the train as regards other trains; on the time, as shown in the time-table, and on the vigilance of the engineman in seeing that the preceding train is out of his way. Under the block system these otherwise vital features become matters merely of convenience or expediency. With no block system rear collisions are provided against by flag or lantern signal, but the failure of this safeguard is notorious. It fails both from the negligence of flagmen to carry out or display the signal, and of enginemen to heed it when it is given. On a single-track line, in addition to these uncertainties, the men in charge of trains have the burden of considering their rights as against trains coming from the opposite direction, which are of two or more different classes, and the superiority of which as related to their train may vary from hour to hour, or may be varied by telegraphic orders from the train despatcher at any stage of the train's journey. Butting collisions due to confusion in these things—to mistakes in reading the time-table, to wrong telegraphic orders, to non-delivery of orders, to forgetting orders and other blunders—are as notorious as are rear collisions from flagmen's failures.

On either double track or single track we have on the one hand (in the block system) fixed signals, situated at known locations, few and simple requirements, and few men to share the responsibility of any given operation. On the other hand, we have in the old system, signals (as flags), not fixed but to be encountered at unexpected places, or no signals at all, compelling dependence on the time-tables, watches and confusing rules of superiority. Responsibility is divided among a larger number of men.

It is therefore not necessary to be acquainted with the details of railroad working to decide which must be the safer method of operation.

The engineman who makes a mistake under the block system usually finds himself condemned by all competent critics, with little palliation, because the problem under which he breaks down has been simplified to the last degree; whereas mistakes made under the other system (forgetfulness, mistakes in reading poor handwriting, errors in adding and subtracting hours and minutes, neglect of some rule that rarely affects him) are of a kind that enlist sympathy by reason of the general appreciation of the great difficulty of surely avoiding such mistakes 365 days in the year, one year after another.

Every railroad company finds evidence of the superiority of the block system in the record of collisions, regardless of all theoretical arguments. A few roads have informed the commission that by the introduction of the block system their expenses for collisions have been reduced. One makes the definite statement that this reduction—1906 compared with 1896—was 45 per cent., notwithstanding a great increase in the volume of traffic, which increases the dangers. It is undoubtedly true that but for the use of permissive blocking for freight trains a part of the time, which involves a virtual suspension of the block system, this percentage of saving would have been much larger.

There is no escape, therefore, from the conclusion that the block system is the best known instrumentality for the prevention of collisions, notwithstanding the imperfections which have been shown in the results of its operation, and that the highest standard, both of the public requirement and of expert railroad opinion, calls for its general use. The most progressive railroads are using the system extensively and are extending it, and their signal engineers and operating officers are constantly striving to make it more perfect.

Considering now the question of safety more particularly and looking at each method of signaling by itself, we will take first the "controlled manual." For the reason that comparative statistics of safety are not to be had in authentic and lucid form, the question of safety must be decided in all of the systems largely by a critical examination of the apparatus, the principles of the system, and the methods of administration.

The Controlled Manual.—This system is the safest known. All signal operations are made by regular attendants in the signal cabins, and the man (A) giving a clear signal must always have the co-operation of the one (B) at the other end of the block section. The movement of the train itself also checks the operation of A. In some few installations the last-named safeguard—that depending on the movement of the train—is made constant during the passage of a train through the whole length of the block section by having a track circuit throughout the section. This secures the advantage both of human attendants and of the self-acting machinery of the automatic block system. There can be no question that in this system false clear signals due either to errors of signalmen or faults of apparatus are fewer than in the telegraph block system or in the automatic system; though it is fair to say that, because of its mechanical refinements (deemed an extravagant expense because of the infrequency of the errors that it is designed to prevent), the controlled manual in its complete form has not come into extensive use. For this reason the superiority of this system cannot be compared with that of the others on a satisfactory basis.

Errors of enginemen are probably neither more nor less frequent with this system than with the telegraph block system, though there are no available statistics on the point.

The Telegraph Block System.—Faults of apparatus are in this system too rare to merit attention in this place. The question of safety as compared with the other system hinges on the efficiency of the signalman. Considering the controlled manual system as the standard, this system is inferior by reason of the chance that a signalman will give a wrong signal because his error or neglect is not invariably checked by any other person, nor by any electrical machinery. Looking at the accident records compiled by the commission for the last two years, July 1, 1904, to July 1, 1906, it appears that of the 160 rear and butting collisions which were deemed "prominent" and entered in class A (persons killed, 507; injured, 2,597) 13 occurred under the telegraph block system.

All of these are charged to the negligence or misconduct of signalmen, and none primarily to faults of enginemen, though in one case an engineman disobeyed a rule designed to provide against signalmen's neglect. In the same two years seven collisions in class A on lines worked under the automatic block system were reported as all due to misconduct or neglect of enginemen. These figures tend to indicate that in its feature of monitorship the telegraph block system has a marked advantage. The presence of the attendant at or near the signals keeps the engineman wide awake and attentive to the signal indications. The causes of the signal-

men's errors in these 13 cases are various. Inexperience and culpable neglect—the latter apparently a grave moral defect—are the two most prominent.

Without the fuller statement of facts which an inquiry on the spot would furnish, a closer analysis of this accident list cannot be made; but there can be no question that the number recorded (13) is far smaller than would have been the case had the block system not been in use.

In aiming to define or even to discuss a standard of perfect safety, human fallibility cannot be ignored, as the mysteries of the "personal equation" have never been fathomed. However, should the "control" apparatus be regarded absolutely necessary in manual block signals, the record of the British railroads must be considered. Most of their lines have no "control," yet the records show that collisions are rare. Again the introduction of machinery to check the errors of men cannot be fairly accepted as a justification of neglect to use any well-known means of preventing human errors by wise selection and adequate discipline. The British Government inspectors have discussed "control" but have never formally recommended it, or given any decided opinion in favor of its general use.

The facts of the accident records justify a strong presumption that American signalmen are not so carefully selected nor so well trained as those of England. The average signalman in America is young, and has had, probably from six months to two years instruction—not systematic training—under another signalman, whose superiority to the student is due entirely to what he has learned by experience and not at all to methodical and authoritative instruction. The average block signalman in England, on the contrary, has served as such from five to 25 years and has been through a long course in a signal cabin as "booking boy," or as assistant, before being trusted with full charge of the block signals. This difference in personnel of the signalmen of the two countries undoubtedly explains in large measure the nearer approach to perfection of the block signal service in England. The fact that youth and inexperience are factors in our "failures in block working" has been repeatedly illustrated in the accident records, as given in the quarterly bulletins. A more searching study of this feature of the practice in this country would involve detailed inquiries in many places. So long as the telegraph block system is worked anywhere with a higher degree of safety than on American railroads, the practice of American roads to the extent of such superiority must be declared deficient. The commission knows of no American who has made an extended examination of the men and methods in English signal cabins, nor of any Englishman who has studied the practice in America, but such brief and partial studies as have been made confirm what is here said.

The Automatic Block System.—The basic block-signal principle applies to the automatic and the non-automatic alike. Considering the distinctive features of the automatic, we have to deal primarily with the behavior of apparatus and fixtures instead of with the acts of men. A number of railroads have records showing only one dangerous failure of apparatus in millions of movements. These railroads are the busiest in the country, and these signals have been in use from five to 20 years. Faults of apparatus, where developed, have been diligently investigated, and constant progress has been made; the manufacturers of signals and signal apparatus co-operate with the railroads in seeking perfection, even at great expense.

Nearly all of the larger roads operating the busiest lines show by their acts that they deem the automatic system preferable to the non-automatic. One prominent road, the Pennsylvania, is constantly introducing the automatic on its lines of heavy traffic in place of the telegraph block system. The automatic signals have thus already superseded the telegraph block system on lines where the latter had been in use 25 or 30 years. Errors of enginemen constitute the most prominent fault in the autmatic system. Faults of apparatus are considered under another head.

DEFICIENCIES OF THE BLOCK SYSTEM.

The complete space interval system is sufficient for all demands of any possible train movement. The time interval is partial. It has to be bolstered up by the red-flag system, and the flag has to be bolstered by the torpedo. But we must recognize all known deficiencies of the block or space system and thus avoid cherishing extravagant expectations of perfection.

Under the telegraph block system an operator may omit to record the passage of a train or to advise the next block station; he may clear the signal for a certain track without first looking out of the window to see if the track is not obstructed near his cabin by another train. Unless the standard of selection and discipline is high, moral faults come in, such as allowing inexperienced persons to perform responsible duties, or going to sleep with signals in the clear position. (Signals when not in use are to be left in the stop position, which provides against danger from a sleeping operator; violation of this rule is therefore to be classed as a moral fault.)

An element of weakness in the system as worked on many railroads is found in the long hours of service. A great majority of the signalmen on American railroads are required to be on duty 12 hours out of the 24, and seven days in the week. This is a practice which must be a violation of true economy, except possibly in cases where the work is very easy and hours off are freely granted. Most men who are of sufficient intelligence and moral character to make thoroughly satisfactory block signalmen will naturally seek a respite occasionally from such a confining routine, and if they cannot accomplish this without securing a substitute at their own expense they are under constant temptation to "change off"—the day man working for the nightman and the nightman for the day. If they can do this they work more than 12 hours without adequate intermission, which, in such delicate work, is a reprehensible practice.

Errors of enginemen, though rare under the telegraph block system, must be recognized. In spite of the monitorship of the signalmen, enginemen do sometimes run past stop signals. These errors occur usually in the night or in a dense fog, but in probably 99 per cent. of such cases the engine runs beyond the signal only a short distance. Against this chance of collision there is a rule requiring the signalmen to forbid the starting of a train from A to B until the last preceding train has passed some distance beyond the signal at B, say 300 ft. These errors of enginemen are mostly due to allowing enginemen to run in districts with which they are not thoroughly familiar or to lax discipline.

The faults of automatic signals are largely non-dangerous—that is to say, they may cause a failure of a signal and thus delay one or more trains, but involve nothing worse than delay. To recount these faults would be chiefly a technical essay showing how well the signal engineers and designers have succeeded in eliminating faults and perfecting the system. By successive improvements, following the lessons of experience, failures of batteries, breakage or crosses of wires, and other mishaps have been so controlled that they always set or retain the signal in the stop or danger position.

Dangerous failures of apparatus are those which cause a signal to indicate "proceed" when the block section is not clear. When a train enters a block section, the block-signal arm indicates "proceed." By the passage of the train over the rails, it is caused to move at once into the position to indicate "stop" to the next following train. This is accomplished by the reduction of the force of the electric current flowing through an electro-magnet. This allows the armature of the magnet to drop through the space of a small fraction of an inch. If the armature should fail to move freely in its bearings, or if, in consequence of lightning or some other foreign electric current, the magnet should continue to exert its attractive force, or if the small space should be closed (in freezing weather) by condensed moisture or any substance forming an electrical conductor, the signal would continue to indicate "proceed," and this would permit a second train to enter the block section already occupied by the first one. If then the first train should be unexpectedly stopped, there would be a collision unless (*a*) the engineman of the following train should see the rear car in time to stop, or (*b*) the flagman of the train that had stopped should get off and go back and signal the oncoming train. As to the engineman, he might be prevented from seeing ahead by a curve in the line, or by fog or falling snow; and flagmen, from various causes, often fail to perform their duty. If trains follow one another at very short intervals and at high speed, a flagman may be unable to stop a following train even when doing his best. Knowing that the block signals are almost perfect, he will shirk the task as unnecessary, unless his devotion to duty is of the highest grade. The rules specifically require the flag protection (with both automatic and man-operated block signals) and thus theoretically provide against collision from any failure or wrong indication of the block signals, but the coincident failure of both the block-signal protection and the flag protection must be recognized.

At the same time it is fair to observe that these dangerous failures of automatic block signals are exceedingly rare. Collisions by reason of them are still more rare. One company reports that in a period of five years certain automatic block signals were operated 19,000,000 times, with only two dangerous failures. Other companies could give reports nearly as good, probably; but many of the roads say they have no satisfactory records.

The faults of enginemen respecting signals are largely susceptible of correction by rigid discipline. The more progressive roads have introduced "surprise checking," by which if an engineman has fallen into the careless and dangerous habit of assuming that a signal will be all right, and thus approach it at such high speed that he cannot stop when it is against him, he is detected and called to account. This is done by sending out inspectors to put the signal in the stop position when, so far as safety is concerned, it might be in the proceed position. There can be little doubt that of the seven collisions before referred to, most or all would have been prevented or greatly mitigated if this means of enforcing discipline had been in use.

On some single-track roads, where the telegraph block system has been introduced on the cheapest scale, a deficiency in the protection of train movements at the smaller stations appears also in another feature, namely, the use of a single signal opposite the tele-

graph office in place of two signals, one at the approach to the station yard and the other at the outgoing end of it. This single signal being used to stop trains which must, for convenience, stop with the engine several hundred feet beyond the signal violates the fundamental principle that the stop required by a stop signal must be either exactly at the signal or at some point short of it. While, with this single-signal arrangement, and with switches not interlocked, the block system is incomplete, the fact remains that by suitably modifying regulations and by good discipline, the block system still serves well in its chief function, the important and essential one of preventing collisions between stations.

Before leaving this branch of the subject, mention should be made of the necessity for interlocking. While many of the more important trunk lines are measurably well equipped with both block signals and interlocking signals, which may be called twin safety devices, there are many hundreds of miles on which the block system is used with a fair degree of success, although the interlocking is not complete.

The term "interlocking" is used to designate the arrangement of switches and signals at junctions and crossings by which the attendant is prevented from giving conflicting signals—from permitting trains on two or more converging or crossing lines to come into collision with one another and from giving any signal to pass over a switch until the switch is in a safe position. The signals are the same in appearance as block signals, but in their construction provision has to be made for indicating to a train not only that it may proceed but over which of two or more diverging tracks it is to proceed. If the switch at a junction or cross over is not suitably interlocked with signals, and with distant signals when necessary, the safe passage of trains past such switch depends on rigid adherence to regulations, and on the vigilance of the engineman; and if such a switch is situated within the limits of a block section, the block system is to that extent imperfect. The same is true of a crossing, where one railroad crosses another at grade.

If there are not suitable interlocked signals, which are made a part of the block-signal system, the signals of the block system give only a conditional right to proceed. Likewise a drawbridge, if not interlocked with the block signals, constitutes a break in the block system, which is not provided for except by modifying provisions in the rules under which the block system is worked. There are many lines on which there are both crossings and drawbridges, as well as numerous switches, which are not suitably equipped. At a drawbridge or a crossing in this condition, trains are required to come to a stop, thus providing against wrong movements by putting a rigid limit to the speed of all trains.

On roads where the side-track switches are not interlocked, which is the case at many of the smaller stations on some lines, the safety of trains as regards the danger of misplaced switches depends on the old rules and on a vigilant lookout on the part of the engineman. On such lines the block system is useful mainly in preventing collisions on the open road between stations.

LOCOMOTIVE CAB SIGNALS.

A locomotive cab signal was in use for some time (1902-1906) on the Harlem Line, partly in tunnel, in Park avenue, New York City. It is by this line that the trains of the New York Central & Hudson River and the New York, New Haven & Hartford Railroads enter New York City.

In this system the signal indications are given by colored electric lights in the cab. The circuits of the lamps are controlled by a relay similar to that used on the track circuit. At certain predetermined points along the line the circuit that includes the winding of the electro magnet of the relay comes into connection through the wheels of the engine and the rails of the track with an outside controlling circuit which in turn is controlled by the track relays or equivalent devices for the next block section ahead. As the train passes each of these points, if the block ahead is clear, the circuit of the relay on the engine remains unbroken and the lamp indicating "clear block," which has been burning since the last point for the actuation of the relay was passed, continues to burn, but if the block ahead is occupied the relay circuit is broken, the lamp indicating clear is extinguished, and the lamp indicating stop is lighted.

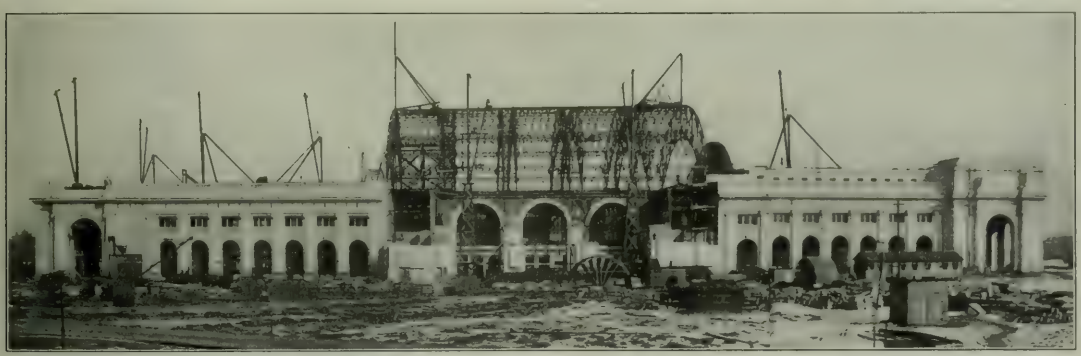
As applied on the Harlem Line the system was worked as an adjunct to the ordinary roadside block signals already in service. It is understood, however, to be designed for use without other signals, as a complete system in itself.

(To be continued.)

Progress of Washington Union Station.

The new Union Station of the Pennsylvania and the Baltimore & Ohio at Washington, D. C., and the progress of its construction has been described in the *Railroad Gazette*, December 4, 1903; January 15, 1904; June 3, 1904; November 11, 1904; April 21, 1905; April 13, 1906 (page 109, General News Section) and August 3, 1906. The last of these articles was a particularly full and detailed description of the progress of the work up to the middle of last summer. The advancement since that time may be seen by comparing the accompanying photograph of the main station building taken on Feb. 22, 1907, with the photographs in that article.

It is worth while to briefly review the main features of the undertaking. The cost of the new station and approaches will be about $20,000,000. The work is being done by the Washington Terminal Company, which is owned jointly by the Philadelphia, Baltimore & Washington and the Baltimore & Ohio. James McCrea, President of the Pennsylvania, is President, and Hugh L. Bond, Jr., Vice-President of the Baltimore & Ohio, is Vice-President. George W. Martin is Superintendent. The engineering departments of the two roads are represented by Robert Farnham for the Pennsylvania and W. F. Strauss for the Baltimore & Ohio. The site of the new station is just northeast of the Baltimore & Ohio passenger station and four blocks north of the Capitol. It will require little change of tracks to bring the Baltimore & Ohio tracks into the new station, but in order to give an entrance for the Pennsylvania a new branch has been built from Magruder, Md., on the present main line from the north to Washington southwest six miles to the new station. To connect the station with the roads to the south a tunnel has been bored under Capitol Hill connecting with the main line of the Philadelphia, Baltimore & Washington, and over it with the Richmond, Fredericksburg & Potomac. The present line between Magruder and the junction of this tunnel line is to be used for freight only.



Front View of Washington Union Station, Feb. 12, 1907. Granite and Brick Work in East Wing Finished; in West Wing 80 Per Cent. Finished.

The progress of the work may be summed up as follows: Most of the material for the plaza, and for raising the radiating streets to the new grade has been delivered. There have been 40,000 cu. yds. of masonry put in the foundation of the head house; 1,000,000 cu. yds. of clay, sand and gravel deposited on the site, and over 2,500,000 cu. yds. of material excavated during the past three years. Originally the station site was low, undesirable land, about 25 ft. above tide. This has been raised by filling to be nearly 60 ft. above tide with gently sloping approaches, insuring good drainage.

Severe weather this winter has greatly interfered with the general progress of the work which, along certain lines, has been at a standstill. On the station building, bricklaying and granite setting have been seriously delayed since the middle of December. The outside granite work of the east wing of the station is finished

and about 80 per cent. of the west wing in place. Less than 30 per cent. of the granite and brick work for the main entrance has been placed, due, until recently, to difficulty in securing base blocks from the quarries. All the interior granite work is finished except a little in the ticket lobbies. Most of the remaining granite has been cut and delivered and granite work should be finished within three or four months. There is about 250,000 cu. ft. of this in all, of which total about 80 per cent. is in place and about 75 per cent. on the site, making about 85 per cent. of the whole completed.

There are to be about 13,000,000 common, pressed and enameled bricks used, of which about 90 per cent. are in place. About the same amount of the 7,500 tons of steel in the head house is erected in place as against 75 per cent. in July; the remaining 10 per cent. belonging in the extreme west end of the building over the carriage porch and in the roof over the general waiting room. The height of the steel roof trusses over the general waiting room is about 120 ft. above the general floor level.

The ornamental iron work in the stairways, windows, doorways and large semi-circular openings in the general waiting room has advanced as fast as other conditions would allow, and is now 80 per cent. in place with additional fabricated material at hand. The carpentry and glazing work has not progressed as fast as the other work, but has been finished in the east wing as far as it was possible at the present stage of construction. The roof of the east wing is finished, except for some work on the skylights. The concourse and dome of the general waiting room are to be covered with concrete tiles which are being manufactured on the site at the rate of 1,500 sq. ft. a day. The copper and sheet metal work on the skylights and valleys is being put in position. The concrete slabs on which the concrete roof proper will rest are all in place, and waterproofing material has been applied over most of the area. The skylights in the concourse roofs are now being put in. Including finished roofs and labor in preparation of the roofing material, about 60 per cent. of this class of work is finished. Little work has as yet been done on concrete floors. This is due largely to the fact that small floor space was available before winter weather set in.

The laying of concrete floors and setting up of concrete partitions has been resumed with warmer weather. A complete system of conduits for electric wires is being installed throughout the station and concourse. This is about 60 per cent. done. About 90 per cent. of the ornamental terra cotta work and about 70 per cent. of the fireproofing terra cotta is in place. The heating, ventilation, plumbing and drainage systems are now finished except for installing fixtures which cannot be put in place until floors are laid. The foundations for most of the shelter sheds in the train yard have been laid and nearly all the drainage pipes put in. The cast-iron columns for about 30 per cent. of the sheds are on the ground ready to set up. The tracks on the low level have been laid and partly ballasted.

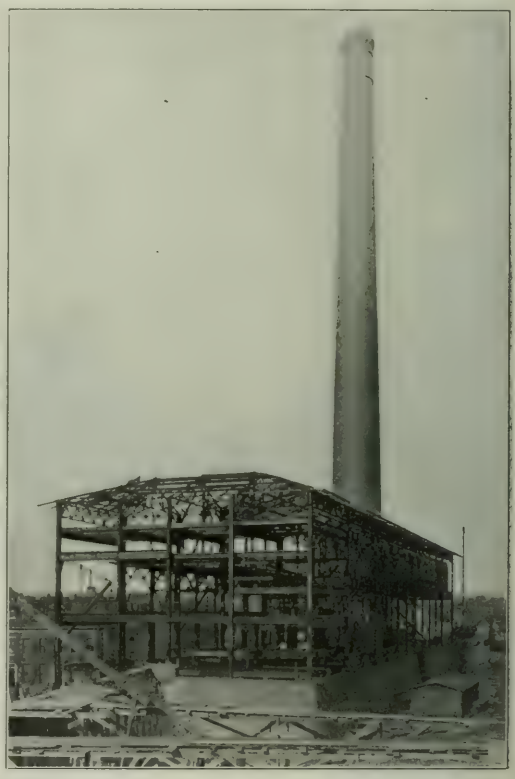
In the power house the structural steel is now almost all erected and all the heavy retaining walls and foundations finished. The masonry construction in the building proper has been started. Some of the machinery has been received and installation is well under way. The pipe work between the power house and the station and the express building is about 75 per cent. finished. The power house stack, 275 ft. high, shown in the accompanying photograph, is finished, except for placing in position the cast-iron draught flue. All express matter will be handled in a separate express building in which nearly all the heavy steel work is erected. The brick work in the south two-thirds of the building is 90 per cent. finished and nearly ready for the steel work in the roof.

On September 30, 1906, the traffic of the Baltimore & Ohio was thrown over to the new tracks between Langdon and New York avenues. Since then the gaps in the masonry walls, forming the limits of the terminal at I street, have been closed, except for a little masonry in the west wall between the inspectors' building and H street. The filling in this part of the work has been finished except for the space immediately east of the power house and the inspectors' building which, up to lately, has been occupied by contractors' material. The property owned east of the station has all been filled to approximately the newly established grades of the streets leading to the plaza.

The steel work in the New York avenue bridge has been finished and jacketing begun. The back wall and coping of the abutment have been finished and forms for finishing the west abutment back wall and coping are now being made ready. Little work has been done on the jacketing of steel during the past few months owing to the danger of damage to concrete by frost.

Construction of roundhouses and shops is well under way. The machine and blacksmith shop, 80 ft. x 145 ft., is all finished, except for applying the composition roofing, installing window sash and doors and putting down floor. One 25-stall locomotive roundhouse is completed except for a few engine pits, about half the roof, the brick cornice and putting in doors, windows and floor. The car repair shop is ready except for roof finish, doors, windows and floor. The steel work for the coal wharf and sand house is on the site and some foundations have been laid. The foundations of the oil house have been begun. The engine turntable pits have been finished except for putting in brick floor and setting wood curb on circle. The tables are both on the ground. The First street tunnel has been finished except for a small amount of track work and is ready for use. The putting in of special frogs and switches under the plaza is finished and ready for use.

To sum up, about 75 per cent. of all work on the station building has been finished, the proportion completed covering work which takes a long time, the remaining work that which can be done with speed. The filling of the plaza and the streets leading to it is about 80 per cent. completed, the remaining work being the filling of the space now occupied by the passenger tracks of the Baltimore & Ohio. This will be undertaken as soon as the B. & O. begins running trains into the new station, which will be during the present year. The filling of the north approach and train yard is about 95 per cent. finished, there being a little work still to be done east of the power house. The masonry construction on this part of the work is done. About half the track work on this section has been finished, including most of the special frog and switch work in the throat of the train yard. The grading for the coach yard, including roadbeds for the Washington and Metropolitan branches of the Baltimore & Ohio and the Magruder branch of the Philadelphia, Baltimore & Washington, is 90 per cent. finished, and about half of the tracks have been laid. Grading in the shop yard is finished and about half of the work on roundhouses and shops completed. Some 70 per cent. of the tracks in this locality are laid and ballasted.



Main Power House, February 22, 1907. 275-ft. Stack Finished. Structural Steel Nearly All Erected and Riveted. Stone and Brick Work Just Started.

Both Hamburg and Berlin trade representatives have asked the Prussian railroad authorities to arrange for the transportation of milk to the great cities in tank cars. The Hamburg people say that transportation in cans limits the field of supply to dairies within 100 kilometers (62 miles), which certainly is not the case in this country. But the rates on milk have more to do with it than the receptacles in which it is carried. Milk was brought from Denmark in tank cars for a little while a few years ago, but this was found to be illegal.

Track Deformations and Their Prevention.*†

BY G. CUENOT.

Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway.

IV.

DETERMINATION OF THE LENGTH TO GIVE TO CROSS TIES AND TO THE TAMPED BED.

After proving that the most advisable length for a tie for diminishing its flexure ought to be in the neighborhood of 7 ft. 2.64 in. I desired to determine the latter experimentally with wood ties of different lengths, tamped unequally, and placed on a level and on straight line, in order to avoid all chance of error.

SIDE TRACK AT BOURG-EN-BRESSE.

Mr. Ferry, Sub-Engineer of the P. L. M. Co., wished expressly to aid me with his counsels, and to build an experimental side track. This track, placed at the extremity of the cul-de-sac of the track for unloading animals at the station of Bourg, P. V., was isolated from the switching of that station, so that we could easily proceed with all the trials without being obliged to abandon them and then resume them, which causes the loss of much time and interrupts their course.

The ties on trial, wood, steel and composite, were always placed at the same point, about 6.56 ft. from the neighboring ties; the rail was raised up on it $^{25}/_{64}$ in. above them; thus the axle load, 13.22 net tons, rested entirely on the experimental piece. In order to avoid raising of the track at the extremity of the cul-de-sac, the extremity of the rails was loaded and held in place. A tent was set over the working place to completely shelter the track and withdraw it from atmospheric influences; in this manner, the ballast, formed of fine gravel, and the subsoil, were always found in the same hygrometric conditions. A tie was placed at the predetermined site, and at the aforesaid height, with reference to the neighboring cross ties; for there were buried in the roadbed in excavation, on both sides of the track, two strong stakes 4.92 ft. deep, and between them a rigid string was extended, in order to determine the position of the axis of the piece and the height of the rail.

The parts marking the surface of the tie in a free state were measured by means of the rule described, as has been explained in the preceding tests. Two readings were taken by means of the wedge gage provided with a runner, in order to be able to estimate the hundredths of a millimeter. The wood ties were provided, as before, with screws with square heads, invariably fixing the points of measurement; but in order to assure the horizontality of the wedge, there was placed in front of the first screws other similar screws provided with a notch for guiding it.

The vehicle, loaded with care with pieces of rails, weighing 26.46 net tons, was mounted on two axles; when the first reading was finished, it was brought close to the cross tie, at a point of the rail determined by the position of the wooden wedges. It was allowed to stand for an hour, and two readings were made on each point, as in the other tests. Each reading was controlled with care and checked by other experimenters when the difference attained two hundredths of a millimeter. The mean of the figures was taken, which approached consequently nearly to one hundredth of a millimeter. The vehicle was removed, the beam recovered, and the new position of its axis was ascertained by two new readings. The difference between the figures of the original position without load and of the position with load, gave the total sinking; the difference between the latter situation and the new position of the piece without load, determined the elastic sinking. The permanent sinking resulted from the difference between these figures. In Nos. 1 to 12 of Fig. 12, which displays these experiments, the full lines represent the position of the original axis and of the deformed axis; the dotted line, the axis after recovery of the beam.

The experiments were made with wood ties of different lengths with variable tamped beds, and with the composite tie and the steel tie of the state.

Wood tie 8 ft. 6.36 in. by 8.66 in. (Nos. 1 and 2, Fig. 12.)—We commenced with an oak cross tie well squared, 8.66 in. wide, 5.51 in. thick and 8 ft. 6.36 in. long. The tamping extended over its whole length. The beam was deformed under the load according to the curves in Nos. 1 and 2 of Fig. 12. Their form is convex, raised towards the center, with a tendency to uplift at the extremities, the pressure being less strong at those points. The sinking is more pronounced on the left side, .16 in. by .18 in., than on the right side, .154 in. by .173 in., by reason of the greater solidity of the subgrade. At the center it is only .10 in. and .12 in. The elastic upraising is greater in the first test than in the second, without doubt because the tamping had been more compact; it attains, in fact, .91 in. in the first case and .06 in. second. The greatest compression is found on the exterior side of the rail (first test .185 in., second test .18 in.), which is explained by the reaction of the ballast, which rights the cross tie and inclines it towards the extremities.

Tie 8 ft. 6.36 in. by 8.66 in., tamped at the end at 15.75 in. each side of the rail. (No. 3, Fig. 12.)—The same tie, tamped at its extremities and at 15.75 in. on each side in the interior, served for this test. The tamping was limited by two angles fixed to the bottom of the tie at the extreme points of the tamping. The form attained is that of the basin observed at St. Etienne-du-Bois; the bottom is slightly raised in comparison with the left side; the extremity of the right, resting on a more solid foundation, is raised more. The compression is maximum in the interior of the track; the sinking attains .185 in. to the left and .18 in. to the right. The elastic uplift has taken place according to a slightly concave curve, like that which is generally observed at the working places of cross tie renewals. It is sensibly equal to that stated above, about .063 in., the mean permanent sinking being .106 in.

Tie 7 ft. 6.96 in. long, tamped over 15.75 in. on each side of the rail. (No. 4, Fig. 12.)—The same tie reduced to 7 ft. 6.96 in. and tamped over 15.75 in. on each side of the rail was the object of a test. The tamping was limited as above by angles. The curve took the form of a basin more flattened than the preceding, with raising in the central part, the pressure tending to be distributed equally over the ballast. The total sinking is less in consequence of this fact; it scarcely reaches .150 in. while it exceeds .18 in. in the preceding case. The elastic uplift is consequently a little less. The maximum pressure is exercised in the interior and near the rail.

Tie 7 ft. 6.96 in. long, with tamped bed 15.75 in. and 21.65 in. (No. 5, Fig. 12.)—This tie, 7 ft. 6.96 in. long, was unsymmetrically tamped 15.75 in. at the extremities and 21.65 in. in the interior. The total sinking is not greater than in the preceding case; the pressure is distributed; the center is raised up, being little more than with the symmetrical tamping, which depends on the fact that it is naturally more supported. The elastic uplift is made as above; the beam is righted so to speak parallel with itself.

Wood ties 7 ft. 3 in. long, with tamping 13.78 in. on each side of the rail. (No. 6, Fig. 12.)—The same tie, reduced to 7 ft. 3 in. long, was tested with two different repetitions with a symmetrical tamping 13.78 in. long on each side of the rail. The curvature of the elastic line diminishes (No. 6, Fig. 12); the beam is lowered, so to speak, parallel with itself. The pressure is equally distributed over the ballast. The total sinking seems greater, which holds with tamping which has been more or less condensed; but the elastic uplift, which is only to be considered, is nearly the same, to some tenths of a millimeter.

Wood tie 7 ft. 0.6 in., with unsymmetrical tamping. (No. 9, Fig. 12.)—The unsymmetrical tamping of this same tie, which is 7 ft. 0.6 in. long, because it was effected over 12.6 in. at its extremities and over 14.96 in. towards the interior, raises the preceding curve toward the center, a curve which is convex at the middle and inclined towards the extremities.

The pressure is exercised more towards the exterior, for the reason that the beam is sustained on the side of its center; it is distributed, however, better than in the first cases examined; the total sinking is always nearly the same as the elastic uplift. The latter preserves the same value approached after a second test. The beam returns parallel with itself.

Wood tie 6 ft. 11.04 in., with unsymmetrical tamping. (No. 8, Fig. 12.)—This tie was 6 ft. 11.04 in. long, with an unsymmetrical tamped bed of 11.81 in. at the extremities, and of 15.75 in. towards the center. It takes a convex form under the load, as in the preceding test. The maximum sinking, very pronounced towards the extremities, is more important because the latter have been brought more closely to the point of application of the pressure. The elastic uplift is the same, and is made nearly parallel to the axis of the deformed beam. After three successive tests, the second after two hours, the third after four hours, the lowering has scarcely increased; the beam is always deformed parallel with itself and the elastic uplift remained what it was after the first test.

COMPOSITE TIE.

(No. 10, Fig. 12.)

The composite tie behaved as in all the earlier experiments; it was lowered nearly parallel with itself without apparent deformation. It reascended the same. The total sinking is nearly the same as for the wood ties; the elastic uplift is also the same. The beam is righted according to a plane slightly inclined on the side where the earth was the more solid.

METALLIC TIE, STATE STANDARD.

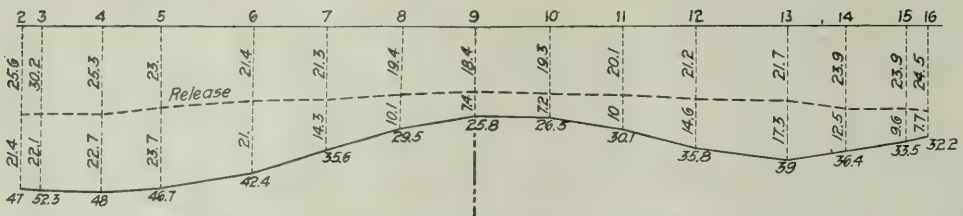
(Nos. 11 and 12, Fig. 12.)

The metallic tie of the state system was tested with two tamped beds, the first over its entire length, the second over its breech, and 15.75 in. long in the interior of the track.

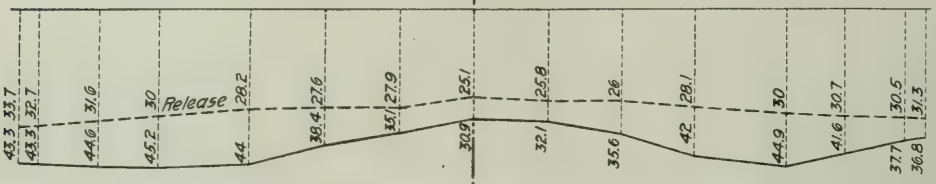
In the first case the deformation has occurred in a very irregular fashion, following a convex form in the center with the ordi-

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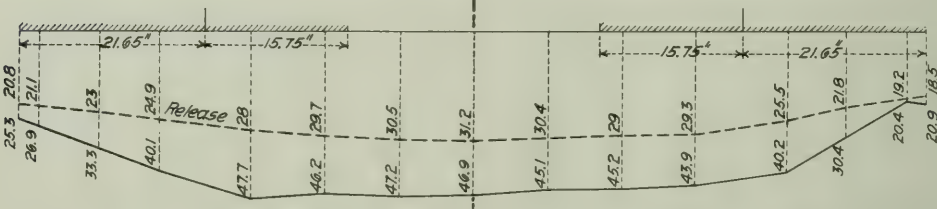
†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.



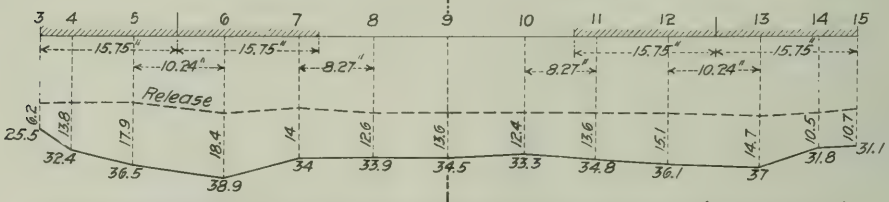
No. 1—Wood Cross Tie of 8.53 ft. x 8.66 in. Tamped for its entire length.



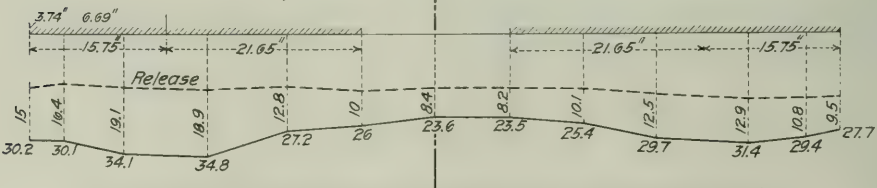
No. 2—Wood Cross Tie, of 8.53 ft. x 8.66 in Tamped for its entire length.



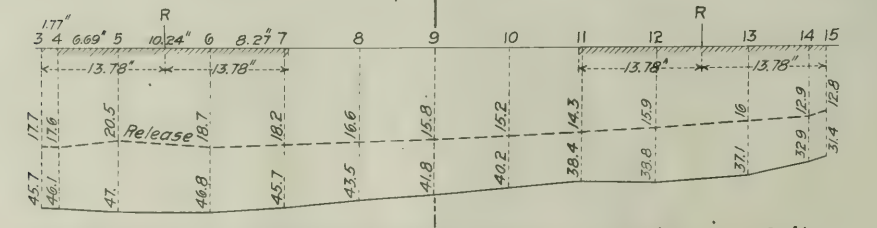
No. 3—Wood Cross Tie of 8.53 ft. x 8.66 in. Tamped at end and for 15.75" on each side, in the Interior.



No. 4—Wood Cross Tie of 7.58 ft. length Tamped for 15.75 in. on each side of the Rail.

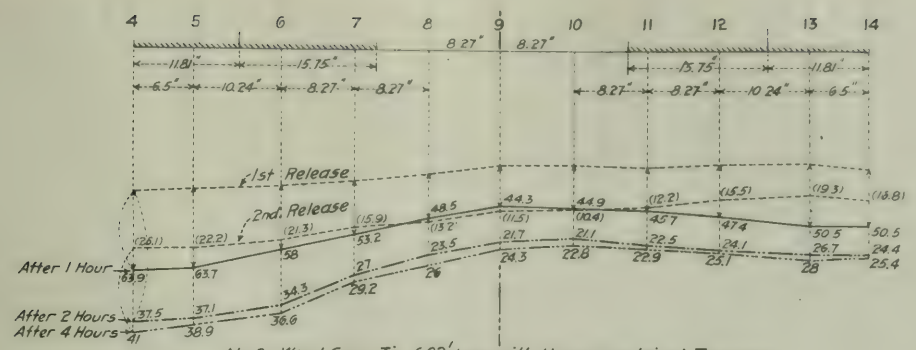


No. 5—Wood Cross Tie 7.58 ft. long Tamped for 15.75 in. and 21.65 in.

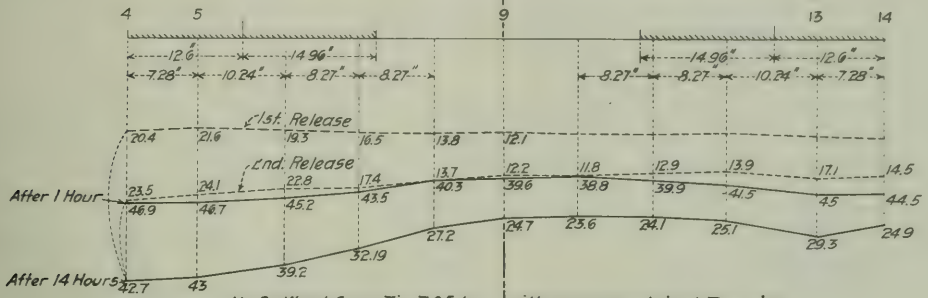


No. 6—Wood Cross Tie 7.25 ft. long Tamped for 13.78 in. on each side of the Rail.

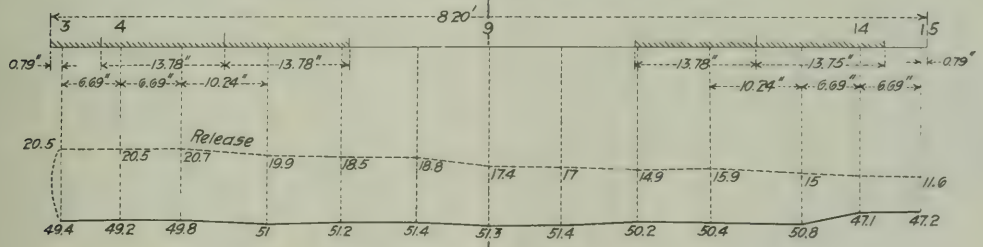
Fig. 12.



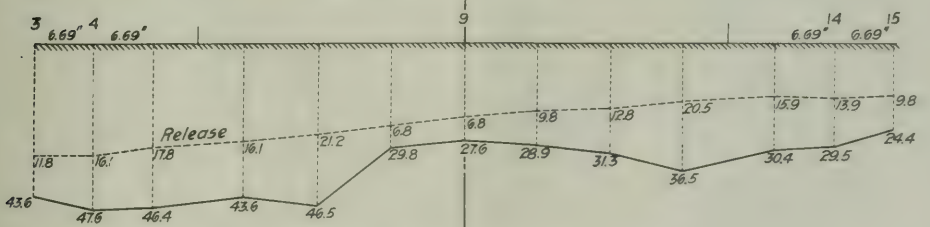
No. 8—Wood Cross Tie 6.92' long with Unsymmetrical Tamping.



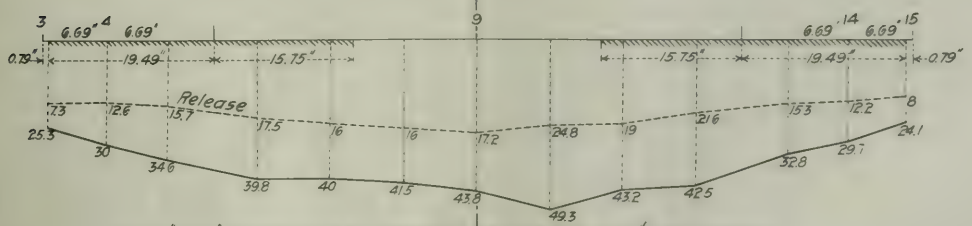
No. 9—Wood Cross Tie 7.05 long with Unsymmetrical Tamping.



No. 10—Composite Cross Tie.



No. 11—"State" Metallic Cross Tie Tamped for its entire length.



No. 12—"State" Metallic Cross Tie Tamped at the Ends and 15.75" in the Interior.

Fig. 12 (Continued).

nary sinking; the beam is uplifted according to a plane inclined to the left. It seems, at first sight, to have no very regular resistance in all its sections, and te be bound to be deformed quite rapidly.

In the second case, the curve is more regular and is concave towards the center. The beam is righted according to the profile of a catenary, which ought to give it in time a permanent deformation and produce a diminution of the track gage.

SUMMARY OF EXPERIMENTS.

In all the experiments which have just been related, the relative sinking of the ties with each other has not been sought for, since that question was solved on the main track from Bourg to Saint-Amour, and since the necessity for a tamped bed, executed in a more or less firm manner, in one test or the other, and, as a consequence, irregularly settled, render all comparison illusory.

But the following points should be retained from the study which has been made:

(a) The long ties, 8 ft. 6.36 in. to 7 ft. 6.6 in., take, under the load, the form of a basin, with the bottom slightly raised in the center.

(b) The short ties, 7 ft. 0.6 in. to 6.5 ft., are deformed according to a curve, convex or otherwise, and inclined toward the extremity.

(c) The ties between 7 ft. 0.6 in and 7 ft. 2.64 in. are lowered parallel with themselves without sensible curvature.

(d) The unsymmetrical tamping raises the curve towards the center; a very feeble lack of symmetry reacts very clearly in this direction.

(e) It is possible, then, by increasing the rigidity of a cross tie, notably by concentrating the material about the supports, to reduce its sinking to the quantity which is intended as a limit, and its flexure in such measure as one would wish.

(f) The permanent sinking of the ballast is variable according to the case, but the elastic sinking, the only one there is reason to consider, is, so to speak, constant, whatever be the length and type of the cross tie adopted. The deformation is slowly produced and augments with time.

DYNAMIC EXPERIMENTS.

Main track No. 2, from Mouchard to Bourg.

The results obtained under moving loads, at the passage of several trains traveling with different speeds, have always been the same, comparatively, as those obtained in the static state. They are always less, from 10 to 20 per cent., than the latter, and the difference observed between the flexure of the wood ties and of the composite ties supporting the same rails is maintained, the latter being less deformed, and sinking less than the former. The reference marks were at first placed at 5.12 in. on the interior of the two rails, points where the maximum deformation in the static state is produced, then on five points equally distributed over the length of the pieces. The figures have always been found less than those of the static state (the mean .05 in. for ties of wood, .035 in. for composite ties); the composite tie descended parallel with itself, while the wood tie is deformed according to the curves described above.

All the experiments which we have made, as well as those which have been previously realized by Mr. Ferry, lead to the same conclusion; dynamic actions produce less effect than static actions; in order to obtain the maximum deformation, it is then sufficient to examine what occurs in the static state.

The apparatus for measurement, which is very simple, and disposed in such a manner as not to be influenced in the course of the trial, cannot be considered faulty. The rod which sustains the spring is buried to 4.92 ft. in the soil; it should be able to rise up vigorously under the load, which would increase the bending figures, but it cannot descend under that influence. As to the spring, it will not grip against the glass plate, but it will slide against it. Besides, Mr. Ferry has shown that the figures of deformation were the same in the static state, whether they be observed by means of the rule or by means of the spring register. The results obtained under a moving load ought, then, to be considered as exact.

It is necessary, then, that the dynamic actions be exercised with less intensity than the static actions. There is, we believe, a law which ought to be nearly general, except in certain particular cases. The deformation of the material is made slowly, and as much more slowly as the latter is more rigid, and as the mechanical actions take place in a short time. A spring registers slowly the forces to which it is submitted; at the same time, preserved from their effect, it is distended no less slowly, and retakes its primitive form in a time of definite duration. One can walk without leaving an imprint on a moving soil of weak consistency, when walking rapidly; the deformation has not had time to be produced. If, on the contrary, one stood still on the same soil, the latter would be deformed more or less rapidly, according to its degree of resistance.

All the known facts confirm this law of deformation, which can be considered as general. Without doubt, it is admitted that in metallic work, dynamic actions increase static actions by 70 per cent.; but that does not weaken in any way the law which we have derived from these experiments.

The tie on which the flexure has been studied does not take the proper deformation which it should have under the action of loads, but it undergoes that of the ballast, which serves for its support, and of the bed of the ballast. It results that its deformation is limited by that of the material which sustains it. This material acts on the tie after the manner of a powerful spring, which slowly registers the forces which it receives, and which does not attain to registering them completely when they arrive in too short a time. In particular, the shocks which are the consequence of dynamic actions, and which are only susceptible of increasing the flexures in the static state, cannot produce this effect, because they act in too short a time for influencing the spring.

It is not the same as a piece of metallic work, which, not being sustained, obeys all the vibrations it receives, and which are so much the more intense as they are due to a more violent and shorter shock. Such is the chord of an instrument, which, taut, enters into vibration under an instantaneous influence, for example, the sound rendered by a neighboring instrument. Shocks have thus an important action on a metallic floor, which registers them by reason of its situation and their instantaneousness; but they have not any on a piece sustained by an elastic material but reacting by its mass after the fashion of a spring. It is possible that the materials of the track, the rails, for example, do not obey this last law, but the experiments made up to this time permit of no conclusion either in one direction or the other.

LATERAL MOVEMENT.

Apart from the transverse movement, which we have just been studying, the track is submitted to a lateral movement, which is explained as a sliding movement, and often causes derailments. Weber has determined the maximum values of the sliding movement of the track which are produced in the course of normal traffic. His tests have demonstrated that in alinement it produces displacement which may reach ⅛ in. for the base of the rail, and .28 in. for the head.

Engesser has proved that it would suffice for main tracks, to take 0.15 to 0.25 G (G load on wheel) as the ordinary value of the horizontal force.

But if the greatest vertical pressures on the track are produced by the overloaded axles, the greatest horizontal pressures are due to the unloaded axles. The latter have their greatest effect when the ballast is the most unsettled, that is to say, when it has just been changed or renewed.

It was then placed under the most unfavorable conditions; the experimental ties were arranged as follows: Wood ties and steel ties in a switching track at the Bourg station. They were isolated from the neighboring ties, either by superelevating them and removing the plates from the neighboring pieces, or again by withdrawing the latter from the track (Nos. 1 and 2, Fig. 13); in this manner it was certain that the cross tie under experiment alone sustained the weights which were placed on it. Besides, the shoulder plate of the cross tie under experiment was replaced by an ordinary flat plate, and the screw spikes were withdrawn so that the cross tie could slide under the rail, but in order to diminish the friction, the surfaces in contact were greased.

This done, the tie was pushed, being thus rendered independent, and without load, by means of the Collet déclimèter, installed, on the one hand, against the extremity of the piece, and on the other hand against a very solid wall. Then the same tie was loaded by means of an axle of 6.61 net tons, and the experiment pushed in the two cases up to the moment when a displacement of .8 in. was obtained, at which the track can be considered as out of service.

The results of these experiments are given in the table below:

	For a displacement of .8-in.	
	Without load.	With load.
Composite tie, in the free state	From 4,189 to 5,291 lbs.	15,212 lbs.
Wood tie, in the free state	220 lbs.	11,684 "
Steel tie, in the free state	1,102 "	7,496 "

The composite tie offers a resistance 24 times greater than that of the wood tie when it is not loaded, that is to say, when this resistance presents its weakest value. When it is loaded with an axle of six metric tons, its resistance to sliding is still greater by nearly 3,307 lbs. than that of the wood tie. This is not true of the steel tie; the latter, at first more resistant than the wood tie, not carrying any load, becomes less under the load, which appears to arise from the less friction of the ballast against the metallic body.

If only the two ties, respectively the wood and the composite one, are considered, it is observed that their resistance to sliding being respectively about 220 lbs. and 4,409 lbs. without load, there remains for the resistance under the load of 6.61 net tons, 11,464 lbs. for the first and 10,802 lbs. for the second. The friction which operates against the sliding is thus proportional to the weights and not to the frictional surface or the substances having the same adherence with the ballast. Mr. Ferry has found that for wood ties this resistance varies from 50 to 80 per cent. of the overloading, 50 per cent. when the pieces are smooth, freshly creosoted, 80 per cent. on the contrary when they are rough, and when the superficial layer of creosoting has been cut by the rubbing against the ballast. He has equally demonstrated that the addition of angles

under the cross tie, in a word of projections able to give support against the ballast, sensibly increased the resistance to sliding by about 20 per cent. of the overload.

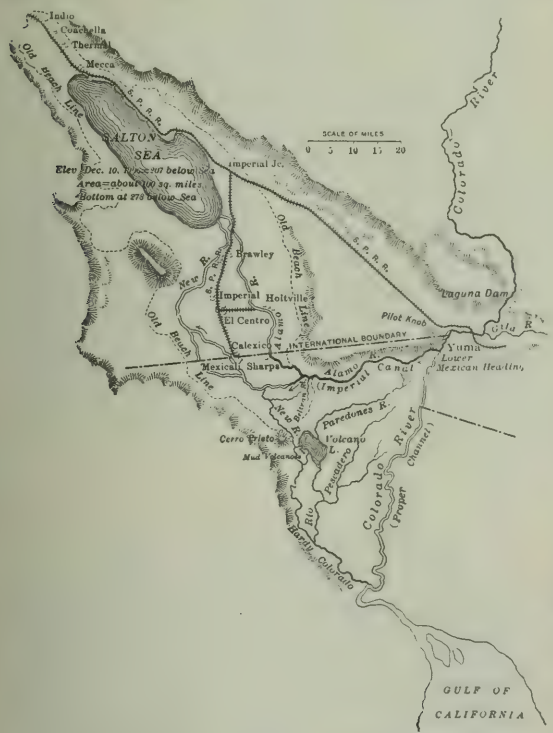
In the particular case, the wood ties being experimented with, having been placed for a long time in the track, ought to offer a maximum adherence; the coefficient reached 80 per cent. of the overload, that is to say, about 10,582 lbs., nearly the figure given above, 11,464 lbs. For the composite tie placed in the track at the same moment of the experiment, the adherence was not great, scarcely 60 per cent.; it was then 7,937 lbs., to which it was necessary to add the 20 per cent. due to the cross bars, 2,646 lbs. The total resistance would thus be, theoretically, from 10,582 lbs. to 220 lbs., near the figure obtained. The observations of Mr. Ferry are then completely confirmed.

Again, it ought to be remarked that the thickness of the cross bar or of the roughness ought to be relatively small, to have its full efficiency. A centimeter of protuberance suffices and it is easily conceived, for the tamped bed has no compactness, and only offers consequently resistance in its upper part. The maximum useful effect is thus produced on the surface of the ballast; an increase in the relief of the cross bars does not produce an increase in the resistance. That results from experiments made by the P. L. M. Co., and explains the results which have been found with a tie provided with cross bars.

(To be continued.)

The Lower Colorado River and the Salton Basin.*

Early in 1905 it became apparent that the Colorado river would change its low-water course; that it would thereafter send its low-water flow and a part of its flood volume inland into the Salton Basin instead of oceanward into the gulf of California. The point



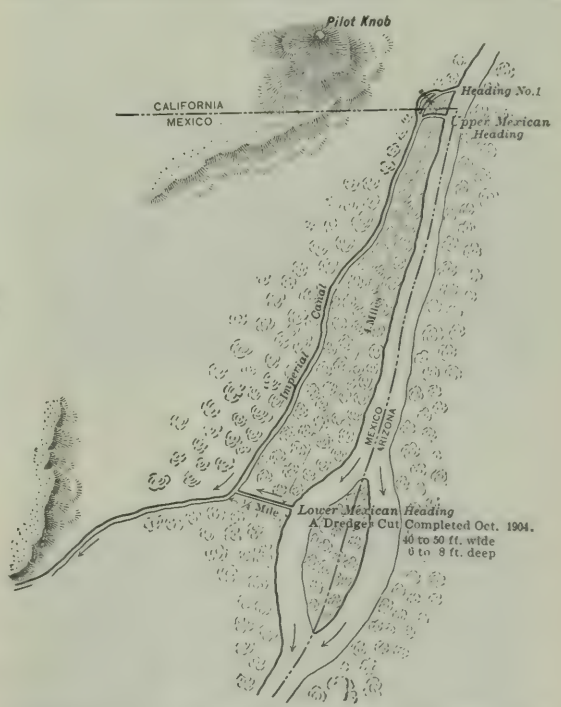
Lower Colorado River and Salton Basin, October 1, 1906.

in Mexico where the canal company (the California Development Co.) made the diversion which threatens to become the permanent river channel is about four miles south of the boundary line between California and Mexico. In the spring and summer of 1905, the Colorado river—in lower California at this point, which is some 12 miles below Yuma—enlarged a small artificial channel or cut which connected the river with the Imperial canal, and also enlarged the canal to such an extent that this so-called canal heading and the canal became the river's low-water channel. The river, in November, 1905, during a flood stage, made this heading and portions of Alamo and New rivers and certain sections of the canal its main channel. The river thereupon flowed inland for a year, discharging into the Salton sea instead of holding to its original southerly course with discharge into the gulf of California, where it belongs, and where its waters have gone for centuries. The river was turned from this inland course on November 4, 1906, but could be held in its proper channel only until December 7th, when the protection works gave way. The river is again flowing into the Salton sea. The Salton sea is the water of the Colorado river which has accumulated in California in the bottom of the depression known to geographers as the Colorado Desert.

The canal, which for the present has become a river, was built for irrigation of lands in California in the Imperial Valley, as the southern portion of the Salton Basin is called. The original water diversion from the Colorado river, by the California Development Co. was made in the southeastern corner of California within a few hundred feet of the international boundary; but the operations which led to a change of the river's course were entirely in Mexico, and are presumed to have been conducted under concessions granted by that country.

A continuation of the inland flow of the Colorado river would in time bring disaster to the Imperial valley. It would further damage the property of the Southern Pacific, which has already sustained great financial loss, and would ultimately ruin all improved lands in the Salton Basin as well as the lands along the lower sections of the Colorado river. It would modify or destroy the irrigation possibilities along this river below its canyon.

"Salton Basin" is the name applied to the region in southeastern California and northern Lower California which will ultimately be submerged if the Colorado river continues to discharge inland instead of into the gulf of California. This region extends northward to a point a few miles beyond Indio, and toward the south overlaps the international boundary some 15 to 20 miles. The length of the basin which is thus threatened with submersion is about 100 miles from north to south; its surface area is about 1,950 square miles, and its mean width nearly 20 miles. The lowest point of this basin, at the former salt beds, now more than 70 ft. under water, is 278 ft. below sea level. The rainfall in the country adjoining this great depression is so slight—only a few inches a year—that practically no run-off reaches its lowest points. All the water now there, covering more than 400 square miles, is inflow from the Colorado river.



Colorado River and Imperial Canal Headings in Spring of 1905.

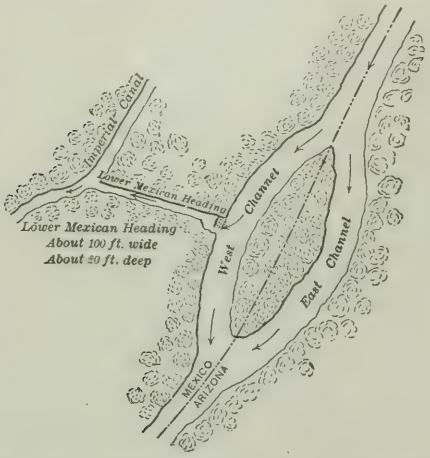
The Southern Pacific about 1876 built its main line across this depressed area, dropping to a lowest point near Salton, about 265 ft. below sea level. Its main line, from a point several miles north from Indio to near Flowing Well, some three miles east

*Presented by C. E. Grunsky, M. Am. Soc. C. E., March 20, 1907, before the American Society of Civil Engineers, and published in the *Proceedings* for February, 1907, page 102, Vol. XXXIII., No. 2.

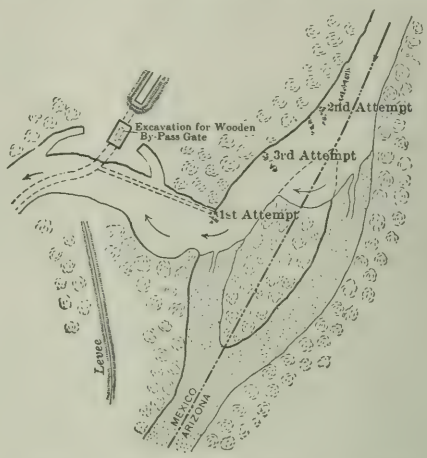
from Imperial Junction (formerly Old Beach), is below sea level. In January, 1905, the population of Imperial Valley was 10,000. Calexico is at sea level, Imperial about 60 to 70 ft. below sea level, and Brawley about 110 ft. below sea level. The surface of Salton sea is now about 207 ft. below sea level. The rise of the water, therefore, would have to be about 90 ft. before the country near Brawley would be inundated.

The canal system was not planned for such unforeseen flood conditions. Structures were inadequate to safeguard properly the supply to the canals. Constant vigilance was required to keep out the undesirable flood, and to keep, in the canals, an adequate supply for the needs of the irrigators. In fact, many critical periods have been passed. Any untoward accident at Sharp's Heading during the flood stage of the river would have made the entire Imperial country untenable. An accident there, such as a wash-out of the waste-gate, which drops water some 20 ft., would have deprived the canal system of water—a serious situation for a region in which even the water for domestic use is supplied by the canals.

The topographic features of the country make it plain why all this has happened. The river, like all turbid streams, is still building up the alluvial country through which it flows. It drops some of its silt wherever it sends its water. At flood stages, when there is overbank flow, the rate of silt deposit is most rapid near the river. The frequent inundation of the bank lands adds to their elevation more than is added to land farther away. Therefore, here, as should be expected, the land slopes away from the river. The Colorado river flows southerly in a direction in which the general fall of the ground surface is only about 1½ ft. per mile, which the river in its meanderings cuts down to an effective fall of about 1 ft. per mile. Toward Volcano lake, southwest from the river, the general surface gradient is 2 ft. or more per mile; and westward, in the direction paralleling Alamo river, it is nearly 3 ft. per mile to a point near Calexico. Thence northward into Salton Basin, on lines of greatest slope, the country falls away at the rate of from 4 to 5 ft. per mile. These gradients, which are cross-country gradients and do not show the fall of the water surface following the meanderings of the several watercourses, make it plain that the river while flowing inland must cut deep into any yielding material. Its proper fall was about 120 ft. in its course from Yuma to the gulf, 80 miles distant, whereas it now falls some 325 ft. to the Salton sea which, in the general direction of the water's flow, is only from five to ten miles farther removed from Yuma. The excess of energy represented in these figures has been largely expended by the river in deepening and enlarging its new bed.



Colorado River at Lower Mexican Heading of Imperial Canal, June 23, 1905.



Colorado River at Lower Mexican Heading of Imperial Canal, March 19, 1906.

The canal of the California Development Co., as originally built in 1899, had its head in California about 100 yds. north from the international boundary. Silt accumulations in the head of the canal interfered with its successful operation, and water shortage resulted in the Imperial valley in the fall of 1903, and continued throughout 1904. On application to the Mexican government a concession was granted which made it possible to construct the works which in operation have proven so disastrous. The original canal was carried from California into Mexico, and paralleled the river for a distance of about 4½ miles, being at no point much more than one-quarter mile from the river bank.

There was built just south of the international boundary a cut less than 100 yds. long from river to canal, also a second similar connection about four miles south of the boundary line. Neither of these connections between river and canal, commonly referred to as the Upper and Lower Mexican headings, was provided with regulating gates. Both were simple dredger cuts of moderate depth and width. The Upper Mexican heading, like the original canal head in California, showed a pronounced tendency to silt up. The Lower Mexican heading, on the contrary, which came into use as



Lower Colorado River, Showing Location of Dam Which Turned the River Into Its Proper Channel, November 4, 1906.



Lower Colorado River, Showing Condition on December 12, 1906. Break in Levee Came at 3 A. M., December 7th.



Alamo River at Holtville Railroad Bridge, August 1, 1906.



By-Pass at Lower Mexican Heading of Imperial Canal, August 26, 1906.



The Barranca of New River at Mexicali, September 1, 1906.



The Barranca of New River Five Miles Northwest of Imperial, August 31, 1906.



Ruined Field Near New River, About Four Miles Northwest of Calexico, September 2, 1906.



Sunset Across Salton Sea. From New Salton Railroad Station, August 29, 1906.

a channel from 40 to 50 ft. wide and from 6 to 8 ft. deep, had sufficient fall from river to canal (reported at upwards of 1.5 ft. in about 1,300) to give the water a scouring velocity. The bed of this heading was enlarged by the flow through it, but this, at first, caused no alarm. Large canal capacity was desirable, and natural erosion of the channel would reduce the ultimate cost of construction; but soon a time came when the progress of this channel enlargement was too rapid, and measures had to be taken to shut off the flow at the intake. The canal company being in financial difficulties in June, 1905, direction of the work of checking the excessive flow was assumed by the railroad officials. The situation in parts of the Salton Basin had in the meantime become serious. The rising waters were at the base of the railroad embankment (end of June, 1905), and it was only a question of a few days before the roadbed for many miles must be abandoned. Quick action, and an early check of the inflow of water would save the railroad great expense. Strenuous effort to accomplish this result, therefore, was justified, and led the railroad company to extend financial aid to the canal company.

All the time (summer, 1905), even while the river was falling, the volume of water presented for passage into the Salton sea kept increasing. The lower heading, in the latter part of June, had been widened to 100 ft. or more, with a depth of about 20 ft. It was then discharging about 7,000 to 8,000 cu. ft. per sec., and it was but a short time before this flow was doubled. It became evident early in July that, if not checked, the river would make the Lower Mexican heading its low-water channel. Not only did the river do this, but it increased the canal capacity to such a degree that the canal during the flood stage of November and December, 1905, became the main channel of the river.

In the fall of 1905, after several failures, an attempt was again made to force the entire river into a channel east of an island in the Colorado river opposite the Lower Mexican heading. This island was narrow, and about a mile long. The point at which the attempt was made was about 1,000 ft. below the head of the island. Here the construction of a dam with a broad brush mattress foundation was undertaken. Mats of brush 100 ft. wide in the direction of the stream, were placed from bank to bank across the western channel of the river. Piles were driven in three rows through these mats, which were about 18 in. thick, and more brush was woven between these piles. This work is reported to have been making fair progress, notwithstanding a stage of the river considerably higher than the ordinary stage for that time of year, when the unexpected happened. A flood occurred on the Salt and the Gila rivers, and a tremendous volume of water was suddenly discharged into the Colorado river at Yuma. In a few days the river rose from a low stage to become a raging torrent with a maximum discharge, on November 30th, of more than 100,000 cu. ft. per second. This water overtopped the island. It cut around the eastern end of the incomplete dam and tore away the head of the island. It quickly cut the heading to a width of several hundred feet and gave it all the appearance of a permanent section of the main river.

Throughout 1906 the river has been continually at higher stage than normal; the monthly discharge for each month is nearly if not quite equal to the maximum monthly totals ever recorded, and the aggregate discharge has been more than twice as great as the river's normal annual flow. Preparations were made for a supreme effort to stop the flow at the lower heading during the expected moderate and low stages of the river in the late fall of 1906.

A spur track about six miles long was built in August from near El Rio to the Lower Mexican heading. A large force of men was assembled, and all the facilities at the disposal of the railroad were called into requisition. The importance of rapid work was thoroughly appreciated. Brush mattresses were placed successfully across the 600-ft. opening in which the river was to be held, and in which its waters were to be gradually raised by obstructing its flow with brushwork and rock. Two trestles were built across the stream, facilitating the rapid delivery of material. This work was making favorable progress, and a fair proportion of the river's flow —still far above normal—was already passing through the timber gate when, on October 11th, this gate suddenly gave way. It broke in two and its northerly half floated away. Although the situation looked hopeless, there still remained a chance of dropping rock, into the new branch of the river thus opened, faster than the water could undermine and bury it. Orders were issued to all quarries within some 400 miles to load cars with large rock, and locomotives were pressed into service to rush the loaded cars to the work. Night and day the material thus obtained was dumped into the waterway. In the meantime the rock fill, already well advanced in the main channel of the heading, was lowered by rolling rocks from its crest, thereby increasing the flow over this barrier and reducing the flow in the by-pass channel. This operation was successful. The by-pass was completely closed on October 27th, and the dam in the main arm of the heading raised to full height, the difficulties decreasing as the volume of flow down the river's proper channel gradually increased with the increasing height of water surface. When finally the water surface had been raised 14 ft., the entire flow of the river was in the original channel. The river was thus completely turned on November 4th.

It had been foreseen by the engineers that the deterioration of the river channel below the Lower Mexican heading, which had occurred during the year in which the river flowed inland, would result in higher water surface elevations than had theretofore prevailed. Earth dikes or levees, therefore, were extended up and down stream from the rock dam in the canal heading. These were made 10 ft. wide on top, and had side slopes of 2 to 1. They were built of material taken from borrow-pits on the canal side.

During the last days of November and early in December heavy rains on the headwaters of Gila river sent a freshet flow down this stream, which reached its maximum at Yuma on December 7th. The water rose to 26.2 ft. on the gage at that point (about 7 ft. above low water), and the river's flow had been increased from about 10,000 to a maximum of 56,000 cu. ft. per second. A levee had just been built from the rock dam in the canal heading up and down stream. It was found that the porous material on which this rested would allow considerable underflow. There was a concentration of such underflow at a point about one-half mile south of the rock dam, and the water quickly cut a passage into which the levee collapsed. This occurred early in the morning of December 7, when the water stood about 3 ft. deep against the levee.

The break in the levee rapidly widened to 800 ft. The waters flowed north toward the canal heading, and dropped into the channel from which the river had so recently been turned. The flow along the levee could not be withstood, and soon another section, some 500 ft. long, nearer the rock dam, was cut away. Within a few days the river had cut a channel through the yielding bank deep enough to put its entire flow back upon its inland course. The entire flow of the Colorado is again concentrated in the watercourses which lead into Salton Basin. [According to our records this break was closed at 6 p.m., February 11.—Ed.]

To illustrate the progress of the change from the river's proper course to its inland channel the original lower heading in October, 1904, had a width of from 40 to 50 ft. and a depth of from 6 to 8 ft. It had been enlarged to a width of about 100 ft. and a depth of about 20 ft. by the end of June, 1905. It had become the main channel of the river in December, 1905; was from 300 to 600 ft. wide in March, 1906, and more than one-half mile wide at some points in June, 1906. Subsequent to June, 1906, during its falling stages, the river built out sand bars from the northern bank of the cut, and soon thereafter had concentrated its water in a channel generally about 600 to 800 ft. wide, the south bank of which was from 3,000 to 4,000 ft. from the original north bank of the canal heading.

The immense energy of the spring flood of 1906 which poured into Salton Basin was not long in cutting great barrancas some hundreds of feet wide and from 40 to 80 ft. deep, into the alluvial soil of the Imperial Valley. The upper lip of a barranca of this kind on New river was at a point due west from Imperial on March 15th. In two months it traveled up stream some 15 miles to within a short distance of Calexico. It is reported to have progressed over parts of this distance nearly a mile in a day. Opposite Imperial, at the beginning of the year, the river was in a slight depression, practically on top of the ground, but in August it was a chasm 80 ft. deep and upwards of 1,100 ft. wide. Near Calexico the cutting of the barranca approached dangerously close to the town. It took some of the railroad land, all the railroad improvements at Mexicali, and many of the adobe buildings of that town, and left the remainder of these towns some 40 ft. above the plane of the river's water which, but a few days before, had covered the surrounding country 4 or 5 ft. deep and had threatened destruction by inundation. It has been estimated that from 400,000,000 to 500,000,000 cu. yds. of material have been thus excavated by the river water and "ground-sluiced" into Salton sea.

Not only has the river been carving out the great barranca above described, but, throughout the course along which the water flows from near Pilot Knob to New river, the swirling waters have deepened the channel here and widened it there until a broad continuous channel has taken the place of the original poorly defined channels through miles of mesquite thickets. Month by month, as channel capacity has thus increased, the river has burrowed deeper into the ground at the critical point, at the Lower Mexican heading, and thus, as time went on, the height that water must be raised to send it down the proper channel has increased. At the same time there was a deterioration of the proper river channel below the heading. The last of the water taking that course built up sand bars for some miles down stream, and these, temporarily at least, are in the way of the restored flow. The growth of weeds and willows in the river-bed while dry is a further unwelcome obstruction. In the spring of 1905 the water surface was already so low in the new river channel that a waste-gate in the south canal bank, some eight miles from the Colorado, had been left high in the air. The water was too deep in the ground to continue to flow into it. The cutting off of the discharge of the Colorado into the gulf was complete after August, 1906.

GENERAL NEWS SECTION

NOTES.

The workmen in the shops of the Philadelphia & Reading are now working 13 hours a day.

The Southern Pacific is reported to have imported from Japan 1,500,000 oak ties for its California lines.

A press despatch from Baltimore says that the Baltimore & Ohio Railroad has greatly reduced its engineering forces.

The state of West Virginia has passed a law limiting the working hours of telegraph operators, which is to go into effect May 9. The railroads say that they are going to make a proportionate reduction of pay, and the operators announce that they will accept nothing less than what they now receive for 12 hours.

The Delaware & Hudson has made a general increase in the wages of its enginemen. President Murray, of the Baltimore & Ohio, announces that the wages of the employees of the B. & O. have been increased an aggregate of nearly $3,000,000 annually. No horizontal advance has been made, but employees most faithful and deserving have been "rewarded."

The Interstate Commerce Commission has received a complaint from Chicago declaring that in the middle western states the express companies do a regular commission business, thus greatly interfering with the prosperity of regular commission merchants. It is alleged that the express agents buy goods for which no purchasers have been found, and that at destination the agents run peddling carts.

The Chicago reporters, having worked up a great interest (among themselves) in alleged proposed reductions in the speed of fast trains on all of the big railroads, are now engaged in letting themselves down again, the suggestion that speed should be reduced having been badly "frosted" by the protests of certain cities between Chicago and the Pacific coast, where it is felt that business will be much disturbed if mail trains are made to arrive any later than they do now.

The Nebraska legislature has passed a law to provide for the taxation of railroad property in cities and villages for local purposes, the same as other property. It is said that the law will put an increased burden of $500,000 yearly on the railroads of the state. The bill provides that the franchise value of roads shall be included in the property subject to this tax, except that the valuation shall be distributed through the state, instead of taxed in the bulk in the local community.

The Car Service (Demurrage) Associations in the territory south of the Potomac and Ohio rivers and east of the Mississippi have made their rules uniform. This will greatly simplify the work of dealing with demurrage questions on railroads which are members of a number of different associations. The most important change that has been brought about by the simplification of the rules is the abolition of all exceptions to the 48-hour rule. Henceforth two days will be the limit of free time for the unloading of all commodities.

On Saturday, March 23, the fast train of the Colorado & Southern, engineman J. O. Thompson, was run from Trinidad to Denver, 120 miles, in 2 hours 30 minutes, or at the rate of 48 miles an hour, including all stops. This time is 20 minutes shorter than the best heretofore made. While, for a road with 40-mile tangents, this would not be remarkable speed, the performance is looked upon by those acquainted with the C. & S. as very creditable for, as we are informed by a correspondent, "the line between the cities named has so many steep grades and sharp curves that an eastern engineman would look twice before he tackled it."

The Cost of Team Hauls of Agricultural Products.

At the second annual banquet of the Jamestown (New York) Chamber of Commerce, held March 29, Luis Jackson, Industrial Commissioner of the Erie Railroad, made a comparison of the expense of hauling agricultural products to the railroad station with the expense of carrying them on trains. His facts were taken from a recently issued bulletin of the Department of Agriculture, showing the cost of hauling crops by teams from farm to railroad station.

Taking 23 kinds of agricultural products, from apples to wool, the average cost of the team haul was found to be 11 cents per 100 lbs., and the average cost per ton mile 23 cents. Detailed figures were given for the three great staples, wheat, corn and cotton. The following were the average figures for wheat: Miles to shipping point, 9.4; pounds in one load, 3,323; cost to farmer per load, $2.86; cost per 100 lbs., 9 cents; cost per ton per mile, 19 cents.

For corn: Miles to shipping point, 7.4; pounds in one load, 2,696; cost to farmer per load, $1.78; cost per 100 lbs., 7 cents; cost per ton per mile, 19 cents.

For cotton: Miles to shipping point, 11.8; pounds in one load, 1,702; cost to farmer per load, $2.76; cost per 100 lbs., 16 cents; cost per ton per mile, 27 cents.

The average earnings per ton per mile on the Erie Railroad are a fraction less than 6 mills. Railroad rates are about as low as we can get them, and the moral of the figures for team hauls is that we must improve our country roads and possibly get automobiles to haul the products to the station. All this is a matter for the earnest consideration of the farmer, the manufacturer and the commercial man.

Scholarships for P. R. R. Employees' Sons.

The children of the late Frank Thomson, Annie, Frank and Clarke, have given to the Pennsylvania Railroad $120,000 to establish the "Frank Thomson scholarships" to give the sons of living or dead employees of the lines of the system an opportunity for a technical education. Competitive examinations will be held, beginning this year, for two scholarships, each of which amounts to $600 a year. Two will be added each year, and after four years two will be given annually, keeping a total of eight in college or school all the time.

Train Wreckers Near Pittsburg.

Two fast passenger trains of the Pennsylvania Railroad have been derailed near Pittsburg by wreckers within five days, and the company has offered a reward of $2,500 for the conviction of the guilty person or persons in each case, and $500 for information leading to the arrest of any of them, $5,500 in all. The trains were the westbound Chicago Limited of March 22d, derailed at Stewart, 17 miles east of Pittsburg, at 4 a.m., and the eastbound Keystone Express of March 27th, derailed at Wilmerding, 12 miles from Pittsburg, at about the same hour. In both cases rails were loosened, but care was taken to leave the bond wires at the joints unbroken so that the automatic block signals should not indicate stop. In the first case the tools used in loosening the track, which were found nearby, were not those of the company, but in the second case they had been taken from a chest not far away. On the second occasion the rails of two main tracks had been loosened. In the first derailment the engineman and 18 of the 83 passengers were injured, the engine was overturned and the mail car took fire from the engine, but in the other all on the train escaped without serious injury, though the derailment occurred on a curve.

Twenty-four Passengers Killed at Colton, Cal.

In a derailment on the Southern Pacific at Colton, Cal., March 28th, 24 passengers and a section master (who was not on the train) were killed, and about 60 were injured, eight of the injured being seriously hurt. The men in charge of a switching train had left a switch open and the passenger train, the westbound Sunset Limited, about 12 hours behind time, came on at such high speed that its engine was overturned and the first three cars were wrecked. Of the killed 22 were Italian immigrants or laborers riding in the day coach and the smoking car.

New Railroad Laws.

The legislature of Colorado, which has adjourned, has passed a bill to appoint a state railroad commission of three members. The Governor of Nebraska has signed the bill establishing a railroad commission in that state and regulating railroad rates. Press despatches indicate that under this and another law rates on grain, live stock, lumber, coal and other commodities must be reduced 20 per cent.; but there is a provision giving the railroads 30 days in which to make certain changes in tariffs on their own initiative. A bill requiring new issues of railroad stocks or bonds to be approved by the railroad commissioners, was defeated. At Springfield, Ill., last week, Messrs. Winchell of the Rock Island, Willard of the Burlington, Jackson of the C. & E. I. and Daly of the Illinois Central addressed the joint committee of the legislature in opposition to pending bills. The state of Nevada has an elaborate new railroad law. It provides for a board of three commissioners, to receive $5,000, $2,500 and $2,500 salary, respectively (the first to devote his whole time to the work), and prescribes maximum freight rates. On ores there are nine different rates per ton per mile, and are graduated according to the value of the ore.

The Indiana Railroad Commission has issued a statement of the

changes and additions to the laws concerning railroads in that state since 1902. First is named the two-cent fare law, just passed, which will become effective when the acts are published about the middle of this month. There are thirteen sections relating to the prohibition of dangerous structures and the use of safety appliances. These deal with power brakes, grab irons, couplers, safety appliances for passenger trains, air-brakes on motor cars and overhead bridges sufficiently above the track. Inspectors are provided for. Commercial travelers' samples must be carried as baggage, and the charge for excess is to be one cent for three miles for each 100 lbs., the minimum charge to be 25 cents on less than 500 lbs. and 50 cents on over 500 lbs. Power is given the commission to require that cars go forward at an average of fifty miles a day; that cars be set for unloading within 24 hours after they have been received, and to be furnished within 48 hours after a demand is made. There must be a full crew of five or more men for all freight trains having fifty cars or more, and for all passenger trains having five cars or more. All companies operating dining cars and selling liquors must pay a state license of $1,000. Laws concerning train rules and requiring the use of the block system are referred to elsewhere in the *Railroad Gazette.*

Immigration to Western States.

The Western Passenger Association has issued a comparative statement of the immigrant business passing through all ports of entry destined to Western states from 1900 to 1906 inclusive. The number of immigrants steadily increased up to 1904, when it showed a falling off. In 1905 again it showed a decided increase, and 1906 was the largest year, with a total of 94,507.

The figures are taken from the reports of the railroad agents ticketing the passengers from ports of entry. It shows that a total of 499,665 people have moved into the West during the seven years from foreign countries. Following are the totals by states:

Alaska	2	Montana	9,612
Arizona	1,846	Nebraska	17,504
Arkansas	1,055	Nevada	3,960
British Columbia	2,342	New Mexico	1,102
California	70,958	North Dakota	17,236
Colorado	22,781	Oklahoma	677
Idaho	2,295	Oregon	7,341
Illinois	59,957	South Dakota	15,534
Indian Territory	1,683	Texas	2,097
Iowa	32,133	Utah	6,935
Kansas	10,554	Washington	17,800
Mexico	122	Wisconsin	66,689
N. Michigan	57,599	Wyoming	4,240
Minnesota	79,484		
Mississippi	10		
Missouri	11,819	Total	499,665

—*Chicago Tribune.*

Railroading in Porto Rico.

According to James Peabody, who has been investigating the railroads of Porto Rico at the invitation of Governor Winthrop, the lines are in a very bad condition, due primarily to the fact that most of the funds originally received for building the roads were used in bribes to Spanish officials. The American Railroad of Porto Rico includes all the railroad mileage. It is a single-track, meter-gage line 200 miles long, including a branch. It connects San Juan, on the north shore of the island, with Ponce, on the south shore, by a roundabout course running along the northern and western coasts. There is, however, a 25-mile gap in the line between these points, which is covered by automobiles. Mr. Peabody is quoted as follows:

"The railroad passenger service on the island is pitiable. Not one of the passenger cars has a brake on it. The only brake for a passenger train is the one on the locomotive. As some of the grades of the railroad are steep, it is distressing to think what would happen if a train should break in two going up one of the grades. There would be no way to stop the cars that got away from the locomotive.

"There were no bell cords on the trains when I began to investigate the system. One of my first recommendations was to have bell cords connecting the cars with the locomotive. The conductor used to poke his head out of a window and blow a blast on a pocket whistle when he wanted to stop a train between stations. I was on a train one day when a rear car got off the track. The conductor tried to stop the train, but the locomotive happened to be blowing off steam at the time, and the engineer could not hear the pocket whistle. We kept going ahead, with the rear car bumping along on the ties. Finally the conductor drew a pistol and fired a shot out of the window, and the engineer heard the shot and pulled up. I asked the conductor if he had shot at the engineer.

"The freight cars have brakes, but the brakes are so arranged that they can be set only from the ground, after the car is stopped. The reason for that is that nobody ever wants to stop a freight car there until it is on a siding where it is to be loaded or unloaded. It sometimes happens that a freight car breaks loose from the locomotive on a grade, and there is a smashup, but that does not seem to worry anybody.

"As there are practically no wagon roads, the sugar planters have many movable railroad tracks leading to their plantations, the cars on such tracks being hauled by mules. They think nothing of running one of the movable tracks across the railroad track. The engineers of the railroad have to keep constant lookout for one of these obstructions. There are many private sidings for freight cars along the line of the railroad, also, and it often has happened that a car has run off the siding to the main track in the way of a train. One of my recommendations was for a derailing switch at every siding."

Mr. Peabody has drafted a set of regulations for the passenger service, and a budget for the next five years based on the amount of former business and the new freight tariff.

The Cape Cod Canal.

The Cape Cod Canal Construction Co., recently incorporated in Maine, and of which August Belmont, of New York, is President, has contracted to dig the Cape Cod Canal from Barnstable, Mass., to Buzzard's Bay, for $11,999,000. This is the first estimate of its kind for the construction of the canal made by any construction company since the first canal was started nearly twenty years ago. It is said that work will be begun by the middle of May, provided that the Massachusetts Railroad Commission approves certain plans by that time. W. B. Parsons is to be Engineer in charge of the work, and J. B. McDonald, Vice-President of the construction company, will be in charge of the labor department.

An Improved Compressed Air Forge.

The Buffalo Forge Co., Buffalo, N. Y., has recently put on the market a new and improved compressed air forge which is shown in the accompanying illustration. It is listed as No. 22C. In the previous models a tiny jet of compressed air was made to impinge on the blades of a fan wheel causing it to revolve within a casing in such a way as to act as an ordinary centrifugal fan, drawing in through the inlet to the casing 40 times the volume of compressed air used and forcing it all to the tuyere. The design of the improved forge, however, is radically different. There are no moving parts requiring oiling or attention to keep clean. The clinker falling through the tuyere drops to the ground of itself and the windbox cannot become clogged. Compressed air from the shop system passes through a small globe valve and ¼-in. pipe to a one-piece vertical windbox directly beneath the bowl and tuyere. At the lower end of the windbox is placed the compound nozzle which works on the injector principle. The use of a small jet of compressed air at high velocity in the nozzle delivers a large volume of air at moderate pressure to the tuyere. The design is neat and compact and has no projecting parts. The weight is only 65 lbs., which makes the machine readily portable. Any desired intensity of blast may be secured, and the large tuyere bowl allows a deep fire to be carried. On account of the simple construction the forge can be sold at a low price. It is adapted for bridge and tank builders, railroad and car shops, boiler makers' and contractors use.



Buffalo Compressed Air Forge.

Steel Plant To Be Built at Duluth.

The United States Steel Corporation has authorized the construction of a new steel plant at Duluth. Steel rails, structural shapes and bars will be manufactured. It is expected that the plant will cost about $10,000,000. The cost of building the plant will be charged to surplus. A site has already been selected for the plant and work is to be begun at once.

Traffic Club in Chicago.

Following the successful beginning of the New York Traffic Club organized last summer, a similar organization has been formed in Chicago with the following officers:

Frank T. Bentley, Traffic Manager Illinois Steel Co., President; Darius Miller, Vice-President of the Chicago, Burlington & Quincy; Frank A. Spink, Traffic Manager of the National Packing Co.; and George H. Ingalls, Freight Traffic Manager of the New York Central Lines West, Vice-Presidents; M. S. Connelly, General West-

ern Freight Agent of the Pittsburg, Cincinnati, Chicago & St. Louis, Treasurer; and John T. Stockton, Manager of the Joseph Stockton Co., Secretary.

New General Manager of the Public Service Corporation.

R. E. Danforth, Manager of the Rochester Railway, has been appointed General Manager of the street railways owned by the Public Service Corporation of New Jersey, succeeding A. H. Stanley, who recently resigned to go to London as General Manager of the Underground Electric.

Maintenance Cost of English Highways.

United States Consul Walter C. Hamm, of Hull, England, reports as follows on the maintenance of highways in Yorkshire: The roads were well constructed originally and are well cared for now. It is a rare sight to see a rutty or muddy country road in this neighborhood. Most all of them are macadamized, well-drained and kept in good repair. As a consequence one horse can draw a load which would require two or three horses over the usual country road in America. The following table gives the total expenditure for each year, the total length of roads in the district considered, and the average cost per mile for 12 years past. The pound sterling is estimated at $5:

Year	Total cost.	Miles.	Cost per mile.
1895	$734,270	1,122	$654
1896	741,925	1,122	661
1897	787,940	1,122	702
1898	826,120	1,125	735
1899	812,850	1,128	720
1900	766,765	1,133	768
1901	789,295	1,111	710
1902	793,950	1,107	717
1903	796,990	1,104	724
1904	889,160	1,094	766
1905	879,720	1,094	804
1906	910,750	1,094	832

As will be seen, there is a constant tendency to increase in the cost of maintenance, but this increase is, in part, accounted for by the construction of footpaths and the placing of granite "sets" to protect the roads from injury by trolley lines.

Manufacturing and Business.

The name of the Sawyer-Man Electric Company has been changed to the Westinghouse Lamp Company.

Part of the plant of the Maryland Steel Car Wheel Co. at South Baltimore, Md., was burned on March 30. The damage is estimated at from $60,000 to $100,000.

Walter D. LaParle, Manhattan Building, Chicago, has been appointed Chicago representative of the Helwig Manufacturing Co., St. Paul, Minn., and sole railroad representative of the Automatic Oil Cup Co., Milwaukee, Wis.

The Philip Carey Manufacturing Co., Lockland, O., has begun work on two new brick and concrete factory buildings 80 ft. wide x 400 ft. long, which, it is expected, will be ready by September 1. All building material and equipment have been ordered.

The Wason Manufacturing Co., Springfield, Mass., has been taken over by the J. G. Brill Co. The last named company has sold $1,270,000 preferred stock, part of the proceeds of which were used for the acquisition of the smaller car-building company.

G. S. Brantingham, Second Vice-President of D. E. Baxter & Co., railroad contractors, New York, and Charles M. Meeker, New York, have been elected Directors of the Lake Superior Southern, which is being built from Madison, Wis., north to Huron Bay, Mich., by D. E. Baxter & Co.

The Cleveland-Cliffs Iron Co. has ordered a 60-drill air compressor from the Sullivan Machinery Co., Chicago, for its new Maas mine at Negaunee, Mich. The machine will be the Corliss cross-compound, condensing, two-stage type, with large receiver intercooler. The steam cylinders will be 24 and 46 in. x 48 in., and the air cylinders 24 and 40 in. x 48 in., with a displacement capacity of 4,000 cu. ft. of free air per minute at 60 r.p.m., or nearly 5,000 ft. at 70 r.p.m. The compressor will be built at the Chicago works of the Sullivan Machinery Co.

The Union Switch & Signal Company recently bought 34 acres of land adjoining the plant at Swissvale, Pa. The company has decided to grade 10 acres of this plot at once, on which switching tracks will be put in, and to which site the lumber yard will be removed. Plans are being drawn for a new building to contain a foundry, a blacksmith shop and a power house, giving the company 140,000 additional square feet of floor space for manufacturing purposes. The business of the company increased 70 per cent. last year, and from present indications the gross earnings this year will be about $10,000,000.

Alva J. Grover, formerly resident engineer on the Wisconsin Central, was recently appointed, through Hapgoods of Milwaukee, inspecting engineer in charge of railroad construction in the Philippines for the United States Bureau of Insular Affairs. Mr. Grover is 49 years old and a graduate of the University of Wisconsin, class of 1881. From 1898 to 1899 he was transitman, assistant engineer on location and chief of locating party on the Union Pacific. In 1901 he was made resident engineer of the Choctaw, Oklahoma & Gulf. Later he had charge of construction work at Ramsdell, Tex., in addition to building 11 miles of road near Guthrie, Okla. After the absorption of the road by the Chicago, Rock Island & Pacific he was appointed resident engineer of the last named company in charge of soundings for permanent bridge foundations on lines between Haileyville and Kansas City. In 1903 he went to the Pittsburg, Shawmut & Northern R. R. at Smethport, Pa., where he finished the line between Clarmont and Kasson Junction and made permanent revision of the line between Kasson and Caryville, Pa. He then was made Assistant Division Engineer of the Chicago, Milwaukee & St. Paul at Milwaukee, and later went to the Wisconsin Central, to take the office which he has now left to go to the Philippines.

Iron and Steel.

Among the orders recently placed for rails were 6,000 tons for the American Electric Co. of Idaho, 2,000 tons for the Oakland Consolidated Co., California, and 700 tons for the Augusta, Oakland & Waterville, of Maine.

Contracts for steel for bridges have been let as follows: Pennsylvania Steel Co., 4,000 tons for the Chicago, Milwaukee & St. Paul; 1,600 tons to the Morava Bridge Co. for the Chicago Terminal Transfer Co.; 700 tons for the Lehigh Valley, and 250 tons to the Boston Bridge Co. for the Boston & Maine.

The Chicago, Milwaukee & St. Paul has ordered 21,000 tons of structural steel for its Pacific coast extension, as follows: Between 8,000 and 9,000 tons from the Pennsylvania Steel Co., 7,000 tons from the American Bridge Co., and the rest from the McClintic-Marshall Construction Co., and several other companies.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Civil Engineers.

At a meeting of this society, April 3, a paper on "Movable Bridges," by C. C. Schneider, was presented for discussion. This paper was printed in the *Proceedings* for February, 1907.

The American Railway Association.

The spring meeting of the American Railway Association will be held at the Auditorium, Chicago, on Wednesday, April 24. Reports will be presented by the Executive Committee and the Committees on Train Rules, on Car Service, on Safety Appliances, on Statistical Inquiry, on Standard Cipher Code, on Transportation of Explosives, on Standard Rail and Wheel Sections, on Standard Location of Third Rail Working Conductors, and on Car Efficiency. The election of a President and a Second Vice-President will take place at this meeting.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Astoria & Columbia River.—F. D. Kuetner, Auditor, has also been appointed Auditor of the Columbia River & Northern, and his office has been moved from Astoria to Portland.

Atchison, Topeka & Santa Fe.—See Atchison, Topeka & Santa Fe Coast Lines.

Atchison, Topeka & Santa Fe Coast Lines.—W. J. Healy, Freight Auditor of the Atchison, Topeka & Santa Fe, has been appointed Auditor of the Coast Lines, succeeding G. A. Davidson.

Brimstone Railroad & Canal.—The officers of this company are: President, J. Toniette; Vice-President, J. L. Henning; Secretary, S. W. Maxwell, all with office at Sulphur Mines, La. General Manager, Henry Whiton, and Traffic Manager, J. P. Magill, both with office at New York.

Chicago, Ziegler & Gulf.—F. M. Wakefield has been elected Vice-President.

Great Northern.—J. J. Hill, President, has been elected Chairman of the Board. L. W. Hill, Vice-President, succeeds Mr. Hill as President.

Grand Trunk.—W. G. Brownlee, Superintendent of the Middle divi-

sion, has been elected Fourth Vice-President, succeeding F. H. McGuigan, resigned to go to the Great Northern.

Intercolonial.—The Hon. H. R. Emerson, Minister of Railways, has resigned.

Isthmian Canal Commission.—R. R. Rodgers, General Counsel, has been appointed a member of the Commission.

Litchfield & Madison.—F. M. Campbell has been appointed Auditor, Secretary and Treasurer, with office at Edwardsville, Ill., and the office of Assistant Treasurer, formerly held by H. W. Berger, has been abolished.

Louisiana Railway & Navigation Co.—The office of the President has been removed from New York to New Orleans.

Norfolk & Western.—J. I. Doran, General Solicitor, has been appointed General Counsel, with office at Philadelphia. T. W. Reath succeeds Mr. Doran.

Pacific Coast Company.—J. B. Amos, Assistant General Auditor, has resigned, and the office has been abolished.

Pecos System.—A. E. Meyer has been appointed Auditor of the Pecos Valley & Northeastern and of the Pecos & Northern Texas, with office at Amarillo, Tex., succeeding D. A. Sweet, resigned.

Pennsylvania Lines West.—J. L. Mason has been appointed Assistant Secretary, with office at Pittsburg.
See Pittsburg, Wheeling & Kentucky.

Philadelphia & Reading.—G. S. Hanley has been appointed Assistant to the First Vice-President.

Pittsburg, Wheeling & Kentucky.—E. B. Taylor, Third Vice-President of the Pennsylvania Lines West, has been elected also President of the Pittsburg, Wheeling & Kentucky, which is operated as part of the Southwest system of the Pennsylvania Lines West, succeeding W. P. Hubbard, resigned. Joseph Wood, First Vice-President of the Pennsylvania Lines West, has been elected also Vice-President of the Pittsburg, Wheeling & Kentucky, succeeding James McCrea, resigned.

Rio Grande, Sierra Madre & Pacific.—L. D. Baldwin has been elected Vice-President.

Trinity & Brazos Valley.—W. E. Greene has been elected Vice-President and General Manager, succeeding M. Sweeney, resigned to go into other business.

Western Maryland.—Alexander Robertson, General Manager, has been elected Vice-President, succeeding F. S. Landstreet.

Wichita Valley.—Frank Trumbull is Chairman of the Board, and J. S. Mackie, Assistant Secretary and Assistant Treasurer; both with office at New York.

Operating Officers.

Canadian Pacific.—F. F. Busteed, Assistant Chief Engineer of Western lines, has been appointed General Superintendent of the Pacific division, with office at Vancouver, B. C., succeeding R. Marpole, promoted. The Central division has been divided as follows: Fort William terminals, consisting of the line from Port Arthur to Westfort; First district, with headquarters at Kenora, Ont.; Second district, with headquarters at Winnipeg, Man. Winnipeg terminals, consisting of the lines from Whittier Junction to Rugby Junction and St. Boniface; Third district, with headquarters at Brandon, Sask.; Fourth district, with headquarters at Brandon, and Fifth district, with headquarters at Moose Jaw, Sask. J. G. Taylor, Assistant Superintendent at Fort William, has been appointed Superintendent of Fort William terminals. C. S. Maharg, Assistant Superintendent at Brandon, Sask., has been appointed Superintendent of the Third district. G. E. Graham, Assistant Superintendent at Moose Jaw, has been appointed Superintendent of the Fourth district.

Chicago & Illinois Midland.—M. A. Zook has been appointed Superintendent, with office at Pawnee, Ill., succeeding C. F. Clendenen.

Chicago, St. Paul, Minneapolis & Omaha.—G. W. Steen has been appointed Superintendent of Dining Cars, with office at Minneapolis, Minn., succeeding I. H. Shattuck, deceased.

Colorado & Southern.—J. H. Young, General Manager, has resigned to go to another railroad company, and the office of General Manager has been abolished. J. D. Welsh has been appointed to the new office of General Superintendent in charge of transportation, motive power and maintenance of way. See St. Louis & San Francisco.

Erie.—R. C. Thurston has been appointed Supervisor of Electric Service, with office at Avon, N. Y.

Fort Smith & Western.—See St. Louis, El Reno & Western.

Fort Worth & Denver City.—O. E. Maer has been appointed Trainmaster at Childress, Tex., succeeding J. H. Riegel, resigned.

Galveston, Harrisburg & San Antonio.—Richard Jones, Assistant Superintendent of the Victoria division, has been appointed Superintendent of that division, succeeding G. Radetzki, resigned to go to the Houston & Texas Central.

Grand Trunk.—C. S. Cunningham, joint Superintendent of the Wabash and the Grand Trunk at St. Thomas, Ont., has been appointed Superintendent of the Middle division, with office at Toronto, Ont., succeeding W. G. Brownlee, promoted. U. E. Gillan, Assistant Superintendent of the Grand Trunk, succeeds Mr. Cunningham. See this company under Executive, Financial and Legal Officers.

Hocking Valley.—See Toledo & Ohio Central.

Kanawha & Michigan.—T. M. Connors, Superintendent of the Toledo & Ohio Central, has been appointed Superintendent of the Kanawha & Michigan, with headquarters at Charlestown, W. Va., succeeding W. C. Franz, who has been appointed General Manager of the Kanawha & West Virginia, with headquarters at Charlestown, W. Va.

Mexican Central.—H. Putnam, Assistant Purchasing Agent, has been appointed Superintendent of Car Service, with office at Mexico City.

Maricopa & Phoenix & Salt River Valley.—C. M. Scott, formerly chief clerk to the President, has been appointed Superintendent, succeeding M. O. Bicknell, transferred.

Northern Pacific.—The Idaho division, from Trout Creek, Mont., west to Ellensburg, Wash., will hereafter be operated in two divisions. The Idaho division will hereafter consist of the line from Spokane, Wash., to Trout Creek, and the Washington Central, the Palouse and the Lewiston branches. The new Pasco division will consist of the line from Spokane to Ellensburg, including the Sunnyside branch. J. L. De Force, Trainmaster at Spokane, has been appointed Superintendent of the new division, with office at Pasco, Wash. The change is effective May 1.

Pennsylvania.—W. C. Coughlin, Superintendent of the Elmira & Canandaigua division, has been appointed Superintendent of the Middle and Western divisions of the Erie grand division, succeeding T. A. Roberts, deceased. H. A. Jaggard, General Agent at Pittsburg, succeeds Mr. Coughlin. James Buckelew, Superintendent of the P., B. & W. at Media, Pa., has been appointed Superintendent of the Allegheny division. C. T. Dabney succeeds Mr. Buckelew. A. J. Whitney, Jr., Principal Assistant Engineer of the Eastern Pennsylvania grand division, has been appointed Superintendent of the Delaware division of the P., B. & W., succeeding R. S. Holliday, deceased.

W. C. Copley, Assistant Trainmaster of the Middle division, has been appointed Freight Trainmaster of that division, succeeding J. B. Fisher, promoted.

Pennsylvania, New York & Long Island.—C. S. Krick, Assistant Engineer of the Philadelphia terminal division of the Philadelphia, Baltimore & Washington, has been appointed Superintendent of the Pennsylvania, New York & Long Island, which is building that part of the Pennsylvania's New York improvements extending from the center of the Hudson river east across Manhattan Island and under the East river to Long Island City.

Philadelphia, Baltimore & Washington.—See Pennsylvania.

Pullman Company.—W. H. Deal, Assistant Superintendent at Detroit, Mich., has been appointed Assistant Superintendent at Norfolk, Va. F. L. Wood succeeds Mr. Deal.

St. Louis & San Francisco.—J. H. Young, General Manager of the Colorado & Southern, has been appointed General Superintendent of the First district of the St. Louis & San Francisco, with office at Springfield, Mo., succeeding Andrew O'Hara, who has been Acting General Superintendent, and has now been reappointed Superintendent at Springfield, Mo. H. H. Brown, Superintendent at Springfield, Mo., has been appointed Superintendent at Memphis, Tenn., succeeding A. D. Lightner, transferred to Birmingham, Ala., as General Agent of the St. Louis & San Francisco, and General Manager of the Birmingham Belt. A. J. Sams, Superintendent at Birmingham, Ala., has been appointed Superintendent at Enid, Okla. T. T. B. Coppage, Superintendent of the Gulf, Colorado & Santa Fe at Temple, Tex., succeeds Mr. Sams. J. W. Walton has been appointed Superintendent of the Red River division, with office at Francis, Ind. T.

St. Louis, El Reno & Western.—B. F. Beckman, Engineer of Maintenance of Way, has been appointed to the new office of Superintendent of this road, and of the Fort Smith & Western, with office at Fort Smith, Ark., and the office of Engineer of Maintenance of Way has been abolished.

Southern.—G. R. Loyal, General Superintendent of the Eastern district, has been appointed General Superintendent of the Middle

district, with office at Knoxville, Tenn., succeeding M. M. Richey, promoted. H. E. Hutchens, Superintendent at Memphis, Tenn., succeeds Mr. Loyal, with office at Charlotte, N. C.

Toledo & Ohio Central.—C. L. Gardner, Trainmaster of the Hocking Valley at Columbus, Ohio, has been appointed Assistant Superintendent of the Toledo & Ohio Central, with office at Bucyrus, O., succeeding T. M. Connors, appointed Superintendent of the Kanawha & Michigan.

West Virginia.—See Kanawha & Michigan.

Traffic Officers.

Bennettsville & Cheraw.—G. P. Bourdelat, Auditor of the Aberdeen & Rockfish, has been appointed Traffic Manager of the Bennettsville & Cheraw, with office at Bennettsville, S. C.

Chicago & Calumet River.—Clive Runnells, Traffic Manager, having resigned, matters regarding traffic originating on the lines of the company are now handled by A. P. Bowen, Purchasing Agent, and claims are handled by W. K. Stuart, Assistant Auditor.

Chicago & North-Western.—H. G. Graves has been appointed Acting General Baggage Agent, with office at Chicago, succeeding to the duties of F. D. Taylor, General Baggage Agent.

Chicago, Milwaukee & St. Paul.—W. B. Dixon has been appointed Assistant General Passenger Agent, with office at St. Paul, Minn.

Chicago, Ziegler & Gulf.—W. B. Clark has been appointed Traffic Manager.

Cincinnati, Lebanon & Northern.—J. P. Romey, General Agent at Middletown, Ohio, has been appointed General Agent at Cincinnati, succeeding George Hooke.

Cleveland, Cincinnati, Chicago & St. Louis.—F. L. Talcott has been appointed General Eastern Freight Agent, with office at Buffalo, N. Y., of this road and of the Lake Erie & Western, succeeding C. E. Crane.

Durham & Southern.—S. H. Reams has been appointed General Freight and Passenger Agent, succeeding to the duties of R. I. Cheatham, Traffic Manager, resigned to go to the Seaboard Air Line.

Erie.—H. E. Huntington, General Agent at Cincinnati, has been transferred to Buffalo, succeeding H. A. Jaeger, deceased. A. C. Hilton, General Agent at San Francisco, succeeds Mr. Huntington.

Fort Smith & Western.—See Oklahoma Central.

Galveston, Harrisburg & San Antonio.—A. W. Reeves, General Agent of the Houston & Texas Central at Mexico City, has been appointed General Agent of the Galveston, Harrisburg & San Antonio, at El Paso, Tex., succeeding A. W. Cheesman.

Lake Erie & Western.—See Cleveland, Cincinnati, Chicago & St. Louis.

Las Vegas & Tonopah.—E. W. Gillett has been appointed Traffic Manager, with office at Los Angeles, Cal., succeeding H. T. Greene, deceased.

Maricopa & Phoenix & Salt River Valley.—M. O. Bicknell, General Freight and Passenger Agent and Superintendent, has resigned as Superintendent and has been appointed General Freight and Passenger Agent of this road and of the Arizona Eastern, the Arizona & Colorado, the Cananea, Yaqui River & Pacific, and the Gila Valley, Globe & Northern.

Mississippi River, Hamburg & Western.—H. C. Townsend has been appointed General Passenger and Ticket Agent, with office at St. Louis, Mo.

Oklahoma Central.—J. O'Donnell, General Agent of the Fort Smith & Western at Oklahoma City, Okla. T., has been appointed General Freight and Passenger Agent of the Oklahoma Central, with office at Purcell, Ind. T.

Pennsylvania.—J. W. Reynolds, General Agent at Erie, Pa., has retired.

Rutland.—F. E. Barbour, General Agent at Montreal, has been appointed General Passenger Agent.

St. Louis, Watkins & Gulf.—R. F. O'Brien has been appointed General Agent at Lake Charles, La.

Southern.—G. R. Browder, General Freight Agent, has been appointed to the new office of Assistant Freight Traffic Manager at Atlanta, Ga. J. B. Munson, General Agent at New York, has been appointed to the new office of Assistant Freight Traffic Manager at Washington, D. C. Seven General Freight Agencies have been created: J. H. Drake, Assistant General Freight Agent at Richmond, Va., has been appointed General Freight Agent at that place, in charge of lines in Virginia and eastern and central North Carolina. E. H. Shaw, Assistant General Freight Agent at Birmingham, Ala., has been appointed General Freight Agent at Charleston, S. C., in charge of lines in South Carolina, western North Carolina and terminals at Augusta, Ga. Randall Clifton, Assistant General Freight Agent at Atlanta, Ga., has been appointed General Freight Agent at that place, in charge of lines in Georgia and Florida. H. L. Miller, Assistant General Freight Agent at Knoxville, Tenn., has been appointed General Freight Agent at that place, in charge of lines in eastern Tennessee. R. B. Pegram, Assistant General Freight Agent at Nashville, Tenn., has been appointed General Freight Agent at that place in charge of the Nashville division. I. L. Graves, Assistant General Freight Agent at Memphis, Tenn., has been appointed General Freight Agent at that place, in charge of the Memphis division. R. L. Simpson has been appointed General Freight Agent at Birmingham, Ala., in charge of lines in Alabama excepting the Memphis division.

Texas & Pacific.—W. S. Braggins has been appointed General Agent at New Orleans, succeeding Robert Strong, deceased.

Engineering and Rolling Stock Officers.

Algoma Central & Hudson Bay.—K. J. C. Zinck, Engineer of Maintenance of Way and Construction, has resigned.

Ann Arbor.—See Detroit, Toledo & Ironton.

Chicago, Rock Island & Pacific.—Five Assistant Superintendents of Motive Power have been created: J. B. Kilpatrick, with office at Chicago, formerly Superintendent of Motive Power; W. L. Harrison at Cedar Rapids, Ia., heretofore Master Mechanic at that place; S. W. Mullinix at Topeka, Kan., heretofore Master Mechanic at Horton, Kan.; C. M. Taylor at Shawnee, Okla. T., heretofore Master Mechanic at that place, and F. W. Williams at Fort Worth, Tex., heretofore Master Mechanic at Chickasha, Ind. T.

Colorado Southern, New Orleans & Pacific.—L. F. Lannbladh, principal assistant to the Engineer of Construction of the Southern, has been appointed Chief Engineer of the Colorado Southern, New Orleans & Pacific, with office at Beaumont, Tex.

Detroit, Toledo & Ironton.—The office of Chief Engineer of this road and of the Ann Arbor has been abolished, and reports formerly sent to the Chief Engineer are now sent to C. M. Cornwell, general roadmaster.

The offices of Master Mechanics of this company and of the Ann Arbor have been abolished. W. G. Wallace has been appointed to the new office of Superintendent of Motive Power of both roads, with office at Jackson, Ohio.

Georgia, Florida & Alabama.—J. D. Crawley has been appointed Master Mechanic, with office at Bainbridge, Ga.

Mississippi Central.—W. J. Haynen has been appointed Master Mechanic, succeeding R. M. Boldridge, resigned.

Missouri & North Arkansas.—S. W. Lee, Chief Engineer, has been appointed Consulting Engineer. W. S. Dawley succeeds Mr. Lee. The offices of both are at St. Louis, Mo.

Missouri Pacific.—J. Schumacher has been appointed Master Mechanic at Ferriday, La., succeeding J. W. Ruffner, resigned. F. K. Tutt, Master Mechanic at Van Buren, Ark., has been appointed Master Mechanic at Osawatomie, succeeding W. B. Gaskins, resigned. B. Donohue succeeds Mr. Tutt.

Pennsylvania.—G. W. Snyder, Assistant Engineer of the Pittsburg division, has been appointed Principal Assistant Engineer of the new Western Pennsylvania grand division. A. B. Cuthbert, Assistant Engineer of the Middle division, has been appointed Principal Assistant Engineer of the Eastern Pennsylvania grand division, succeeding A. J. Whitney, transferred.

D. M. Perine, Superintendent of Motive Power of the Philadelphia & Erie and the Northern Central, has been appointed Superintendent of Motive Power of the Western Pennsylvania grand division. D. M. Wallace, Master Mechanic of the Baltimore and West Philadelphia shops, succeeds Mr. Perine.

Philadelphia, Baltimore & Washington.—Elisha Lee, Assistant Engineer of the Philadelphia terminal division of the Pennsylvania, has been appointed Principal Assistant Engineer of the Philadelphia, Baltimore & Washington, succeeding C. S. Krick, transferred.

See Pennsylvania, New York & Long Island under Operating Officers.

Southern Pacific.—J. H. Wallace has been appointed Assistant Chief Engineer, with office at San Francisco.

Trinity & Brazos Valley.—E. T. Mooney has been appointed Master Mechanic, with office at Teague, Tex., succeeding W. C. Burel, resigned.

Purchasing Agents.

Mexican Central.—O. C. Omer has been appointed Assistant Purchas-

ing Agent, with office at Mexico City, succeeding H. Putnam, transferred. See this company under Operating Officers.

Pullman Company.—H. P. Waldon, Assistant Purchasing Agent, has been appointed Purchasing Agent, succeeding W. A. Hughes, deceased. W. T. Stewart succeeds Mr. Waldon.

LOCOMOTIVE BUILDING.

The Tidewater has ordered four locomotives from the American Locomotive Co.

The Western Allegheny is said to be in the market for one 10-wheel locomotive.

The Buffalo Creek has ordered two locomotives from the American Locomotive Co.

The Gulf & Ship Island has ordered six locomotives from the American Locomotive Co.

Corrigan, McKinney & Co. have ordered one locomotive from the American Locomotive Co.

The Missouri, Kansas & Texas has ordered 10 locomotives from the American Locomotive Co.

The Republic Iron & Steel Co. has ordered one locomotive from the American Locomotive Co.

The American Smelter Securities Co. has ordered one locomotive from the American Locomotive Co.

The Central Ontario has ordered four simple 10-wheel locomotives from the Canadian Locomotive Co.

The Mississippi River & Bonne Terre has ordered two locomotives from the American Locomotive Co.

The Henry Cowell Lime & Cement Co., Cleveland, Ohio, has ordered two locomotives from the Baldwin Locomotive Works. These locomotives are to be used on the Bay Point & Clayton Railroad, California.

The Pennsylvania, as reported in the *Railroad Gazette* of March 29, has ordered from its Juniata shops 20 class H6b consolidation (2-8-0) type locomotives; 20 class B8 switching locomotives, and six class E2d Atlantic (4-4-2) type locomotives. The specifications are as follows:

Type of locomotive.	Switching.	Atlantic.	Consolidation.
Weight on drivers	144,100 lbs.	156,700 lbs.	181,170 lbs.
Total weight	144,100 lbs.	190,000 lbs.	204,470 lbs.
Diameter of cylinders	20 in.	20 in.	22 in.
Stroke of pistons	24 "	26 "	28 "
Diameter of drivers	56 "	80 "	56 "
Type of boiler	Belpaire sloping top.	Belpaire wide firebox.	Belpaire wide firebox.
Working steam pressure	205 lbs.	205 lbs.	205 lbs.
Heating surface, total	1,868 sq. ft.	2,640 sq. ft.	2,442.4 sq. ft.
Firebox, length	66 x 69 in.	72 x 111 in.	66 x 107 in.
Grate area	31.62 sq. ft.	55.5 sq. ft.	49.11 sq. ft.

The Argentine Central has ordered three Shay geared locomotives from the Lima Locomotive & Machine Co., for delivery May 20. Specifications are as follows:

General Dimensions.

Weight, total	92,000 lbs.
Diameter drivers	32 in.
Cylinders	11 x 12 "
Boiler, type	Extended wagon top
" working steam pressure	200 lbs.
" material of tubes	Cold drawn steel
" diameter of tubes	2 in.
" length of tubes	11 ft.
Firebox, length	72½ in.
Firebox, width	46¾ "
Grate area	23 sq. ft.
Tank capacity	1,750 gals.
Coal capacity	6,500 lbs.

Special Equipment.

Air brakes	Westinghouse
Couplers	Lima automatic
Injector	Monitor
Piston rod packings	Lima Locomotive & Machine Co. metallic
Valve rod packings	Lima Locomotive & Machine Co. metallic
Safety valve	Kunkles
Sight-feed lubricators	Nathan Bull's-eye
Steam gages	Ashcroft
Tires, driving wheels	Latrobe Steel Co.

The Yosemite Valley has ordered one simple eight-wheel passenger locomotive from the Rogers Works of the American Locomotive Co., for April 15 delivery, and is considering the purchase of an additional locomotive. Specifications for the eight-wheel locomotive are as follows:

General Dimensions.

Weight, total	110,000 lbs.
Weight on drivers	72,000 "
Diameter, drivers	63 in.
Cylinders	18 x 26 in.
Boiler, type	Wagon top.
" working steam pressure	165 lbs.
" number tubes	265
" diameter of tubes	2 in.
" length of tubes	11 ft.
Firebox, length	73¼ in.
Firebox width	33⅜ in.
Firebox, grate area	17 sq. ft.
Heating surface, total	1,700 sq. ft.
Tank capacity	4,000 gals.
Oil capacity	2,250 gals.

Special Equipment.

Air brakes	Westinghouse
Injector	Ohio
Piston rod packings	Jerome
Valve rod packings	Jerome
Safety valve	Crosby
Sanding devices	Leach
Sight-feed lubricators	Nathan
Steam gages	Crosby
Tires, driving wheel	Midvale

CAR BUILDING.

The Tidewater is in the market for 2,000 coal cars.

Dolese & Shepard, Chicago, have ordered 300 wooden gondola cars from Haskell & Barker.

The Harriman Lines have revised plans on 30 all steel passenger cars and are now asking prices.

The New Berlin & Winfield is said to be in the market for one passenger car and one baggage car.

The St. Louis, Brownsville & Mexico has ordered 200 stock cars from the American Car & Foundry Co.

The Interstate Railway has ordered five gondola cars of 80,000 lbs. capacity from the Ryan Car Co.

The Brinson Railway has ordered 15 flat cars of 60,000 lbs. capacity from the South Atlantic Car & Mfg. Co.

The Grand Rapids & Indiana is said to have ordered 30 passenger cars from the American Car & Foundry Co.

The South Manchuria has ordered 75 passenger coaches, baggage and mail cars from the American Car & Foundry Co.

The Baldwin Lumber Co., Baldwin, La., is said to have ordered 20 narrow gage logging cars from the Orange Iron Works.

The Pennsylvania had not, on April 1, ordered any steel passenger cars, as reported in the *Railroad Gazette* of March 29.

The Lutcher & Moore Tramway Co., Fields, La., is understood to have ordered 10 logging cars of 80,000 lbs. capacity from the Orange Iron Works.

The Great Western Oil Refining & Pipe Line Co., Chicago, Ill., has ordered 25 tank cars of 8,000 gallons capacity from the American Car & Foundry Co.

The Harriman Lines are understood to be about to order 275 passenger cars, and are said to have prepared specifications for 3,000 steel underframe box cars.

The Interborough Rapid Transit has ordered 65 elevated railroad cars from the Wason Manufacturing Co. This is understood to be part of the order reported in the *Railroad Gazette* of March 1.

The St. Louis, Rocky Mountain & Pacific is having built at the Madison shops of the American Car & Foundry Company, for delivery about May 15, 300 wooden gondolas of 80,000 lbs. capacity.

The Chicago, Indianapolis & Louisville, as reported in the *Railroad Gazette* of March 29, has ordered 300 40-ft. flat and 200 box cars of 80,000 lbs. capacity from Haskell & Barker, and will build 10 cabooses at its Lafayette shops. The flat and box cars are for April, May and June delivery. The box cars will weigh 34,700 lbs., and will measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The specifications for the flat and box cars are as follows:

Bolsters	Haskell & Barker
Brake-beams	Haskell & Barker
Brake-shoes	Haskell & Barker
Brakes	Westinghouse
Brasses	Haskell & Barker
Couplers	R. E. Janney
Door fastenings (for box cars)	Haskell & Barker
Draft rigging	Haskell & Barker
Dust guards	Harrison
Journal boxes	Haskell & Barker
Roofs (for box cars)	Haskell & Barker
Springs	Pittsburg Steel & Spring Co.
Trucks	Haskell & Barker
Wheels	Haskell & Barker

The specifications for the cabooses include:

Couplers	Monarch
Platform	Sessions

RAILROAD STRUCTURES.

Albuquerque, N. Mex.—The Atchison, Topeka & Santa Fe has plans ready for a large addition to the local machine shops. The proposed improvements are to cost several hundred thousand dollars.

Buffalo, N. Y.—The International Traction Company has started work on a new car house 162 ft. x 525 ft.

Carrizozo, N. Mex.—The El Paso & Southwestern shops at this place were recently destroyed by fire, together with five engines; loss about $190,000.

Conemaugh, Pa.—The Council has granted permission to the Pennsylvania and work is shortly to be started on a large dam. The dam is being built for a reservoir to have a capacity of 4,000,000 gallons of water.

Duluth, Minn.—The Great Northern expects to spend $200,000 for a new freight house and terminals in Duluth.

Lincoln, Neb.—Local reports state that the Chicago, Burlington & Quincy is planning to put up a new passenger station, to replace the one destroyed by fire last year.

Milwaukee, Wis.—The Grand Trunk has bought 24½ acres between the lake and the Kinnickinnic river as a site for terminals. In connection with the construction of the new terminals, the company is to add one or two modern car ferry steamers to its Milwaukee line.

New Orleans, La.—Bids are wanted April 29, by Charles R. Kennedy, Comptroller, for building a viaduct over the tracks of the Southern Pacific on Newton street, Algiers.

Bids are being asked by the New Orleans Terminal Company for the proposed passenger station.

New York, N. Y.—A contract has been given to the F. W. Carlin Construction Co. at $404,865 for changes at the Manhattan entrance of the Williamsburg bridge, to include an entrance to the proposed loop subway, over a steel viaduct with masonry approach. The other bids were Snare & Trieste Co., $418,400, and Williams Engineering & Contracting Co., $549,000.

Port Arthur, Ont.—The Canadian Pacific is to improve its yard facilities; a new station and freight sheds are also to be put up.

Winnipeg, Man.—Extensive improvements are to be made to the Canadian Pacific shops here.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Atchison, Topeka & Santa Fe.—This company has opened a new branch, built under the name of the Pecos & Northern Texas, from Amarillo, Tex., south to Plainview, 75 miles.

Asheville & Henderson.—Incorporated in North Carolina, with $750,000 capital, to build a line from Asheville, N. C., to a point in Henderson County, 20 miles. C. F. White, of Skyland, is interested.

Atlanta, Stone Mountain & Lithonia.—Incorporated in Georgia, with $50,000 capital, to build from Decatur, Ga., east to Stone Mountain, thence southeast to Lithonia with branches, a total of 30 miles. Such a line would parallel the Georgia Railroad. It is expected to start work at once on the proposed line. The incorporators include: A. O. Venable, J. S. McCurdy, R. M. Thompson, D. Shepard, A. B. Kellogg and G. R. Pace, of Decatur; T. C. Miller, B. H. Hill, S. H. Venable, J. L. Patrick, J. N. Ellis and C. D. Hill, of Atlanta.

Canadian Northern.—This company has opened the section from Edmonton, Alb., to Stony Plain, 21 miles.

The Morinville branch from Edmonton, Alb., to Morinville, 23 miles, has been opened for business.

Chicago, Cincinnati & Louisville.—This company has built about 12 miles of road, completing its entrance into Chicago, and the new line will be in full operation on April 7. The C., C. & L. has entered into a contract with the Wisconsin Central by which it secures a joint right to use the latter's freight terminal privileges at the Illinois Central terminal by a sub-lease. Both roads have the same president, and are almost entirely owned by the same financial interests. They have a common junction point at Chicago, and together form a through line from Duluth to Cincinnati.

Chicago, Milwaukee & St. Paul.—A contract is reported let by this company for building an extension from Mason City, Ia., south to Hampton, 30 miles. In connection with the Des Moines, Iowa Falls & Northern, which is building north from Iowa City, this will make the shortest line between St. Paul and Des Moines.

Colorado, Oklahoma & Gulf.—Incorporated in Oklahoma with $3,000,000 to build a line from Arapahoe, Okla., southeast via Ardmore, Ind. T., to Sherman, Tex., 300 miles. J. M. Allen and J. Q. Robins, of Tupelo, Miss.; C. W. Young, of Memphis, Tenn.; W. M. Cox, of Baldwin, Miss.; J. S. Jenkins and W. E. Hodges, of Oklahoma City, are incorporators.

Corbin & Nashville.—This company, projected to build from Corbin, Ky., into Tennessee, is reported having let contract to Peter & Co., of Louisville, to build the first section from Tateville, south of Somerset, Ky., to Monticello, 25 miles. James Denton, Somerset, Ky., is interested.

Denver, Laramie & Northwestern.—Plans are about ready and preliminary surveys have been made for building this proposed line from Denver, Colo., via Boulder, Fort Collins, Laramie and Yellowstone Park to the northern boundary of Wyoming. (March 15, p. 383.)

Duluth & Iron Range.—This company, it is reported, is planning to extend the Range spur from Mesaba, Minn., to Mayas Mine and thence to Syndicate Camp, about 12 miles.

Fairchild & Northeastern.—This company has extended its road from Bright, Wis., north to Owen, five miles.

Grand Trunk.—The Provincial Legislature has authorized the city of Montreal to spend an amount not to exceed $2,000,000 for a share of the cost of elevating the Grand Trunk tracks at that place.

Illinois Central.—Contract has been given to H. C. Hodges & Co., of Birmingham, Ala., to build the Memphis & State, which is to be a double-track line from Aulon, Tenn., to the Nonconnah yard, about seven miles.

Memphis & State.—See Illinois Central.

Memphis, Covington & Northern.—Surveys are reported made by this company for building a line from Memphis, Tenn., northeast to Covington, 29 miles. Contract will be let as soon as financial arrangements are made. Such a line would parallel the Illinois Central. The W. K. Palmer Co., Dwight Building, Kansas City, Mo., is the Engineer.

Mississippi Southern.—Incorporated in Mississippi, to build from Gulfport, Miss., via Laurel to West Point, 225 miles. The incorporators include: Mayor T. H. Oden and M. Muhle, both of Laurel.

Missouri Pacific.—According to reports from Herrin, Ill., the St. Louis, Iron Mountain & Southern has completed an extension from Herrin to Marion, and will build a branch east 10 miles to the new coal town of Pittsburg.

Norfolk & Southern.—The Columbia branch of this road has been opened for business from Mackie's Ferry, N. C., east to Creswell, 13 miles.

The Raleigh division has been opened for business from Raleigh, N. C., east to Zebulon, 24 miles.

Oregon Railroad & Navigation Co.—Work, it is said, has been stopped on the extension of this road from Elgin, Ore., east to Wallowa, thence southeast to Joseph. Finished to the Wallowa river.

Pennsylvania.—Reports from Newark, N. J., say that the Pennsylvania is about to take title to the property of the Crucible Steel Co. of America, in Harrison, which is the site selected for the new terminal yards of the electric line to New York. The property includes several hundred acres between the present tracks of the Pennsylvania and the Passaic river. Its acquisition will give free access to the main tracks and cut off half a mile of passenger trackage between Newark and New York. It is also reported that the plant of the Marine Engine & Machine Co., occupying one and a half city blocks just south of the Center street bridge in Harrison, will be taken over by the railroad for freight yard purposes.

Pittsburg & Lake Erie.—Joint franchise rights, which involve the expenditure of over $1,000,000, and which are intended to settle the warfare between the Vanderbilt and Gould interests in Pittsburg, have been approved by a special committee of select council after months of deliberation. The committee has approved an ordinance which permits the Pittsburg & Lake Erie to build a bridge over Main street and to construct nine tracks into its present terminal for passenger trains, with freight lines to the warehouses above Smithfield street. The Wabash company has made a traffic arrangement with the Pittsburg & Lake Erie to use the latter company's tracks to the warehouses, and has abandoned the project to erect an elevated spur along Carson street, for which a franchise was secured from the city councils over four years ago. If the city gives its permission to build the bridge over Main street in the West End, the two companies will use the same freight yards in the West End between Main street and Saw Mill run. The Pittsburg & Lake Erie will reach the yards by its present route, while the Wabash trains will run over the West Side belt line. The bridge over Main street is to be 125 ft. wide.

St. Louis & Oklahoma Southern.—Contracts are reported let for building this proposed line from Monett, Mo., southwest via Pineville, Mo., and Tahlequah, Ind. T., to Muskogee, about 115 miles. Surveys are being made. Capital has been secured. J. A. Sturges, President, Pineville, Mo.; C. D. Bennett, St. Louis, Mo., Chief Engineer. (March 15, p. 391.)

St. Louis & San Francisco.—Announcement is made that this company will spend $450,000 this year in laying new and heavier tracks and improving the roadbed of the central division between Springfield, Mo., and Fort Smith, Ark.

St. Louis, Iron Mountain & Southern.—See Missouri Pacific.

St. Louis, Rocky Mountain & Pacific.—This company has filed plans showing a proposed extension from Cimarron, N. Mex., the present western terminus, to San Fernando de Taos, by way of Taos Pass over the Sangre de Cristo mountains, 38 miles. The line is to be built this summer.

St. Louis, Springfield & Oklahoma Western.—Contracts, it is said, are to be let about May 1 for building this proposed line from Lawton, Okla., east to Sallisaw, 225 miles. G. S. Stocker, of Stiegler, Ind. T., is President, and A. D. Goodnough, of Sulphur, General Manager.

Southern.—The company is to make extensive improvements on the Harriman-Nashville line. A number of new stations will be built, also side tracks, filling trestles, and new bridges. Some of the wooden bridges are to be replaced with iron and steel structures. The most expensive work is the filling of trestles.

Texas Railroad.—Incorporated in Texas, with office at Winnsboro, to build a line from Winnsboro north to Mount Vernon, 16½ miles. C. H. Morris, M. D. Carlock and J. M. Langford are interested.

Toledo, St. Louis & New Orleans.—A meeting of this company was to be held in Carmi, Ill., April 2, to arrange for the construction of this proposed line, projected from Effingham, Ill., south to Brookport, 140 miles, with an east branch to Evansville, Ind., 65 miles, and a west branch to Ziegler, 22 miles. N. M. Burns, St. Louis, Mo., is President.

Toledo, Wabash & St. Louis (Electric).—Incorporated in Maine with $6,000,000 capital to build an electric line from Toledo Ohio, to St. Louis. The first 50 miles, from Toledo to Defiance, has been financed. C. W. Whitney is President; Geo. G. Metzger, Vice-President, and J. P. McAfee, Treasurer, all of Toledo, Ohio. F. M. Thompson, L. H. Stevens, C. C. Ballard, F. J. C. Little and I. E. Kearney, of Augusta, Me., are interested.

Topeka-Southwestern.—Contract let to the Southwestern Railway & Construction Co., of Topeka, Kan., for building this proposed line from Topeka, southwest to Council Grove, 60 miles. Additional contract shortly to be let for bridges, buildings, etc. The line is to be laid with 80-lb. rails, and is expected to be finished by the first of next year. W. L. Taylor, President, Topeka, Kan.

Virginia Northern.—Incorporated in West Virginia, with $50,000 capital, to build from Bradshaw, W. Va., south along Middle Fork in Virginia. T. E. Young, A. D. Baldwin, A. C. Hezlop and A. S. Heckler, incorporators, with office in the Rockefeller Building, Cleveland, Ohio.

Wabash.—See Pittsburg & Lake Erie.

West Shore Traction.—A certificate of necessity and convenience has been granted this company by the New York State Railroad Commission to build a high-speed electric line from Tompkins Cove on the west bank of the Hudson river, New York, south to Carteret in Rockland County, about 25 miles. The company hopes eventually to extend the line south to a connection with the tunnels under the Hudson river, at or near Jersey City, and so to New York City. (March 15, p. 394.)

Williamsburg & Iowa City (Electric).—Organized in Iowa to build an electric line from Williamsburg, Ia., to Iowa City; also one from Williamsburg west to Des Moines. C. F. Burns, A. Cox, F. O. Harrington and D. S. Maher are interested.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—On April 3 a semi-annual dividend of 3 per cent. was declared on the common stock, raising the annual dividend rate from 5 to 6 per cent. The first dividend of 3½ per cent. on the common stock was in 1901. In each year since then up to 1906, 4 per cent. was paid. The total payments in 1906 were 4½ per cent.

Belvidere Delaware.—An annual dividend of 10 per cent. has been declared on the $1,253,000 outstanding capital stock of this road, which is leased to the Pennsylvania. The road runs from Trenton, N. J., to Manunka Chunk, 67 miles, with a 14-mile branch. Since 1897 the annual rate has been 5 per cent.

Canadian Northern Quebec.—This company has given notice that it will exchange, not later than April 14, 1907, 4 per cent. perpetual debenture stock for Great Northern of Canada 4 per cent. guaranteed bonds, at the rate of £95 in stock for each $500 in bonds. The Canadian Northern Quebec is a merger of the Great Northern of Canada, the Chateaugay & Northern and the Quebec, New Brunswick & Nova Scotia. (Oct. 26, 1906, p. 115.)

Canadian Pacific.—According to a press despatch from Ottawa, the Canadian Pacific has made a traffic agreement with the Oregon Railroad & Navigation Co. by which the Canadian Pacific secures trackage rights over that company's line from Spokane, Wash., to Portland, Ore., 433 miles. The Canadian Pacific already reaches Spokane over the Spokane International, which runs from a point in British Columbia, on the Canadian Pacific's Crows Nest Pass branch, southwest to Spokane.

Chicago City Railway.—See Chicago Union Traction.

Chicago Terminal Transfer.—The date for the foreclosure sale of this property has been set for May 3. It is understood that the Baltimore & Ohio will bid against the Hill interests for the property. (Mar. 1, p. 290.)

Chicago Union Traction.—The city of Chicago approved by a popular vote on April 2 the traction ordinance. According to the terms of this ordinance, the Chicago Union Traction and the Chicago City Railway are to make needed improvements at a cost estimated at $40,000,000. The city has the right to take over the properties for municipal operation at any time on six months' notice by paying the agreed present valuation of $50,000,000 gross, plus the cost of rehabilitation. The companies are to receive 5 per cent. on their investment, after paying operating expenses, taxes, repairs, renewals and depreciation, and of the remaining surplus 55 per cent. goes to the city and 45 per cent to the company. The city reserves the right to authorize another company to take over the property on certain specified conditions. A board of three supervising engineers is to be created to approve all contracts and with the power to fix salaries. (Dec. 28, 1906, p. 574.)

Erie.—It is understood that the $3,000,000 notes maturing April 8 will be refunded by a much larger new issue, which, it is said, has been offered to Boston bankers.

Galveston, Harrisburg & San Antonio.—See Southern Pacific.

Georgia Railway & Electric.—The shareholders have voted to increase the common stock from $6,014,600 to $8,500,000. The majority of the new issue, it is understood, is to be distributed as a 33⅓ per cent. stock dividend to the present stockholders. The company operates 144 miles of street railway in and near Atlanta, Ga.

Great Northern.—The Supreme Court of Minnesota has handed down a decision holding that the Great Northern may issue $60,000,000 additional stock without first getting permission from the Minnesota Warehouse Commission. This stock was to have been offered to stockholders last December, but an injunction was granted to the state of Minnesota restraining the issue. (Dec. 14, 1906, p. 168.)

Kansas City Southern.—An initial dividend of 4 per cent. was on April 3 declared on the $21,000,000 preferred stock. This calls for payment of $840,000, as against estimated net earnings of $1,965,000 for the year.

Mt. Mansfield (Electric).—Charles E. Burke, of Stowe, Vt., has been appointed receiver. The road runs from Waterbury, Vt., to Stowe, 10 miles, and has outstanding $300,000 stock and $200,000 bonds. The American Trust Co., Boston, is bringing foreclosure proceedings.

Oregon Railroad & Navigation.—See Canadian Pacific.

Pennsylvania.—See Belvidere Delaware.

Southern Pacific.—Holders of a large amount of the $6,354,000 Western division second mortgage bonds of the Galveston, Harrisburg & San Antonio have brought suit to enjoin the Southern Pacific from paying dividends on its common stock. The plaintiffs assert that the Union Pacific controls a competing line, and ask that the Union Pacific and its officers be restrained from voting on any stock of the Southern Pacific or exercising any control over the Southern Pacific or its subsidiaries, including the Galveston, Harrisburg & San Antonio. No interest has been paid on the second mortgage bonds, referred to above, for many years. In 1891 an agreement was made releasing the Southern Pacific from its obligation to pay this interest, and making the securities income bonds. The plaintiffs claim that the Galveston, Harrisburg & San Antonio is an integral part of the Southern Pacific system, and is only showing a deficit because of the methods of accounting adopted by the management. The Southern Pacific interests contend that the Galveston, Harrisburg & San Antonio has not earned the interest on its bonds, and that its earnings do not contribute to the Southern Pacific dividends, but that, on the contrary, the Southern Pacific has advanced money to the Galveston, Harrisburg & San Antonio for payment of first mortgage interest and for improvements.

Toledo & Western (Electric).—Control of this road, which has been in the hands of a receiver since July 2, has been acquired by the Toledo Railway & Light interests. (Jan. 25, p. 130.)

Toledo Railway & Light.—See Toledo & Western.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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CONTENTS

EDITORIAL:

New Hampshire Railroad Legislation ... 501
Raising the Youth-Limit on the Reading 501
Refunding Short Term Note Issues..... 501
Dividend Declarations and the Stock Market—A Comparison..... 502
Right Remedies and Wrong Ones..... 502
Excessive Hours in a Block Signal Station 502
Continuous Rails for Uniform Track Structures 503
Tests at the Bedford Park Curve..... 504

ILLUSTRATED:

Government Report on the Block System. 507
The Grades of the Western Pacific..... 510
The Pennsylvania Railroad Tunnel Extension into New York City 512
New Southern Pacific Station at Oakland, California. 516
Track Deformations and Their Prevention 517
The Transmission of Heat Through Scale-Covered Boiler Tubes 519
The Sixth Street Viaduct at Kansas City 521

CONTRIBUTIONS:

The Profitable Weight and Speed of Freight Trains. 504
Fallacies of Superelevation..... 506

MISCELLANEOUS:

Railroad Legislation in South Dakota.... 506
Dedication of the Engineering Societies Building 514
Decision by Judge Speer on the Federal Employers' Liability Act..... 515
President Joline on the Railroad Situation 516
Foreign Railroad Notes..... 506

GENERAL NEWS SECTION:

Notes 525
Obituary 529
Meetings and Announcements 529
Elections and Appointments 529
Locomotive Building 530
Car Building 530
Railroad Structures 530
Railroad Construction 531
Railroad Corporation News 532

VOL. XLII., No. 15. FRIDAY, APRIL 12, 1907.

The outcome of what it is hardly a stretch to call a "railroad session" of the New Hampshire legislature, preceded, as the session was, by a period of acute anti-railroad agitation, is of civic as well as economic interest. The bill, heretofore referred to, compelling the railroad companies to give free passes to the lawmakers died in the state senate after passing by a large majority the lower house of some 400 members, the largest state legislative body in the United States. The measure was vigorously resisted by the reformers and thus the smaller legislative body, contrary to the rule, became their citadel. Finally both houses adopted the wiser plan of having the state pay directly for the passes—a system already in practice in several states, and toward which many other states are gravitating. The other reform measures prominent in last autumn's political campaign struck rocks and went to pieces. The elective railroad commission—a measure, to say the best for it, of very doubtful wisdom—was rejected without discussion as was the much better measure to pay the Railroad Commission from the state treasury instead of "loading" its costs upon the railroads. It takes, evidently, a somewhat rare and fastidious legislative mind to measure the unwisdom and impropriety of any form of fiscal dependence between a public supervising body and the interests supervised. Taking the results, as a whole, of the anti-railroad movement in New Hampshire, they seem pretty vacuous. They contrast impressively with the recent drastic railroad legislation in Vermont, a state coterminous, with many elements of population similar to those in New Hampshire and *prima facie* the more conservative commonwealth of the two.

The Philadelphia & Reading has followed the Pennsylvania in raising the minimum age limit to be observed in hiring new employees. Men 45 years old may now be employed instead of rejecting all over 35. Two editors of active and academic mind have seized the occasion to philosophize on the "grave mistake" which these roads made when they established the limit at 35 years, and thereby declared that a man 44 years old is always less efficient than one 34. These wise editors should have inquired as to the fact; they would have found that their reasoning is all useless because their premises are wrong. The age limit was fixed primarily to insure equity in the granting of pensions to superannuated employees, and without special reference to the candidate's ability or skill in his work. Pensions are based in part on the length of the employee's service, and it would be unfair to encourage a man to enter a new service at the age of 40. To exclude him has the effect—at least an indirect influence—tending to keep him where he is and, consequently, in position to benefit by any pension that may come to employees of that road. In accepting men over 35 these two roads, driven by necessity, are looking out for the best available men for their service even at the disregard of this consideration in behalf of the employee. This necessity will also result in impairment of the road's interest and welfare in some cases; for most new men have to begin near the bottom of the ladder, and as promotion at the fastest occupies a series of years, men beginning, say, as firemen at 40, will in the natural order not become passenger enginemen till they are so old that they can give only a minimum number of years to that service. The company, if it gives such a man a thorough training, will spend an amount of time and money on the educating process disproportionate to the length of service to be received by it in return. This is only partly true of a man who has some experience before he is hired; but such men—men who change from one road to another after years of service—often have some deficiency which diminishes their value for the highest class of service.

Two railroad companies, neither of them among the strongest in the country, but both large systems, have, during the past week, refunded issues of short-term notes. The Erie sold $5,500,000 one-year credit notes, non-interest-bearing but sold on the regular discount basis of commercial paper. With the proceeds of these there have been refunded $3,000,000 6 per cent. notes sold last December, which matured on Monday of this week. The Wabash has $6,160,000 3-year 5 per cent. notes maturing on May 10. A new issue of the same amount and bearing the same interest has already been sold. The notes maturing are secured by all the stock and $6,600,000 of the 50-year first mortgage bonds of the Wabash Pittsburg Terminal Railroad. The new notes run for two years and are secured by this collateral and in addition by $4,800,000 of Wabash 4 per cent. bonds as well as $10,000,000 in stock of the Wabash-Pittsburg Terminal. It is reported that the funds thus obtained cost the Wabash 8½ per cent. and the Erie 10 or 11 per cent., the high rate in the latter case being because the notes are unsecured and the market is full of short-term notes issued by such strongly solvent companies as the Pennsylvania and the Louisville & Nashville, while the Erie, after its stormy history, has specially high fixed

charges. As a result there is little surplus left over after the first preferred and second preferred dividends, one or both of which may have to be passed in order to pay the face value of the notes a year hence. The expensive terms of the issue for the company, if these reports are correct, may be seen from the fact that it gets about $5,000,000 cash, for which it must pay $5,500,000 a year from now. The Erie has also $2,000,000 of six-month 6 per cent. notes maturing between now and July 3. It is evident that these maturing note issues have seriously failed of their purpose. A railroad issues short-term, high-interest-bearing notes in the expectation of being able to refund them during their life at a lower and more advantageous rate of interest, yet these issues have to be refunded by new temporary financing of the same sort at greater costs than the old issues. The outcome of this present situation is one of the most vital facts which affect the value of railroad properties. The railroad manager who can guess rightly the earliest time at which it will again be possible for his road to sell bonds at a fair rate is in a position to save it more money than he could in almost any other way.

"The amount credited as the gain of E. H. Harriman alone is placed at not less than $10,000,000 by many brokers."—*Wall Street Journal*, Aug. 17, 1906.

"Kansas City Southern advanced before the declaration of the preferred dividend, but the market shows very plainly that there has been none of that preliminary heavy inside speculation which did so much to disturb confidence and start the decline in stocks last year. The controlling interest has not been in the market."—*Wall Street Journal*, April 3, 1907.

These two brief comments selected from the "Features of the Market" column of the *Wall Street Journal* might well be made the subject of careful thought by those high railroad officers who feel that the financial difficulties with which railroads are confronted today are due only to the meddlesome activity of one Theodore Roosevelt, and that the distrust of railroad securities and railroad management has little or no justification. The fact that the railroads cannot borrow on reasonable terms the money necessary for improvements is due to a number of causes, in particular the great demand for capital in all lines of industry. An exceedingly important cause is the widespread distrust of railroad stocks and bonds. The comments noted above, it should be remembered, are taken, not from the editorial column, but from the current comment on the day's stock market sent out from hour to hour over the ticker. They represent, not the quiet and philosophical opinion of an editor in his study, but the swift judgment of market facts of a trained observer. We have several times taken occasion to condemn the Harriman dividend incident as an essentially unjust exercise of corporate power. It is a pleasure in contrast to record this frank opinion of the way in which the first dividend of the Kansas City Southern was declared last week. There is an added contrast between the two instances if one remembers that the Kansas City Southern was, up to two years ago, under the control of Mr. Harriman. The annual report issued after he retired was one of the severest indictments of a railroad management which has been made since the receivership era of 10 to 15 years ago. In brief, the roadbed, structures and equipment had been allowed to seriously deteriorate; traffic had (apparently) been diverted to other lines; there were over 600 wrecks in one year, and improper bookkeeping entries. Without attempting to pass on the truth of these charges, it is to be observed that the Kansas City Southern is now, in comparison with other roads, getting remarkably successful results from operation. The added fact that the men who control it are not using the road as the basis of a stock market campaign is another element of the company's present strength.

There are many indications that we are now seeing the beginning of a widespread epoch of corporate frankness, as already exemplified in the efforts of Mr. James J. Hill to explain fully and clearly the Northwestern situation whenever he has an opportunity to do so; in the extraordinary frankness with which Mr. E. H. Harriman told all he had to tell in the recent investigation and added much that was not required; in the establishment of a thoroughly good, systematic, press bureau service by the Pennsylvania, and in the frequent speeches made by Mr. Charles S. Mellen. The Southern Railway has been for years, and especially in recent times, a most notable example of a frank corporation, and its new President, Mr. W. W. Finley, goes even beyond the traditions left him by his predecessor. In the week ended March 23d, Mr. Finley made two characteristic addresses, each dealing with a separate part of the present situation, and an important one. At Spencer, N. C., he spoke to employees of the company on the occasion of the dedication of the Y. M. C. A. building at that place, and brought out no new points, but emphasized some old ones which can hardly be stated too often; the necessity for intelligent team work by departments and inside departments, the absolute dependence of the corporation upon the efforts of its employees, and extremely good chances for high promotion which an intelligent and capable young man has in railroad work to-day. Mr. Finley's other address was made before the Commercial Club of Birmingham, Ala., and here again he dwelt on some important truths which have been often stated, but are, nevertheless, habitually overlooked. He pointed out that the country at large and the South in particular could not thrive through damage to its railroads, that better passenger service is more important to the South than reduced passenger fares and improved freight service is more important, especially to Birmingham and to the state of Alabama, than any possible reduction in freight charges could be. Regarding legislative proposals to impose penalties on the roads for failures to perform services, Mr. Finley said in slightly different form what he has always said before, for all to hear, that the imposition of penalties for failure to furnish cars, etc., without regard to whether a railroad had a sufficient supply of cars to meet the demands or whether it was possible for it to procure from the car building companies all the equipment necessary in time to meet the demand, would not only fail to help the situation but would tend directly to make it worse, as every penalty imposed would reduce by so much the ability of the road to improve its service. It seems curious that after two generations of experience with transportation problems in this country, a railroad should have to beg a community not to penalize it for failure to accomplish the impossible, but there is plenty of this kind of legislation afloat at the present time. Both President Finley and his neighbor, President Garrett, of the Seaboard Air Line, have come with fresh strength and courage to an old problem, and both have started in by making it quite clear to the communities which they serve that the way to improve the very bad railroad service in the southern states does not lie in the imposition of penalties, in enforced reduction of tariffs, or in constantly increased taxation.

"Crelly, an operator in charge of the block station at Huske, 43 miles south of Richmond, on the Atlantic Coast Line, was reported to the chief despatcher this morning, as having been on continuous duty in charge of the block station at that place for 72 hours, without having been relieved. Superintendent Wooten said to-day that it was an unusual case, and was caused by the wife of the day operator having been taken seriously ill, so that her husband could not leave her, thereby necessitating Crelly's having to work an extra turn."

The foregoing is from a Richmond report in a recent issue of the *Washington Post*. Assuming that for a part of the day or night the trains passing this block station are infrequent, and that the operator in this case had the advantage of an assistant to awaken him on occasion, this report is not incredible. Enginemen and other trainmen do similar "stunts" by sleeping in their cabs or cabooses while another member of the crew keeps awake. Assuming these mitigating conditions, and assuming also that the men thus straining their nerves beyond the elastic limit have intelligent consciences and mean to take all possible precautions against errors, this way of running a railroad is not absolutely impossible. But the significant part of the item is the alleged statement of a superintendent that the conditions "necessitated" this overwork. We hear now and then of superintendents who aver that operators who have done such things as this broke the rules without their superiors' knowledge—an explanation that reflects on the ability of the superiors—but not often does an officer claim that such conduct is necessary. Such an assertion implies that the superintendent consented, or would have consented to the excessive hours. But what superintendent in his senses could be induced thus to consent? An order involving the safety of lives and property would thus be based on bald assumptions. There is a great difference between an operator trying to keep awake most of the time for 72 hours (or even 36 hours, which is a more common occurrence) and a superintendent or despatcher authorizing such hours. The officer may well believe that in a certain case this degree of endurance is possible without bad results, while yet, if reasonably conservative, he must refuse to countenance the attempt. This is a difference that seems to be lost sight of in many of the discussions concerning the rule to prohibit trainmen from remaining on duty more than 16 hours at a time. Ninety-nine men in a hundred may possibly be able to work long hours for a week at a time and even longer, and no harm ensue; but what thoughtful superintendent can for a moment think of authorizing 16-hour days on this assumption? He

is depending on 100 per cent. of good judgment and good conscience and 99 per cent. of good luck, when it is his duty to calculate on a minimum of these elements. He must allow for a low percentage of judgment and conscience and not depend on luck at all. In one aspect of the case the application by Congress of 16-hour law penalties to the employer and not to the employee is rational; for the employee's misconduct in many cases—such as going to a circus or a ball game when he ought to be asleep at home—cannot be made subject to rigid rules (except such as the man himself can establish in his own mind); whereas the officer, being unable to deal with the engineman's conscience and his personal habits when off duty, must of necessity work by a rule, even if it be an extravagant or troublesome rule.

CONTINUOUS RAILS FOR UNIFORM TRACK STRUCTURE.

The function of the rail in the track is to guide the wheels and to distribute the loads to the ties. The ties in turn distribute the loads to the ballast, and the ballast to the subgrade. This applies to lateral thrust as well as to vertical loads. These three distributors should be considered, each entirely separate from the other, and they should each be made to distribute the loads equally at all points along the track in order to have ideal conditions. Bad results come from expecting the ties or rail to bridge over a soft spot where the ballast is not performing its work uniformly, or from expecting the ties to do some of the work of a rail-joint that is not as stiff as the rail. If one of these distributing agents is required to do some of the work of another in addition to its own, at any one point in the track more than at another, then this one point is surely a weak one in the structure.

It is quite practicable to make the ballast conditions along the track almost uniform. The ties in themselves, of course, can be about the same, but in the rail structure, the joining of one rail to another seems to preclude uniformity, and it is very difficult to obtain in this structure exactly the same conditions throughout. Ideal conditions would be attained by a continuous unbroken rail, which would have no joints and would perform its function the same at every tie. This seems then to resolve the task into a problem of uniform splicing of the rails without any reference to the ties, rather than the solving of the long mooted questions, as to whether the joint should be of the suspended or supported type; whether one, two or three ties should help support the joint, or whether the ties should be considered as a permanent abutment for a bridge. If the rail structure throughout its length were in itself uniform in lateral and vertical stiffness, in its bearing on the ties, in its spiking facilities, etc., then all these other considerations of the tie in connection with the splice would be eliminated, and the ties could be placed wherever a good uniform spacing would bring them, as far as the assistance they render to the splicing of the rails is concerned. Railroads would then no longer be spending so much money renewing battered, bent and broken rail ends, or persistently driving ballast under the joint ties as fast as it disappears into the ground. All this trouble seems to be caused by periodic weak and otherwise uniform places in the jointed rail-structure. It is the lack of stiffness in the upper structure that permits the excessive deflecting of the ties, rather than the lack of bearing under the ties that permits the excessive deflection of the rail. This is precisely similar to the lateral conditions in which a lack of stiffness at the joints makes good alinement difficult.

Much of the present research and ingenuity seems to be exerted along wrong lines; all, perhaps, because in these considerations many people have been unwilling to isolate the ties from the joints, and persist in asking one to do part of the work of the other. The isolated splicing of the rails seems to be the fundamental problem, and the correct solution of it should be more generally accepted in the present efforts to strengthen track. With this problem solved, lighter rails would afford as good service as is now obtained with the large rail sections: not that the use of lighter rails is proposed, but what is equal to the same thing, the efficiency and strength of the present track could be greatly increased.

This analysis may seem theoretical and the task impracticable on account of being beset with so many difficulties. It is necessary, then, to look at these difficulties and to consider from the practical side what the conditions are, and what must be met in joining two isolated rails so that they will act like one when laid on the ties.

The two rails must be held together by a device as stiff vertically and laterally as the rail. This device should also have the same flexibility as the rail, should contain the least possible amount of material and the least number of parts. It should not touch the ties; but should allow the rail base or the tie-plates to afford the same bearing on the joint ties as on other ties. Spiking should be the same at the joint ties as elsewhere; except that it may be done in slots to prevent the creeping of the rail. This additional anti-creeping function of the joint will hardly interfere with it as a splice, if the spiking and bearing surfaces are otherwise kept the same at the splice as along the rail. Excessive or different spiking at the joints to compensate for a weak splice laterally makes rigid spots in the track and causes increased lateral wear at the rail ends. The splice must also hold the rails tight enough to give perfect safety and equal stiffness, and yet it must allow for expansion and contraction of the rails.

There are in addition to the requirements just mentioned, certain other difficulties imposed by natural and unavoidable limitations. The space around the rail ends is limited, and ideal conditions would not allow additions below the rail base on account of interfering with the ties and altering the bearing on them. This means that, if additions below the rail base must be used to get sufficient vertical stiffness, all such additions must be located between the ties; this, at the expense of having to adjust the ties somewhat, in order to clear the depending portions. Such adjustment, however, should not be a hardship, as the spiking facilities to prevent creeping are afforded at the same time.

It is now left to consider what appliances are available for meeting these requirements and limitations. This means, primarily, a criticism of the different types of rail joints, the best of which, necessarily, reduce the uniformity of the rail, from the fact that they are added parts; but the nearest approach to the ideal conditions is a splice bar rolled by several of the large steel companies. This bar has a stiffening flange to extend below the rail base between the ties, its end portions being cut away to clear the ties. This method of reinforcing the ordinary angle bar is as simple as it is effective, and it allows the use of the many good features of the angle bar which has stood the test for years. One of the best of these features preserved is, that the bars fit the rail only on two surfaces, which insures flexible adjustment and good tight-fitting contacts at all times, and in this they do not depend on any unusually accurate work at the rolling mills. It is obvious that a free depending flange can be designed and shaped so as to make the stiffness and flexibility of a pair of bars the same as a rail of any section, and also that the ordinary angle bar joint one-third as stiff as the rail can thus be transformed into one having the same stiffness as the rail. This reinforced type of bar is now standard on a number of the large eastern roads, and its popularity is rapidly extending to the various sections of the country where the heavy loads and increasing speeds are demanding stronger track.

There are several other designs of depending flange joints on the market, each with somewhat different characteristics. There is a tendency to make some of them of a light section and to rely on a shallow depending flange for stiffness. This, of course, is done in competition in order to produce a cheap bar. While these light bars give better service than the common angle bar, yet it is very evident that a certain amount of metal is required to make even these reinforced bars as strong as the rail.

Other types of joints not having depending flanges are numerous. Some can be made as strong as the rail, but in doing so too much metal is used, or the metal is so located that various irregularities are introduced, which counteract all the good effect of having a joint of the same strength and elasticity as the rail. Excessive stiffness, laterally or vertically, is just as bad as excessive weakness.

There have been some attempts to increase the stiffness of the common angle bar, and also other weak types, by making them of comparatively high carbon steel; but this has proven to be a great mistake, as the percentage of increase in stiffness is slight and the bars are more brittle and dangerous. The false economy of such a method is recognized when one considers that this practice simply means that the rail ends become worn in the fitting angles, instead of allowing the wear to be taken by the splice bars, which can be renewed at slight cost compared to the cost of the rail. After these fitting angles of the rail become worn by the hard bars, the rails ends cannot again be brought up to line and surface by renewing the splices. They are permanently damaged

and the result is further battering and ultimate renewal. The splice bars should always be of softer steel than the rail.

The increasing use of the different types of reinforced depending bars is a great step in advance. It clearly indicates the practical application of the line of thought here presented, and it may not be long until there will be a general acceptance of the uniform rail structure idea. This will mean improvement in design of the present appliances, as well as the production of new devices to meet more clearly defined requirements. But in it all, the one thing to be considered is, this fundamental idea of tying together the jointed rail structure, so that it will receive uniform wear throughout, as well as act on the ties and ballast with a uniform effect, and be as nearly as possible the same as a continuous rail. It is the failure of the most of the present rail structure to do this that not only makes trouble for the ties and ballast, but also causes battering and breaking of the rails and joints themselves. The railroad tracks must then be considered as made up of these three separate distributors: rails, ties and ballast, each, separately, to be made uniform throughout, one not requiring another to do part of its own work. This seems to be the correct principle to follow in meeting the demands for stronger and safer track. A little energy and thought thus rightly directed would go a long way toward saving some tremendous maintenance costs and, on many roads, would partly solve the problem as to whether or not train speeds must be reduced.

On April 4 the New York Central made tests on the line from Melrose north to Woodlawn to determine if possible, by actual trial, the speed the Brewster express was making when derailed on the Bedford Park curve on February 16, and also to find the maximum speed which a similar train could make on this stretch of track. Conditions were duplicated as far as possible, the test train consisting of two electric locomotives drawing five passenger cars weighted with sand bags to take the place of the passengers which the wrecked train had carried; the contact shoes on the right-hand side of one locomotive and on the left-hand side of the other were removed. The motorman ran the train according to directions given him by the motorman who had run the train when it was derailed. Two trips were made. On the first one the train reached a speed of 62.5 miles an hour at 183d street; at this point the controller, which had been at series-parallel with all resistance cut out, was brought down to series with all resistance cut out, as had been done at the time of the derailment. At Fordham, two-fifths of a mile farther, the controller was put back to series-parallel without resistance and the train rounded the curve a mile farther on at 48.9 miles an hour. The rails on the curve had been double spiked since the accident. The motorman of the wrecked train and several officials of the railroad testified before the New York State Railroad Commission that at the time of the derailment the train was running between 45 and 50 miles an hour. A number of passengers testified that, to the best of their knowledge, the speed was between 70 and 90 miles an hour at this point. The second test run was made to find the highest speed the train could make on straight track and at the curve. The line from Morrisania north to Fordham, 2.22 miles, is nearly straight, on an ascending grade of about 10 ft. to the mile. Over this stretch the motors were run wide open; that is, with the motors connected in parallel and all resistance cut out. The highest speed, 66.5 miles an hour, was made just south of Fordham. At Fordham the power was shut off while the train ran over some frogs and switch points, and five seconds later the controller was put at series-parallel without resistance, where it stayed until the curve was passed. The speed around the curve was 56.5 miles an hour. The locomotives took the curve without shock and with only a slight rocking. The distance from Melrose to Woodlawn is 5.68 miles. The schedule of the Brewster express at the time of the derailment in February made the time between these points seven minutes. The time for this distance on the first test last week, which was meant to duplicate the run of the train on the night of the derailment, was 6 min. 31 sec.; on the second test the distance was covered in 5 min. 48 sec. The following estimates of the speed of the New York Central electric locomotives were made about a month ago. It is to be noticed that these figures are not intended to show actual results, but merely the maximum speed at which the motors can revolve when connected up on the systems indicated. Between Melrose and 183d street the current is delivered to the locomotives at 600 volts; between 183d street and Fordham at 625 volts; and between Fordham and Williamsbridge at 650 volts.

Possible Maximum Speed, Running Light on Level Tangent Track in Still Air, with 600 Volts at Motors.

Position of controller.	Speed in miles per hour—One locomotive.	Two locomotives.
Controller in full series notch	28	30
Controller in full series-parallel notch	50	52
Controller in full parallel notch	86	90

CONTRIBUTIONS

The Profitable Weight and Speed of Freight Trains.

To the Editor of the Railroad Gazette:

I am pleased to see by the proof of Mr. Wild's article, which you were good enough to forward me, that the trend of opinion in railroad circles is beginning to swing away from the large train. From long practical experience under varying conditions, I have found that it is not economical to load engines down to their limit. In Canada, and I take it that it is the same in the United States, it is becoming more difficult all the time to attract the right type of men to the train service, and I attribute a great deal of this to the conditions governing in that service.

Many years ago I started out on the principle that the greatest economy was to be effected through loading engines to the limit, and like many of my confreres I overdid it. Finally I had to switch and found that more economy resulted from loading the trains so that they could get over the road in a reasonable time. Our engine districts here are approximately 130 miles. When we get our trains over in from eight to twelve hours, varying according to the density of the traffic, we have no trouble in keeping men, maintaining high efficiency and minimizing train accidents. Where it takes men from 18 to 24 hours to get a freight train over a 130-mile district, there is an excessive use of fuel and oil, engine failures be-more more frequent through bad firing as a result of the fireman's endurance being overtaxed, train and enginemen become logy and sleep in side tracks, and accidents result.

Apart from this phase of the question, the damage and wear and tear to rolling stock through overloading engines is tremendous, to say nothing of the damage to the contents of cars by the shocks consequent upon pulling out drawbars, resulting in the brakes going into emergency. In the territory that I have charge of, trains are loaded so that they can get over the road in good time. We use small eight-wheel engines on way freight trains, and principally very heavy 10-wheelers on our drags.

In my opinion the overloading of engines and strict adherence to seniority has done more than anything I can think of to prevent the most desirable type of men joining and remaining in the train service.

G. J. BURY,
General Superintendent, Canadian Pacific Railway.

Baltimore, Md., April 8, 1907.

To the Editor of the Railroad Gazette:

It was gratifying to note in your issue of March 8 that Mr. C. F. Noyes was able to confirm my table of load reductions for given increases of speed after making due allowance for terminal delays to engines. Mr. Noyes approaches the subject, however, very cautiously and does not venture to offer an opinion on net revenue results. I quote him as follows: "As to whether the net revenue accruing from the train hauled would show figures corresponding to results shown in number of hours that a given number of cars could be removed, or not, I am not prepared to say."

It is hoped that a perusal of this letter will assist him to a conclusion on the net revenue aspect of the case.

I will now deal with the letter of Mr. W. A. Worthington in your issue of March 29. I hope Mr. Worthington will not consider me unduly severe if I venture the opinion that he has completely begged the point at issue, and in doing so that he has given a most apposite illustration of the remark to be found in Mr. Noyes's letter that "As a rule it would seem that most operating officers base their loading and movement of trains on the showing a single train can make between any two terminals."

It is clearly obvious from my table that, granted the premises, a speed of 15 miles per hour accumulates more net revenue than a speed of 10 miles per hour within a given space of time, and this without an inch of additional track or another locomotive or car. In answer to this Mr. Worthington eliminates the element of time absolutely and fixing his mind purely on the motion element asks for more cars, locomotives and track room. He does not seem to see that the capital charge for his additional facilities would be an addition to the expense of operating at 10 miles an hour, so that his argument from the face of my table neglects an important item which if brought under consideration might actually knock the props from under his own reasoning.

The advocates of the big, slow moving train and the cheap ton-mile display, in my opinion, remarkable confusion of thought as to the connections between costs of operation and net revenues. What does it matter what is the cost of completing and paying for a period of railroad transportation provided the net revenue at the end of the period is more and provided that all the implements of operation have been maintained in proper working order. The operation of railroads is for the convenience of the public and for the accumulation of net revenue for those persons who have invested in them. The unavoidable conclusion from the reasoning of Mr. Worthington and gentlemen of his frame of mind—mostly graduates from the Jas. J. Hill school of thought—is that a rail-

road is a concern with which they are to be allowed to demonstrate triumphs of engineering skill in the magnitude of the locomotives, cars and trains which can be made to run on wheels, hang together and get over the prepared steel tracks at a crawling pace and with a fair measure of safety.

I am not prepared to admit, however, in view of present day developments, that the big train with slow speed is giving us a cheap ton-mile. This statement is apparently inconsistent with the figures of my table. But it is so purposely. It will have been observed that I maintain the value of the car-mile at 10 cents in each of my seven examples and that I reduced my cost per train-mile by nothing more than the cost of repairs per car-mile for reduced number of cars per train-mile. This method of constructing the table was not a very sound one but it was purposely used to give some one the opportunity of criticising it in the light of the ascertained results of operating the concentrated weights of the present day. As there has been no comment on this aspect of the case so far I must undertake a little self-criticism. I do not believe that it is proper railroad operation to run present day 100,000-lb. cars under load at the speeds requisite to give an inclusive speed of 15, 20 or 25 miles an hour. To adjust my table to these conditions I should therefore have to reduce the value of the car-mile by a stated sum. If we will again fix our minds on the two speeds of 10 and 15 miles an hour it would probably be necessary to reduce the car load at least 10 per cent. for the higher speed, and this would give, let us say, a car-mile value of 9 cents. Accompanying this reduction in car mileage and increase in speed, however, there would actually be very important reductions in costs per train-mile. There was a time not so very long ago when from 3 mills to 4 mills per car-mile was looked upon as an adequate rate of car maintenance and repairs. It is true this rate did not take care of much depreciation but there would seem no reason why with a decrease in concentrated weight and a consequent decrease in wear and tear the rate for repairs per car-mile should not fall back from 8 mills to 1.5 cents, where it stands to-day, to, let us say, 4 mills, and if we will add 1 mill to this rate to take care of a much less rapid depreciation than exists to-day we should have a total rate of 5 mills per car-mile for car repairs and maintenance as compared with the 8 mills used in my table. But in addition to this reduction the more rapid movement would give material reductions in the expense for overtime and fuel and stores consumption. What these would actually amount to, of course, it is impossible to say, but inasmuch as the overtime bills are proportionately three and four times greater than they were only a few years ago, and inasmuch as the miles got out of a ton of fuel are from 30 per cent. to 40 per cent. less, it is plain I should have made a liberal reduction in the expenses of my table on these accounts.

The original table gave a reduction of from 75 cents for a speed of 10 miles an hour to 71 cents for the speed of 15 miles an hour. Using all the factors just detailed there is ample warranty for reducing the 71 cents to 55 cents (the reduced rate of car repairs and the reduced number of cars would alone give a reduction of 14.5 cents), and at this rate the cost of making the 57,143 miles of the table would be $31,429, which actually gives a cheaper ton-mile than the 10-mile speed; therefore, on this basis we should have to deny to the advocates of the big train load even the solace of a cheap ton-mile.

To illustrate the advantages derivable from a comparatively small capacity car at a higher speed than 10 miles an hour one can use very advantageously an item of illustration which recently fell from the lips of Mr. E. H. Harriman.

Mr. Harriman described in a recent interview what he saw at some wayside station in New England of the way in which coal cars are held for unloading at stations of that character.

Taking the condition as he described it let us assume coal being delivered in 50-ton lots to small country dealers who have but one team with which to unload the cars. Let the further assumption be that the distance the coal is hauled is 180 miles, and that in one case it moves forward in two cars of 25 tons capacity each at 15 miles an hour, and in the other case in one car of 50 tons capacity at 10 miles an hour. Let it be assumed lastly that the delay for reloading the cars at the mines is one day in each case, and that the duration of the operation is a month of 30 days.

Now if it takes the consignee four days to unload 50 tons it takes him two days to unload 25 tons; therefore, the delay to one of the cars in case 1 is half of what it is to the other car in case 1 or to the one car in case 2. Therefore, the capacity of service of the first car in case 1 is as follows:

180 ÷ 15 = 12 hours + 48 hours + 12 hours for return trip + 24 hours at the mines = 96 hours between the first loading and the second loading.

720 hours ÷ 96 = 7.5 round trips.

Second Car in Case 1.

180 ÷ 15 = 12 hours + 96 + 12 hours for return trip + 24 hours at the mines = 144 hours between first loading and second loading.

720 ÷ 144 = 5 round trips.

We have, therefore, 12.5 round trips out of the two cars which at 25 tons to the car effects the delivery of 312.5 tons in 720 hours.

Case 2.

180 ÷ 10 = 18 hours + 96 hours + 18 hours for return trip ÷ 24 hours = 156 hours between first loading and second loading.

720 ÷ 156 = 4.62 round trips.

50 tons × 4.62 = 231 tons, delivery in 720 hours.

If the rate were $1.50 a ton the gross revenue in the first case would be $468.75 and in the second case $346.50. So much for the gross revenue.

Now as to the expense of the two operations we have already seen that the present cost per train-mile for train expense, roundhouse expense and maintenance of equipment is at least 75 cents per mile. We have also set forth circumstances which would admit of a reduction of this cost to 55 cents. Using these costs for the two cases we have the following statements, viz.:

40 cars at 75 cents is 1.88 cents per car-mile.
35 cars at 55 cents is 1.57 cents per car-mile.

Then with Case 1.

360 miles × 12.5 round trips = 4,500 car-miles.
4,500 car-miles at 1.57 cents = $70.65.

Case 2.

360 miles × 4.62 round trips = 1,663.20 car-miles.
1,663.20 car-miles at 1.88 cents = $31.27.

Case 1 therefore cost $39.38 more than case 2, but as case 1 has given us $122.25 more of gross revenue we have a net balance in favor of case 1 of $82.87.

Since writing the foregoing I have seen the letter of Mr. B. A. Worthington in your issue of the 5th inst., and I am bound to say that he begs the question almost as completely as Mr. W. A. Worthington. This is evident on consideration of his second paragraph. Will Mr. Worthington kindly say what he proposes to do with the 1,429 hours gained as per my table? It is true he speaks later on about increasing "the ratio of delayed time to total time to such an extent as to nullify the benefit which would be derived from handling the trains at higher speeds while actually in motion," but in considering the concrete example of his second paragraph he does not even acknowledge that there is any benefit whatever to be nullified. In dealing with his example his mind is evidently fixed on conjoining a higher motion speed with the present scale of delays while the essential point for determination is whether the possibility of higher motion speed will not reduce delays in sidings through facilitating the despatching of the trains.

While I have already stated my opinion that an operating ratio has no meaning whatever in the eyes of a railroad shareholder provided you can present him with an increased net revenue, I dissent from Mr. B. A. Worthington's statement that the increase of 43 per cent. in his freight train mileage would increase the entire operating expenses of his company 37.5 per cent. or anything like it. Using no more elements of reduced expense per train-mile than those mentioned in the first part of this letter, the 2,992,259 train-miles required for the 30 per cent. reduction in the load would cost at 55 cents per train-mile $1,645,742, while the actual 2,094,132 miles run at 75 cents cost $1,570,599. There is therefore an adverse showing for the smaller load of $75,143, but of course the point is that this amount is overcome by the 1,429 hours saved in the operation of the lighter train. It would be interesting to know on what theory Mr. B. A. Worthington jumps his entire operating expense 37.5 per cent. for an expense of 43 per cent. in his freight train mileage.

With regard to the difference between Mr. Worthington's and Mr. Henderson's scales of resistance, I was aware the difference was slight, but inasmuch as there has been what I will venture to describe as a perfect murrain of exact science in the loading of engines on railroads of late years which has not, however, prevented the overloading Mr. Worthington himself admits, I thought it well to draw attention to the difference such as it is.

I quite fail to see why Mr. B. A. Worthington should be surprised at my objecting to his describing a railroad with a general average rate per ton-mile of 5.13 mills as a high class road. I am willing to concede that a road with 12 per cent. products of animals, 29 per cent. products of manufactures, and 6.5 per cent. products of forests ought to be a high class road, and that it gets no more than 5.13 mills for its work despite its average haul of 250.2 miles evidences that somebody else than it is getting too much of the rate. When it is a matter of talking about high class traffic Mr. Worthington should remember that the lowest class traffic between Chicago and New York earns 5.5 mills per mile on the basis of a haul of 900 miles. Possibly he will be more surprised, however, if I am still more slow to appreciate the significance of his comparison of the haul and the revenue per ton on the two roads. Apparently he expects us to conclude that one road is a high class road because it receives $1.28 for each ton carried and that another road is a low class road because it receives 66 cents for each ton carried. On this theory a railroad should receive no more for carrying a ton of coal than a ton of dry-goods.

With regard to Mr. B. A. Worthington's concluding paragraph, few people seem to realize the debit to the account of the big car

for the simple reason that it is a big car and takes longer to unload. I have partially dealt with this aspect of the question in the foregoing and wish some one would help me out with the rest of it. I have heard it stated that ton for ton a big steel hopper does not dump as quickly as a moderate size wooden hopper. Why this is so I am sure I don't know unless it be that the lower strata of the coal cake and clog under the pressure of the upper strata; but I give the statement for what it is worth.

I am free to admit that the 43 per cent. increase in train mileage instanced by Mr. B. A. Worthington is a formidable looking figure, but if it is attacked in front, as I do not think it has yet been attacked, by the triple battery of decreased difficulty in despatching, decreased probability of breakdowns and increased speed of motion, and charged in flank by a full regiment of decreased expenditures per train-mile it may not prove as unsurmountable as it looks.

M. B. WILD.

Fallacies of Superelevation.

Detroit, Mich., April 8, 1907.

To the Editor of the Railroad Gazette:

That there is something the matter with the commonly accepted theory of the superelevation of the outer rail on railroad curves seems to have been suspected, but not investigated by Mr. Wellington when he said that there is something that "presses the outer wheel against the rail with tremendous force, however high the superelevation."

Since the frequent railroad accidents of the past few weeks have temporarily awakened an interest in the matter we find recent issues of technical journals telling us about balancing a considerable portion of the centrifugal force by superelevation of the outer rail, and that a superelevation of six inches in a track width of about 59 in. creates a counter force (centripetal force) of about 210 lbs. per ton relieving the centrifugal force by that amount. This theory neglects to take into account the lateral friction of car wheels on steel rails.

Assuming the coefficient of this friction to be 0.20, if we elevate the outer rail about 12 in. we shall just overcome this friction, and our theory of centripetal force will then begin to apply, and if we elevate an additional six inches we shall undoubtedly develop a centripetal force of 210 lbs. per ton as desired; but it takes 18 in. instead of six inches of superelevation to do it.

For reasons not necessary to mention here it is tolerably certain that we are not going to elevate the outer rail either 18 in. or 12 in.; and we may confidently say therefore, that within the practicable limits of superelevation there can be no centripetal force developed on a railroad curve, and that we need not hope to relieve the side thrust against the track either in that way or in any other way, and what we must do is to provide for it. All that we need expect to get out of superelevation is a little additional comfort and a little additional stability against overturning (perhaps 10 per cent. of the latter for a superelevation of six inches), not by means of any centripetal force created by the inclined plane, but simply because we thereby move the center of gravity a little further inward from the outside rail and in that way give it a little more leverage, but this does not diminish the side thrust against the track.

The ideal track should therefore be able to withstand a side thrust equal to the full amount of centrifugal force developed by a fast moving train, determined to be $.02335V^2D$ by Mr. Wellington. It seems surprising that even in the latest issues of prominent technical journals this fallacy of centripetal force is treated as though it were gospel truth.

JOHN A. FULTON,
M. Am. Soc. C. E.

Railroad Legislation in South Dakota.

The legislative session which has just closed in South Dakota gave much attention to railroad matters. The Governor was also "reform" but he did not go so far as did the legislature. He does not believe in fixing railroad rates, either passenger or freight, by an arbitrary inelastic legislative enactment. The commissions of different states should work in harmony in fixing rates and also be in touch with the Interstate Commerce Commission. He therefore worked for the passage of a law, which was enacted, which authorizes the State Railroad Commission to employ expert assistance, and learn the actual cash value of the railroads operating in the state for the purpose of fixing rates both passenger and freight, on an equitable basis.

The legislature attempted to enact a two cent passenger rate law but it failed in the house. Finally a compromise was secured in the passage of a law putting it within the power of the commission to fix passenger rates at a maximum of 2½ cents; but as the law providing for valuation for the fixing of rates went into effect before the rate proposition was enacted, there is no likelihood that any move on the part of the commission will be made to fix rates until after they have secured valuation figures.

While the legislature was playing with passenger rates the commission was at work on freight rates, in which they secured the co-operation of the roads. They took the Minnesota commodity tariff as a basis. In this a reduction of about 10 per cent. was agreed on. On request of the Governor the commission has prepared a simple rate sheet, from which any shipper can, with a known distance, easily figure what his freight charge will be on all important commodities. This tariff meets with the approval of the roads and will be accepted by them.

The legislature passed a law providing for the assessment of all property of railroads other than their tracks and fixing the rate of assessment on the tracks outside of towns at a different basis from that for tracks within towns. This Act the roads say will not be upheld by the courts.

A reciprocal demurrage law was passed. It makes a charge against the railroad for failure to deliver cars when ordered, and a fine of one dollar a pay for all time after 72 hours delay after ordering; with a like penalty on the shipper or consignee for failure to unload cars within 48 hours after notification of receipt of the same.

An anti-pass law was passed. It was made an "emergency" law, and went into effect immediately after its approval and filing. At that hour a number of the legislative members were on trains bound for their homes on a recess. The fact of the filing was at once wired to railroad headquarters, and it is reported that conductors took up passes as presented and caught a number of the members who had voted for the law, compelling them to pay fare for the balance of their trips to their homes.

Another law was to empower the railroad commission to order the construction of connecting tracks at all junction points in the state; to order waiting rooms established at such points, and to make joint through rates.

An employers' liability act was passed. It is like the national law, but it applies to all manufacturing and corporation activities.

An "anti-parallel" law was passed. The South Dakota Central is a local independent company which started to build into a territory which had long sought an extension of some of the older systems of the state. As soon as the new company began its line one of the old systems covered the same territory with a parallel road, and as the new company announced its intention of extending further into the field, the older one showed signs of following it up; and the law was enacted prohibiting a rival road to parallel another within eight miles unless it could secure the consent of the commission.

A law was passed to prohibit a railroad employee from working more than 16 hours continuously except in emergency, with eight hours rest after the 16 hours, one making all orders of the railroad commission valid, and placing the burden of proof on anyone attacking such orders; one taking the right of employment of counsel out of the hands of the railroad commission and placing it in the hands of the Attorney-General; preventing any railroad from abandoning any established station where the receipts, counting both outgoing and incoming, are as much as $1,000 in any consecutive three months, and at stations with smaller receipts only on written consent of the railroad commission; requiring railroads to pay double damage for live stock killed on their line where they refuse settlement out of court, and where on suit a judgment is secured for the amount of damage claimed; and another with the same provisions in regard to damages from fire set by engines or by railroad employees.

Corporations for profit are prohibited from making contributions to the candidacy of any person or party for political purposes; and lobbying is forbidden except by registered agents or attorneys, who are limited to presenting their cases to committees of the legislature.

A constitutional amendment will be submitted to the people of the state at the next general election to provide for a classification of property for the purpose of taxation, its main purpose being to allow the application of a gross earnings tax to the railroads of the state.

Foreign Railroad Notes.

In Manchester, England, last week a clerk in a mercantile house was prosecuted by the Lancashire & Yorkshire Railway for bribing a teamster of the railroad company to deliver a few parcels to a customer of the firm. As this was the first case under the new law which has been passed to prevent bribery in cases of this kind, the magistrate let the prisoner off with a fine of £1 and costs; but in this case the costs amounted to over $50.

George Gourlay, the engineman held responsible for the disastrous collision of passenger trains near Arbroath, Scotland, December 28, in a blinding snow storm, has been sentenced to five months' imprisonment. The number of deaths caused by the collision was 22, but the jury recommended leniency, and the magistrate imposed the shortest term permitted by the law.

Government Report on the Block System.*

(*Continued from page 483.*)

BLOCK SYSTEMS.

The several methods of block signaling or block working may be divided into three classes:

First.—That in which the signals themselves are operated manually, by signalmen, in accordance with information transmitted from one signalman to another.

Second.—That in which the signals work automatically; that is, signalmen are not required and the signals, moved by any suitable power, are so controlled electrically as to indicate stop or proceed in accordance with the presence or absence of trains in the blocks or of other conditions, such as open switches, affecting the safe movement of trains.

Third.—That in which the signals are operated manually but are so controlled by electrical devices that a signalman is prevented from setting a signal to allow a train to enter the block until the signalman at the other end of that block co-operates with him to release the controlling device. This form of the block system may and usually does include, either construction such that a train must pass out of the block before the releasing can be effected, or means by which the presence of a train in the block makes it impossible to give a clear signal.

Before the details of these three classes of the modes of block signaling are taken up, the signals themselves, which are, of course, common to all three, and the track circuit, which is the foundation of the systems of the second class and plays an important part in some of those in the third, will first be described.

THE SEMAPHORE.

The signal most generally used in all these systems is of the semaphore type, developed from the semaphore used for the transmission of messages before the invention of the electric telegraph. It consists of a vertical post or mast 20 to 30 ft. high, near the top of which is pivoted a movable arm nearly 1 ft. in width and 4 or 5 ft. long. The semaphore is placed at the right of the track and the arm projects to the right of the mast, as viewed from an approaching train that is to be governed by its indications. Where there are several parallel tracks the signals may be placed on a light bridge spanning the tracks and either a little to the right of, or exactly over, their respective tracks.



Fig. 1.

By day the necessary signal indications for the government of the enginemen are given by the positions of the arm. The arm horizontal, which may have a fancied resemblance to a bar opposing the passage of a train, means stop; an inclined position means proceed. In block signaling it is found to be necessary or desirable to give two different "proceed" indications—one meaning "proceed, block is clear," and the other meaning "proceed, looking out for a train in the block." The latter, known as the caution, or perhaps preferably the permissive, indication, is used to permit a train to proceed into an occupied block, with full knowledge, on the part of the engineman, that he must run carefully and look out for a train ahead, where, on account of the length of the block or the frequency of trains, it is not always practicable to detain one train until the preceding train has passed out of the block.

The permissive indication is usually given by an intermediate inclined position of the arm; on some roads it is given by inclining the arm upward. To make the three indications as distinct as possible, without making the arm work above and below the horizontal the positions 90 deg. and 45 deg. from the horizontal are used on some lines for the "block clear" and permissive indications, respectively.

Home and Distant Signals.—Signals with square ends to the arms are known as home signals, because they are usually located at or near the places from which they are operated. The home signal marks the point at which trains may be required to stop, and, when indicating stop, must not be passed by a train except in the case of a signal located in front of a station; it is usual to allow trains to move a short distance past such a signal in order to stop at the station platform.

To give the enginemen preliminary information as to the indications of the home signal, so that they may have no difficulty in stopping before passing it when it indicates stop, and may proceed at unchecked speed when it is clear, a distant signal is used. The distant signal is distinguished by a notch in the end of the arm. The horizontal position of the arm does not call for a stop at the signal, but cautions the engineman to be prepared to stop at the home signal; the inclined position of the arm is an indication that the home signal is clear.

Night Signals.—At night the indications are given by colored lights. An extension of the arm to the left of the center on which it works forms a frame in which one or more colored glasses are held. With the movement of the arm these glasses move in front of a lamp and give a red light when the arm is horizontal, commonly a green light for the permissive indication, and, by uncovering the lens of the lamp altogether, permit the white light to appear for the "block clear" indication. The distant signal also shows a white light when clear, but, although its aspect by day when indicating "prepare to stop at the home signal," is quite different from that of the home signal giving the permissive indication; it is common practice to use lights of the same color, green, for these two indications at night. This is mainly because of the difficulty in obtaining lights of a sufficient number of different colors and of the necessary degree of visibility. The semaphore arm is moved by a lever in the station or signalman's cabin, connected to the arm by means of rods or gas pipe or, in the case of a signal at a considerable distance, by means of wires. Semaphores are also operated, especially when used for automatic signals, by electric motors, fluid pressure, or other suitable power, electrically controlled.

Counterweighting.—It is obvious that a signal must be liable to failure in the performance of its functions, due to breaking or sticking of some part of its mechanism or of the operating means. A moment's thought will make it clear that, when a failure occurs, the conditions will be much better if the signal stays in the stop position than if it is left in the clear position. For, in the first case, nothing more serious should result than the unnecessary stopping of a train, while in the other event a train may proceed and run into danger when it should be stopped. It is therefore a well-established principle of signaling that signal appliances should be so designed as to cause the signal, upon the occurrence of failures of the most usual or probable kind, to go to, or remain in, the stop position. This condition is met in the construction of the semaphore by counterweighting the arm so that force must be used to bring it to the clear position, and in the absence of such force, it will take the horizontal position. The counterweight may be in the frame that holds the colored glasses or in a separate weight connected to the rod below the arm.

CLOCK-WORK SIGNALS.

An exposed disk signal is used to a limited extent as an automatic block signal. The disk or target is mounted on a vertical shaft revolved through a train of wheels by a weight that hangs in the hollow post; hence the name clock-work signal. Detents controlled by the armature of an electro-magnet hold the shaft at any quarter revolution according to the position of the magnet armature; that is, if the controlling circuit is closed and the armature attracted the shaft is held in either position that presents the disk edgewise to an approaching train, as an indication that the block is clear; the stop indication is given by the disk at right angles to its former position, when the circuit is open and the armature released. At night a lamp placed on the upper end of the shaft, provided with red lenses on two opposite sides and white lenses on the other sides, gives the proper indications as the shaft revolves.



Fig. 2.

INCLOSED-DISK SIGNALS.

A signal that is used to a much greater extent than the clock-work signal is the inclosed disk-signal. The disk, which is of very light construction and protected from wind and weather by the case and glass-covering opening, is easily swung to one side of the opening, as a proceed indication, by an electro-magnet and is returned by gravity to a position in front of the opening, as a stop indication, when the circuit is opened and the magnet ceases to attract its armature. The night indications are given by a lamp placed behind the small opening near the top of the case; a ring attached to a bar that forms part of the disk frame, carries the colored glass which is brought in front of the lamp opening when the disk covers the large opening below.

The disk signal has the merit of simplicity and cheapness both in first cost and maintenance. For this reason, and also perhaps because it is felt that automatic signals should differ in form from other signals, disk signals are in favor for automatic blocking on

*Besides the matter reprinted in this and other issues of the *Railroad Gazette*, the report contains a glossary of block signaling terms; a copy of the law of Great Britain, requiring the use of the block system on the railroads of that country; a copy of the law of Massachusetts, empowering the railroad commissioners to require the use of block signals; a statement of 13 collisions occurring within two years on the railways of the United States on lines worked by the telegraph block system, all due to errors or negligence of signalmen; a statement of seven collisions within the same two years on lines equipped with automatic block signals, all due to errors or negligence of enginemen; and a comparison of the American with the English records of employees killed and injured in train accidents in the four years, 1902-1905. From this last statement it appears that the numbers of employees killed and injured per 100,000,000 train-miles were as follows:

	1904		1903		1902	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
United States	76.8	557.8	86.7	577.8	72.3	491.2
United Kingdom	1.8	28.7	2.3	37.1	1.0	27.5

a few roads. It is, however, held by the majority of signal engineers and officers in the operating department, that the disk signal is, in the point of visibility, decidedly inferior to the semaphore. Except under favorable conditions as to light, it is difficult to see clearly at any considerable distance whether or not the disk is in front of the opening; at times sunlight is reflected from the glass in such a way that the disk cannot be seen; in winter snow sometimes sticks to the glass and obscures the indication.



Fig. 3.

The clock-work signal, while at a disadvantage, as compared with the inclosed disk on account of a somewhat complicated mechanism and in having moving parts exposed to the weather, is little better in respect to visibility; it is still much inferior to the semaphore on account of the small size of the disk or target.

Many clock-work and inclosed disk signals were installed during the early years of automatic signaling, because they were then the only signals that could be had at a cost that could be considered by most railroads. But since the development of automatic semaphores, successful in operation and reasonable in cost, the use of signals of the other two types has extended much more slowly, as it is generally agreed that, in distinctiveness and in the clearness with which its different aspects can be perceived at a distance, the semaphore surpasses all of the numerous other types and forms of signals that have been tried and used since railroads began to require fixed signals.

THE TRACK CIRCUIT.

The track circuit, used for the control of automatic block signals and also to actuate the releasing devices in the controlled manual system is illustrated in Fig. 4. The two lines of rails form the conductors for the electric current. At each end of the track-circuit section the rails are insulated from the adjoining rails by insulating rail splices, so that the flow of current is confined to the desired limits. To guard against interruptions on account of poor metallic contact at the rail splices within the circuit, bond wires, riveted to the ends of the adjoining rails, are provided at every joint.

The two terminals of a battery B are connected by wires to the opposite rails at one end of the section. The ends of the winding on an electo-magnet R are similarly connected at the other end. The opposite rails are imperfectly insulated from each other by the ties and ballast, but while a certain amount of the current is wasted by "leaking" across from one line of rails to the other, a sufficient quantity flows from the battery through one line of rails, through the wire of the instrument, and back through the other line of rails to the battery, to energize the magnet and produce the desired effect. The practicable length of the track circuit is limited by this "leakage" of current, but there is usually no difficulty with sections one-half to three-fourths of a mile in length, and, under favorable conditions, lengths of one mile or more are worked successfully.

The wheels and axles of a train, by making a good metallic connection between the opposite rails, form a "short circuit" or "shunt," through which passes nearly all the current given out by the battery. The flow of current in the wire of the instrument R is thus practically cut-off and the magnet is de-energized. The breaking of a rail or of any other part of the electrical conductors of course has the same effect on the instrument. As the available current is small, the instrument R, known as a track relay, is usually of delicate construction. It does not operate or mechanically actuate the signal, but merely serves, by means of contacts attached to its armature, to complete, when the track circuit is clear, or interrupt, when the track is occupied by a train, one or more other circuits directly controlling the signals.

Failures.—In addition to the most usual failures common to all electrical circuits, due to broken conductors, loose connections and similar causes, the track circuit is especially subject to failures on account of increased leakage resulting from bad-track conditions or wet weather. Failures from these causes are "on the safe side," that is, they cause the signals to indicate stop when the block is clear. With proper construction and maintenance, however, the frequency of such failures is not so great as to interfere with the usefulness of the track circuit.

Dangerous failures of the track circuit are probably not more numerous than similar failures of the other circuits and devices connected with automatic signals; and, as records and experience show, the total of such failures is relatively very small. But they have unquestionably increased in number with the extension of electric railroads in the vicinity of steam roads using track circuits. The stray return currents of electric roads find their way through the earth to the rails of steam roads, and when of considerable strength or under certain combinations of circumstances, cause the magnets of track relays to be energized when trains are on the circuits. One method of securing at least partial protection against failures from this cause consists of connecting a second relay at the end of the track circuit at which the battery is connected, which may be de-energized by a train even though the relay at the other end of the circuit should be energized by stray currents.

THE TELEGRAPH BLOCK SYSTEM.

In simple manual block working any convenient means of communication may be used. With electric bells the necessary inquiries and information may be sent from one man to another by means of a code consisting of various numbers of taps or rings and combinations of numbers separated by pauses. The telephone serves still better or might supplement the bells by furnishing the means for explanations not provided for in the bell code. The Morse telegraph is most extensively employed, however, because its use in railroad working in America preceded the adoption of the block system and, when any line has undertaken block working, the telegraph has been already available; hence the general name, "telegraph block system."

Both the appliances and the working of the telegraph block system are very simple. At each block section there are erected signals to govern movements of trains in each direction (or a signal for movement in the proper direction on each track, where there are more than two main tracks). Each signal may give two indications, "stop" and "proceed, block is clear," or three indications, "stop," "proceed, block is clear," and "proceed, block is occupied by a preceding train," according to the conditions or method of operation. Where the traffic is moderate the signals are usually erected at the regular stations and operated by telegraph operators who perform other duties at those stations. If some of the distances between stations are inconveniently great, or if other special conditions make it necessary, additional block stations may be opened. Where traffic is heavy and the operators' full time will be taken up with the block signal work, separate buildings may be provided for the signalmen and placed with more particular reference to the most suitable lengths of blocks or to the location of junctions, yards, etc.

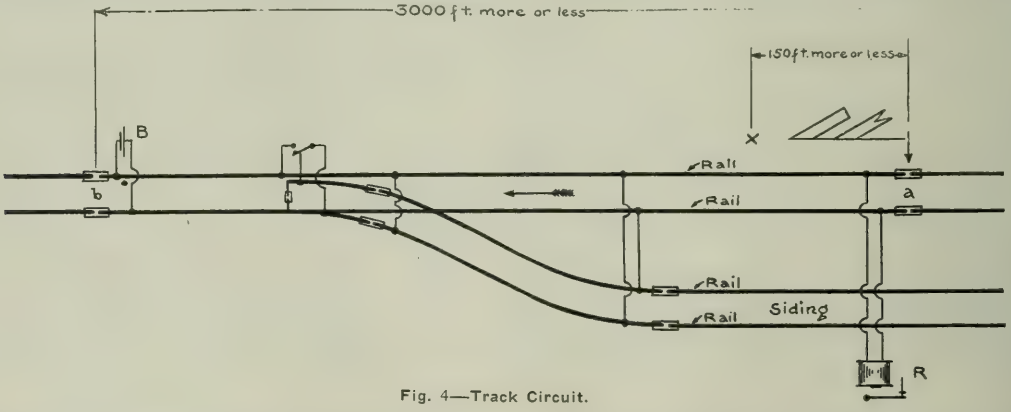


Fig. 4—Track Circuit.

Signals.—Signals having on the same post signal arms governing trains in both directions, are used to a considerable extent on account of the simplicity of the connections and the low cost, and their use is regarded as allowable practice; but they are objectionable because the signal for one track is necessarily on the left hand (wrong) side and, in fact, over beyond the adjoining track, and also because it is occasionally necessary for trains to pass stop

signals in order to get up to station platforms or reach sidings. A much better arrangement is to erect a separate post for each track and locate it in advance of the station so that there will ordinarily be no occasion for trains to move beyond stop signals.

For the sake of economy the telegraph block system has been installed to a great extent without distant signals. Where trains are at all frequent and the speeds of some trains are high, the absence of distant signals is a serious weakness in any signal system, for the reason that trains must either lose time by approaching carefully all home signals that cannot be seen at an ample distance, or must take chances by keeping up their speed at the risk of passing a signal if it is found to be in the stop position. If discipline is good, however, and trains are not allowed to overrun stop signals, the lack of distant signals is not necessarily a dangerous condition.

Permissive Blocking.—Obviously, if but one train at a time were to be allowed in a block, and a considerable number of trains were to be moved over a given line each day, or the movement of several trains in a short space of time without delay were to be provided for, short blocks would be necessary. Short blocks, however, mean large cost for operation, on account of the large number of signalmen that must be kept on duty. In practice, therefore, the length of block must be greater than the ideal length, which would permit the given train movement with only one train in each block, and must be a practicable length, governed by the possible expenditure for block operation, or fixed, in many cases, by the necessity of combining the block stations with the regular stations. With these longer blocks some of the trains must be admitted to blocks occupied by preceding trains—the method of operation known as permissive blocking—since, under this method, a train is permitted, with due warning, to enter a block that is not clear.

The usual practice is to allow freight trains, and in many cases passenger trains, to enter blocks occupied by freight trains, but to allow no train to enter a block occupied by a passenger train except by special order, naming the train ahead to be looked out for. Where freight traffic is heavy the permissive movements are regularly made on a third indication of the block signal, already mentioned, meaning "Proceed; block is occupied by a preceding train." Where traffic is lighter absolute blocking (that is, allowing but one train at a time in a block) may be the rule and permissive movements are then made only in special cases by order of the train despatcher.

Operation.—In operating the telegraph block system each signalman keeps a train record, on which he notes the passage of each train and the information he receives from the signalmen at the neighboring stations as to the approach of trains or their passage out of the block ahead. In the simplest manner of operation the signalman, when he is informed that a train is approaching, if his record shows that the block ahead is clear, clears his signal for the train to proceed. When the train passes his station he notifies the signalman ahead and reports to the signalman in the other direction that the train is out of the block that it has just left. The signalman ahead clears his signal for the next block, if that block is clear, and the signalman in the rear is free to admit the next train that may approach. If, after one freight train has been admitted to the block, a following train approaches before the first has passed out of the block, the signalman, where permissive blocking is regularly carried on, simply sets his signal in a position to permit the train to proceed and to indicate to the engineman that the block is occupied.

Under a more elaborate method of operation the signalman may consult the signalman in advance—that is, go through a form of asking his permission—each time before admitting a train to the block. This practice serves as a check on possible mistakes of the signalman, who, if he depended on his own record or memory, might some time admit a train in error when the block was not clear. This method is necessarily followed on single track, where the purpose is to prevent trains, through possible misunderstanding, from meeting between block stations, as well as to prevent one train from overtaking another.

The only appliances required for block working, as above described, aside from the signals, are a telegraph line and a set of telegraph instruments at each station. The line used for block communication is usually cut into sections, each taking in three or four stations.

Details of Operation.—Referring to the diagram (Fig. 5) which shows several arrangements of signals at three block stations, A, B and C, if a train moving east is approaching A, the signalman there will, if the block is clear, display the "Proceed" indication at A. As the train passes his station A reports it by telegraphic numeral, 4, to B. When the whole train has passed the signal, as shown by the presence of the "marker" flags or lamps carried on the last car, A returns his signal to the stop position. The train having been reported by A, B performs the same operations as to block, B C, and, when the rear of the train is 300 ft. beyond his signal, B, which has been returned to the stop position, reports the block clear of that train by "2" telegraphed to A. If permissive blocking is practiced, in the case of one freight train following another, each train admitted to an occupied block (by the proper signal indication or by caution card) is reported in the block by A, for example, and clear of the block by B, when it passes his signal; when his block record shows that all trains admitted have been reported clear, A may clear his signal for the next train that approaches.

If a train is to cross from the westward to the eastward track just west of C, it is the duty of C not to permit the train to cross if a westward train is approaching in the block B C; if, however, that block is clear, he must arrange with B to protect the train about to cross over exactly as he would protect an eastward train that had entered the block at his station.

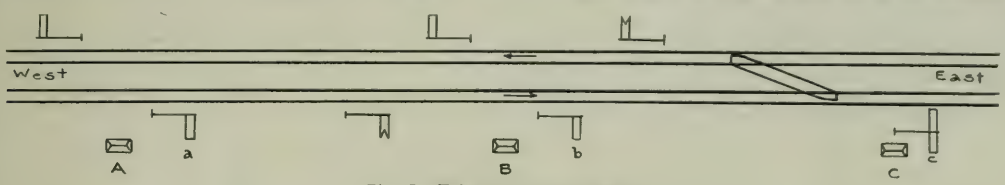


Fig. 5—Telegraph Block System.

Single Track Block.—On single track line trains are governed, with relation to trains moving in the opposite direction, by the time-table and the telegraphic orders of the despatcher. But mistakes, resulting in collision, are occasionally made, and it is obvious that the block system can readily give to each train the protection of signals against trains coming toward it, and so afford a safeguard that will be likely to prevent disastrous results in case of mistake or forgetfulness as to the rights of trains. All that is necessary is that A, for example, before admitting a train to the block on single track, should make sure that B has not previously admitted a train in the opposite direction which has not come through the block, and that B understands that a train is to be admitted at A, and will keep his signal for that block in the stop position against trains moving in the opposite direction until the train arrives at B. Where there is a passing siding within a block, say between A and B, and, on account of the expense, it is found to be impracticable to maintain an additional block station at such siding, the rule must, of course, be temporarily suspended when it is necessary to let trains leave A and B at about the same time to meet at that siding. In such cases, however, the trains are warned by the caution cards issued to them that the situation is exceptional.

Closing Stations at Night.—On some lines where trains, more especially passenger trains, are fewer at night than in the daytime, day signalmen only are on duty at certain block stations. On most railroads these stations are closed and reopened in accordance with the following rules:

338. To open a block station the signalman must give "8" to the next block station in each direction, and record the trains that are in the extended block. He must then display the normal signal indication, and notify the block station in each direction that the station is open.

When trains, which were in the extended block when the station was opened, and which had passed his station before it was opened, clear the block in advance, he must repeat the record to the block station in the rear.

He must not display the "clear" signal until all trains are clear of the block in advance.

339. A block station must not be closed except upon the authority of the superintendent; nor when trains are approaching which are to meet or pass at that block station.

340. To close a block station the signalman must first obtain "2" for trains which he has admitted to the blocks in each direction.

He must give "9" to the next block station in each direction, and transfer the records of the trains in the extended block. He must then enter on his block record "13," with the time it is received from each block station.

The block signals must then be secured in the clear position, all lights extinguished, and the block wires arranged to work through the closed station.

While a station is closed the two blocks on each side of it are thrown into one; that is, if B is closed the block is AC, and A carries on the block signal work with C exactly as he did with B, when that station was open.

Signalmen.—Although the procedure in block-signal working is very simple, so that, aside from the use of the telegraph, the work could be done by any ordinarily intelligent person after a little study, a moment's thought will show the vital importance of good intelligence, coolness, a clear head, good habits, conscientiousness, and a sense of responsibility on the part of each signalman. The

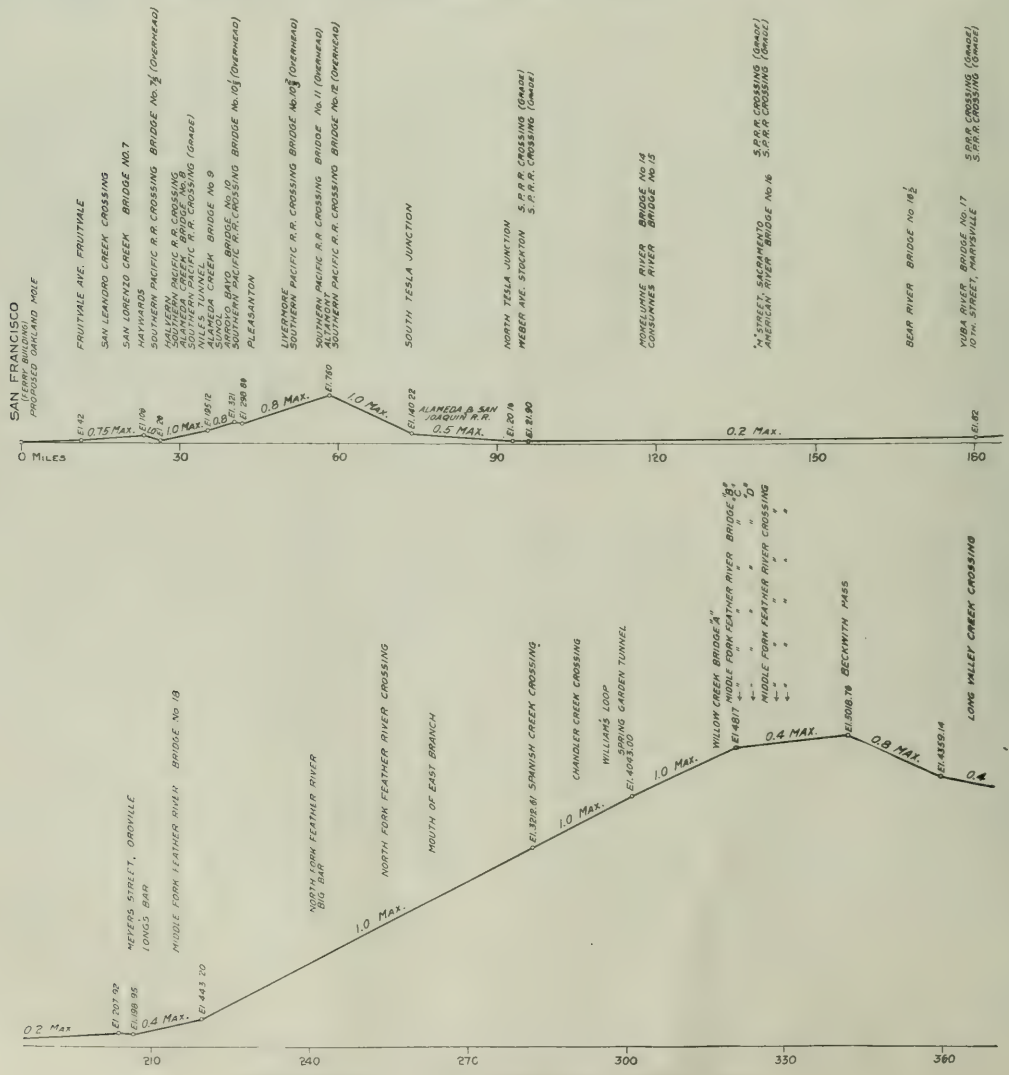
safety of trains is secured, not by the doing of a few simple acts which a child could perform, but by the vigilant habit of mind and thoughtful attention to each thing done that will eliminate or keep at a minimum the always possible mistakes of forgetfulness.

(To be concluded.)

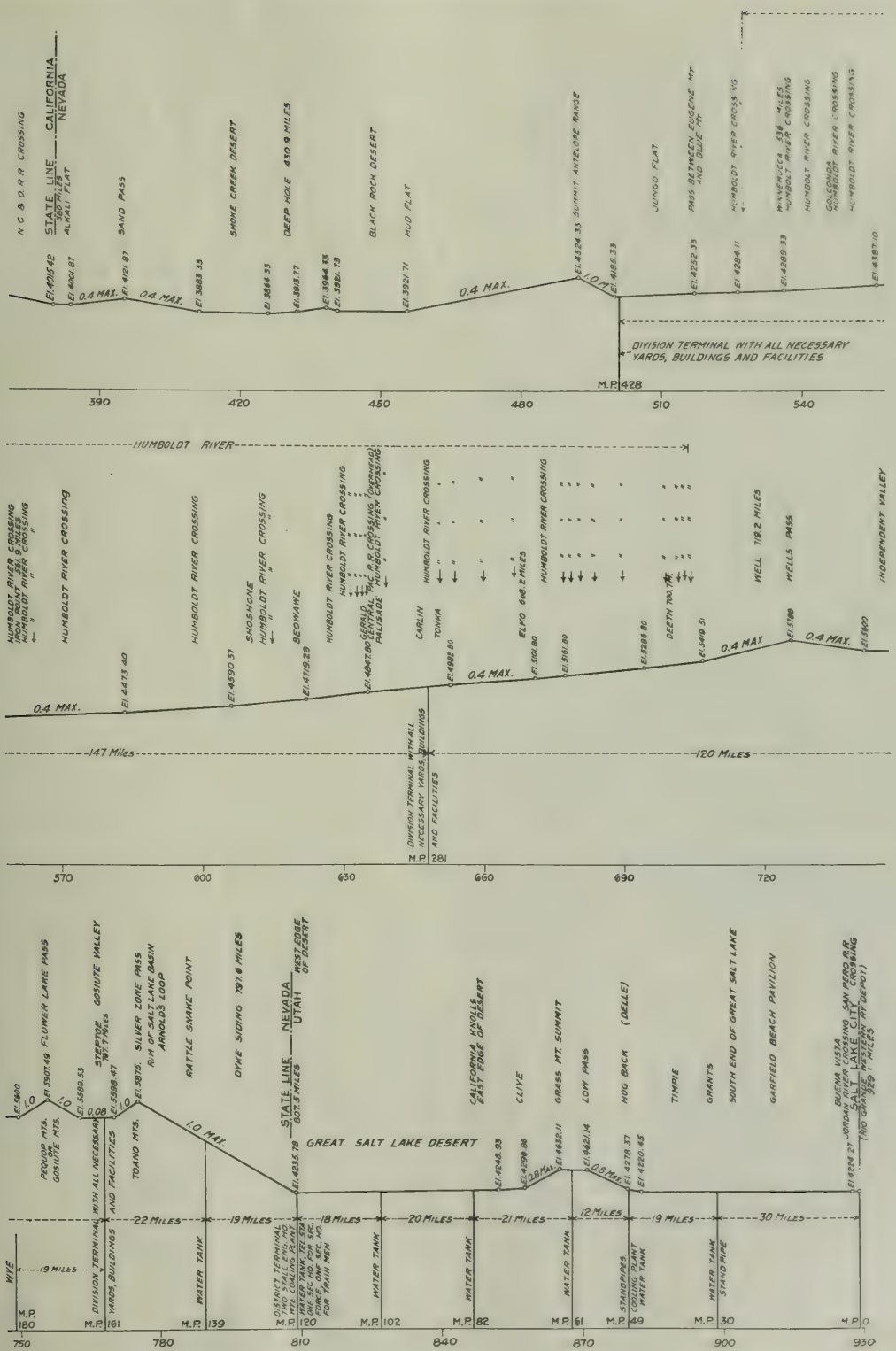
The Grades of the Western Pacific.

The route and construction of the Western Pacific have been described in the *Railroad Gazette* March 16 and September 28, 1906, each time with a map showing the line of the road. The most striking thing about this new Gould road to Pacific tidewater is that it is to be built with much more favorable grades than its pioneer competitor, the Central Pacific line of the Southern Pacific. The company has had the advantage of the experience of the other transcontinental lines and it is believed that the route chosen will never need to be altered by cut-offs or reduction in grades and curvature. In order to obtain favorable grades it has been necessary to sacrifice directness. The Western Pacific is to be 930 miles long between Oakland and Salt Lake City against 781 miles for the Central Pacific between Oakland and Ogden. The Central Pacific, however, passes through more than 40 miles of snow sheds. The Western Pacific will not require any. The Central Pacific has a maximum grade of 105 ft. to the mile westbound and 116 ft. eastbound across the Sierra Nevadas. Besides this summit, it has grades of 75 ft. to the mile east and westbound between Lucin, Utah, and Wells, Nev., across the Pequop range, and a 79-ft. grade eastbound between Rocklin, Cal., and Sacramento. Beckwith Pass, through which the Western Pacific is to cross the Sierra Nevadas, is about 1,900 ft. lower than the Central Pacific summit, and the Western Pacific's maximum grade here and over the rest of its line as well will be 1 per cent., or 52.8 to the mile. The accompanying profile shows in detail the gradients of the new line. It makes clear the great advantages in operating economy gained by the longer distance.

For the first 215 miles from Oakland there are no important grades, except a short grade of 1 per cent. maximum east and westbound at Altamont, 60 miles east of Oakland. At the middle fork of the Feather river at an elevation of 443 ft. begins a 1 per cent. grade 100 miles long, rising to an elevation of 4,817 ft., followed by a 20-mile 0.4 of 1 per cent. grade, bringing the line to Beckwith Pass, 5,019 ft. above sea level. The descending grade on the other side of the pass is, first, 0.8 of 1 per cent. for 20 miles, then 0.4 of 1 per cent. There are several short 1 per cent. grades between Beckwith Pass and Salt Lake. From the level of the Great Salt Lake desert at the Nevada-Utah state line west to Silver Zone Pass there is a 35-mile 1 per cent. westbound grade. The highest point on the line is at Flower Lake Pass, 5,907 ft. above sea level, in the Pequop mountains, 15 miles west of Silver Zone Pass. The line is level for 48 miles through the Great Salt Lake desert and for 47 miles west of Salt Lake City. In all there are eastbound four 1 per cent. grades, a total of 119 miles long, and westbound five 1 per cent. grades, a total of 66 miles, the rest of the line being of lower gradients or level.



Profile, Oakland, Cal., East to Beckwith Pass; Western Pacific.



Profile from California State Line East to Salt Lake City; Western Pacific.

Pennsylvania Railroad Tunnel Extension Into New York City.*

BY A. J. COUNTY,
Assistant to the Third Vice-President, Pennsylvania Railroad.

It is the experience of transportation corporations as truly as of individuals that a selfish and niggardly policy brings ruin, and that permanent development can be secured, and steady reasonable profits realized only by exercising forethought, making judicious expenditures for the betterment of public transportation facilities and providing for future expansion. The Pennsylvania followed a broad policy in undertaking the responsibility of pioneer in tunneling, for long distance and suburban railroad traffic, the North river, which separates New Jersey from that part of New York City known as the borough of Manhattan, and the East river which separates the latter borough from the borough of Brooklyn and the borough of Queens on Long Island.

The lines of the Pennsylvania have terminated on the west bank of the Hudson river since 1871, when it leased the United New Jersey Railroad & Canal Co., and the same barrier of the North river lies between them and the commercial and financial metropolis of the country, hampering the development and movement of traffic. Men have since 1871 slightly bettered their control over nature, but only last month passengers in crossing the Hudson river, from Jersey City to 23d street, New York, usually a run of about 15 minutes, spent between 50 and 60 minutes in fog and ice, this in ferryboats of the fastest and most powerful type. People are landed only on the fringe of the city, where cross-town streets are narrow, and the street paralleling the wharves is filled with drays and heavy wagons, seriously impeding the movement of over 300,000 persons every day. Again, visit Brooklyn Bridge, or any one of the many ferries of the East river on any business day in the rush hour and see the discomforts and delay of travel experienced by the surging masses to and from Manhattan because nature has interposed another barrier called the East river, which is responsible for this congestion and for the comparatively isolated condition of the residents of Brooklyn, to say nothing of those residing in other parts of Long Island.

An examination of the situation shows that in Manhattan, owing to the side barriers of the East and North rivers, and the difficulty of movement between points in such a small and crowded area, the density of population is about eight times as great as the average density of the six other largest cities of the country. Because of these barriers, and the unfavorable climatic conditions of at least six months in the year, Manhattan, although crowded and expensive, is considered the most desirable place for residence, while the suburban section within the limits of Greater New York, in Brooklyn and Queens jointly, have not even the same density of population as found in other cities. These unfavorable conditions have not, doubtless, and doubtless will not, stop its growth, for the population included within a circle of 19 miles inland radius from the City Hall, Manhattan, was, in 1890, over 3,300,000; in 1900, 4,600,000; in 1905, 5,400,000. The increase in 10 years was 38 per cent.

In 1913 the population of this metropolitan territory will, at this rate, be at least 6,000,000, and in 1920 will be well over 8,000,000, without allowing for the effect of the many schemes of improved transportation now under way.

Let me here illustrate the possibility for growth in Brooklyn and Queens, compared with Manhattan, and with the following cities:

	Population.	Area, square miles.	Density per square miles.
Manhattan Borough	2,174,335	21.93	99,148
Brooklyn Borough	1,404,569	77.62	18,097
Queens Borough	200,686	129.50	1,618
Boston	607,340	42.66	14,237
Chicago	2,050,000	190.50	10,761
St. Louis	750,000	61.50	12,195
Philadelphia	1,500,000	129.50	11,582
Greater Pittsburg	450,000	37.25	12,080
Baltimore	560,000	31.50	17,777
London, England	4,542,725	118.00	38,498

It is impossible to judge the growth of a city by the increase of its transportation facilities alone. It is a well-known fact that in New York the transportation companies operating in and near that city have been unable to increase their facilities for travel in proportion to the number of passengers carried, but there has been a notable response to every additional avenue of transportation and commerce. In 1897 over 490,000,000 passengers were carried on the elevated and surface lines in the borough of Manhattan; in 1906 the elevated, subway and surface lines carried over 1,000,000,000 passengers, an increase of 517,000,000, or more than the entire number of passengers carried in 1897.

A similar enormous increase in travel has occurred across the East river. About fifty years ago the first railroad was built in the southwestern part of Brooklyn. This village community was then about 200 years old and had a population of between 20,000 and 25,000. Now there is a city of 77 square miles, with a population of 1,400,000.

Between Brooklyn and Manhattan the traffic crossing the East river, in 1897, numbered 143,000,000. Of these about 50,000,000, including pedestrians, were carried over the bridge. This traffic developed with great rapidity, for in 1906 a close estimate shows that 295,000,000 persons were carried across the East river. The ferries conveyed about 100,000,000, and the railways on the Brooklyn and Williamsburg bridges carried 195,000,000, pedestrians not included.

Leaving the subject of intra-city travel to consider that carried by the railroads across New York harbor, we find that the railroads on the west bank of the North river in 1896 carried nearly 59,000,000 people; in 1890, over 72,000,000; in 1896, 94,000,000, and in 1906 we may safely estimate the figures to be 140,000,000 people. This is the passenger side only; but how are the necessaries of these people provided for, and how do the commodities from the southern and western states reach them? The freight traffic carried on the lines terminating in New Jersey is floated across New York harbor on the East and North rivers. At least 80 to 100 million tons from the railroads are so carried every year. Such conditions indicate that any additional transportation route must be a distinct advantage to the traveling public and to the residents of New York City and Long Island, especially if it remove the inconvenience and delay of transfers across the East or North rivers.

It must be remembered that the problem of the Pennsylvania Railroad in conveying persons and property directly into New York City is not merely a local necessity, but is largely due to the fact that its road is a great avenue of travel between the West and the South and that city, the metropolis of the country for business and pleasure. This responsibility is a gradual growth since its lease of the United New Jersey Railroad & Canal Co. in 1871, when the number of passengers carried was slightly over 7,000,000, and the tons of freight slightly over 2,000,000, whereas, during the past year, there were carried on the United Railroads of New Jersey division 23,000,000 passengers and 31,000,000 tons of freight.

From authentic figures published in 1896 the Pennsylvania carried 25 per cent. of the passenger traffic over the North river, and out of 140,000,000 passengers now carried it is safe to say that the Pennsylvania must move yearly in its ferryboats about 33,000,000 people in and out of New York, in addition to vehicles and commodities. The facilities must be so arranged as to conveniently transport them in comfort and good order during the rush hours as well as in the hours when traffic is lighter, and in the winter months when the conditions of traffic are such as to cause considerable delay and the taking of extraordinary measures to insure safety of passengers.

The Pennsylvania in seeking improved methods of transportation to and from New York, recognized the fact that, trusting solely to ferry facilities, it would fall short of what is believed the future would require for the greater despatch, comfort and convenience of not 33,000,000 people carried to and from the metropolis each year, but what inside of 20 years will be 50,000,000, also had in mind the isolation of Long Island, and the results to be obtained by bringing it into touch by rail with the rest of the world, and accordingly acquired a controlling interest in the Long Island Railroad. This should give it the largest part of the long-distance traffic, both passenger and freight, from that island. As an estimate of what that may be, let me repeat that Brooklyn alone has a population of about 1,400,000, and will, of course, grow enormously when the island is brought into direct contact by tunnel and improved freight routes with Manhattan and the West and South.

The traffic on the United Railroads of New Jersey division of the Pennsylvania in 34 years had a growth of 203 per cent. in passengers and 1,122 per cent in tonnage. I will state this more concretely by saying that since 1895 the ton mileage on the main line of that division increased 104 per cent., and the passenger mileage 79 per cent. Its traffic density per mile of road is now 15,715,246 ton miles and 5,210,804 passenger miles. The passenger traffic on the Long Island Railroad also grew, within this 10-year period, over 33⅓ per cent., and there has been a like increase in its tonnage. The total tonnage of the two for the past year was over 33,720,000 tons, and it may be estimated that the New York and New England tonnage to be handled across New York harbor for the Pennsylvania lines is in the neighborhood of 16,000,000 tons a year.

The situation, therefore, that would confront the company in the next two decades was one requiring instant attention. The interests of the company, as well as the demands of commerce required liberal provision on the Long Island and New Jersey shores for the freight traffic of the entire metropolitan district, and the carriage of through freight to and from the New England states, as well as the passenger extension into New York City and the establishment of a centrally located passenger station, through which inconvenience and delays would be avoided. Various methods of accomplishing this result had at different times been considered, and at one time centered on a bridge for passenger traffic. On account of the great cost of a bridge, and because all the companies whose railroad lines terminated on the west bank of the North River would

*Abstract of an address before the Wharton School Association, University of Pennsylvania, on Feb. 13, 1907. Published in the Annals of the American Academy of Political and Social Science for March.

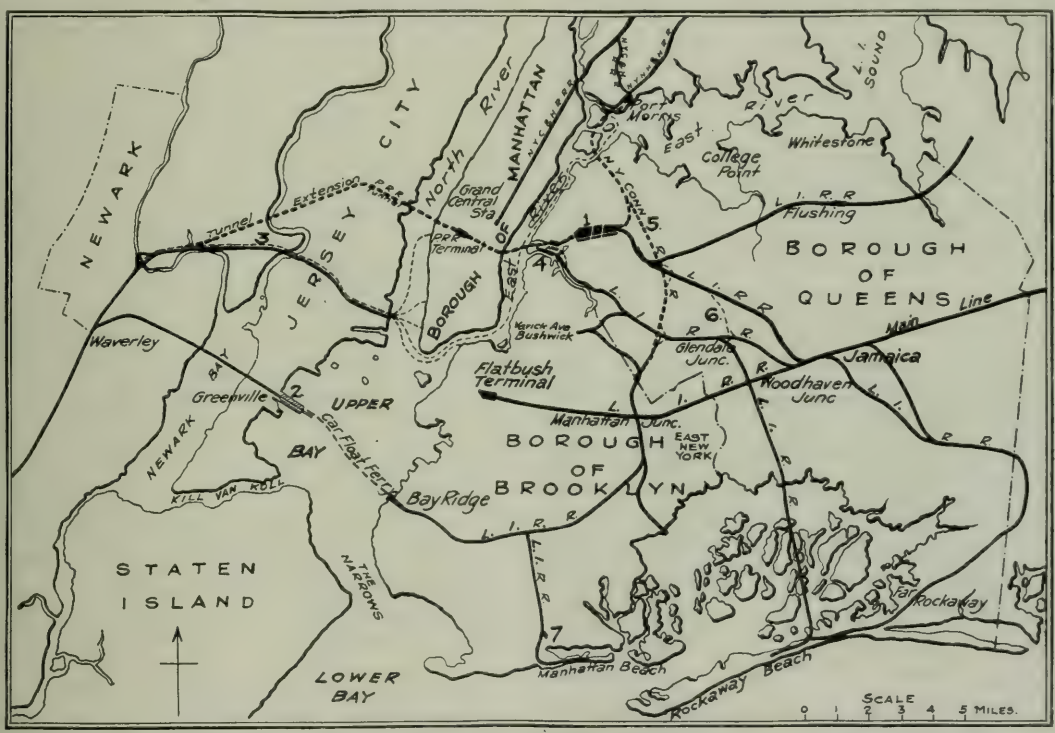
not unite in the undertaking, the bridge was eliminated from consideration. The alternative was the construction of a tunnel line, but the difficulties of steam operation at the depth and with the gradients required by the topographical conditions, seemed to make a tunnel almost, if not quite, impracticable. Meanwhile, however, the successful operation of steam railroad trains in tunnels in other parts of the world by electric power indicated a satisfactory solution of the problem. This undertaking is not an experiment, or a work hastily undertaken. It is the result of many years of deliberate thought and investigation of railroad terminals and tunnels in various parts of the world by engineers of experience and men of executive training. Its practical features have been more than confirmed by the amount of work so far finished, to which I will make further reference.

For many years the company realized that the project was not one that could be financed singly, but necessity eventually became so stern, and growth so great, that the improvements in engineering methods and plans for tunnels were finally regarded as absolutely certain to produce satisfactory results, and such as to justify the company's proceedings alone in its plans for the development of its own system and the movement of its traffic. The tunnel extension has a great advantage over the proposed North river bridge, in that it

Under the franchise the tunnel company must complete its construction within five years and pay the city a compensation per lineal foot for the tunnel tracks, and a further compensation for the use, for station purposes, of the underground portions of the streets, other than 32d, which was vacated and sold to the company, and which it so occupies. Such compensation is fixed for the first period of 25 years, and is subject to readjustment at the end of each like period. For the first period of 25 years it is so adjusted that the tunnel company pays double the amount per annum for the latter 15 years thereof than it does for the first 10, and on this basis the average for the entire period will be about $64,000 a year.

The importance of the project and the engineering questions to be solved in its construction caused the company to create a Board of Engineers, eminent in their profession, to supervise the preparation of all plans and have general direction of the undertaking, reporting to the executives. The work was then divided into three construction sections, the North River division, the East River division and the Meadows division. It consists of about 13.10 miles of new railroad, the part in the open embracing about 7.66 miles and in tunnels about 5.5 miles.

The principal physical features of the work are elevated tracks constructed in the open from a connection with the present main



Pennsylvania Railroad New York Tunnel Extension and Connections.

1. *Sunnyside Yard.*
2. *Greenville Freight Terminal.*
3. *Electrified Line from Newark to Jersey City.*
4. *Newtown Creek Improvements.*
5. *New York Connecting Railroad.*
6. *Glendale Cut off.*
7. *Sheepshead Bay Terminal.*

provides a direct connection between the lines west of the Hudson river and the Long Island Railroad. It also connects with the proposed New York Connecting Railroad, and through it with the New York, New Haven & Hartford, furnishing a through route between the Western, Southern and New England states.

To carry this tunnel scheme into effect the Pennsylvania, New Jersey & New York Railroad was incorporated on February 13, 1902, in New Jersey, to build from a point near Newark to and under Weehawken and the Hudson river to a point on the boundary line between New Jersey and New York. The Pennsylvania, New York & Long Island was incorporated April 21, 1902. Its western terminus is under the Hudson river on the boundary line between New York and New Jersey, opposite West 31st and West 32d streets. The eastern terminus is at points of connection with the Long Island Railroad, in the borough of Queens. The New York State Board of Railroad Commissioners on November 24, 1902, granted a certificate that such extension was a public convenience and necessity. A franchise from the city of New York was granted by the Board of Rapid Transit Railroad Commissioners on October 9, 1902, accepted by the railroad on November 5 of the same year, and approved by the Board of Aldermen on December 16, 1902.

line, east of Newark, across the Meadows to the portals of the tunnels at Bergen Hill, and a double track tunnel under Bergen Hill, West Hoboken, Weehawken, becoming two single track iron tube tunnels as they pass under the Hudson river into New York to a point near Tenth avenue. When the tracks emerge from the tunnels at that point they begin to increase, and at the terminal station, between Seventh and Eighth avenues, will number 21. At the terminal station site there are about 28 acres enclosed by retaining walls, making a total length of such walls of 7,800 ft. and requiring the excavation of 2,500,000 cu. yds. There will be about 45,000 tons of steel required for the terminal station, and it will have ultimately a maximum capacity for about 1,450 trains, accommodating about 500,000 passengers daily. Within the station area there will be about 16 miles of track.

Easterly from Seventh avenue the terminal tracks finally resolve into four tracks in two twin tunnels extending under 32d and 33d streets to the East river shafts in Manhattan. From the latter point four single track iron tube tunnels extend under the East river and into Long Island and the lines reach the open surface at the entrance to the Sunnyside train yard, where connection will be made with the Long Island Railroad, and later with the New York Connecting

to handle traffic to and from New England, as well as Long Island. The company has been negotiating for the past year for necessary changes in the routes of streets in the Sunnyside yard district on Long Island, and they will doubtless be made so that the construction of the large terminal yard may begin in this undeveloped region. It will, with its approach tracks, cover about 389 acres, and have a capacity for about 1,500 cars.

The plans of the company since their first inception have been materially broadened, as the general recital of the physical features of the extension indicates, and the total cost, including real estate, will probably be not less than $90,000,000. It will be well to bear in mind that the tunnel project is on a much larger scale than the existing facilities. Broadly speaking, it is, after all, only the result of the enormous growth of the traffic of the Pennsylvania for over 30 years, demanding some such provision as now being made for its still greater expansion. Although $90,000,000 seems a large sum, it must be considered that six years will have elapsed between the first and the last expenditures for the work. Therefore, it can readily be seen that if it had been deferred for another decade its cost would have been almost prohibitive, but now it is within the bounds of a reasonable outlay for the results to be accomplished. As proof of this, consider the statement publicly made by a Vice-President of the New York Central, that his company required $70,000,000 for improvement and reconstruction of its station and electrification of its tracks for suburban traffic. It must be remembered that the New York Central is compelled to carry on its large work of improvement within the territory where its tracks are at present located, involving great responsibility because the traffic must continue to move, whereas the Pennsylvania Railroad for its $90,000,000 makes a considerable addition to its system, has a terminal in the central part of New York City with connection to Long Island and New England and a clear field to carry on its work.

By the time the real estate and rights of way had been acquired the management had its plans and specifications prepared by the Board of Engineers, contracts were advertised, awards made to the lowest bidder and the active work of construction undertaken. The work has been steadily pursued until to-day it displays the following evidence:

The masonry work of the several bridges on the line from the connection with the New York division near Harrison, N. J., to the portals of the tunnels at Bergen Hill is making rapid progress toward completion.

The tunnels under Bergen Hill are progressing satisfactorily, the excavation has been made and iron tubes laid for the two tunnels under the North river, and the concrete lining is now being placed. The excavation of the east shore end of these tunnels is now within 200 ft. of the terminal site.

The excavation at the terminal site of the estimated 2,500,000 cu. yds. of material, between Seventh and Eighth avenues and 31st and 33d streets, is almost completed, and a large part of the foundations for the building and sub-surface work in hand.

Eastward from the terminal site to the Manhattan shafts considerably more than one-half of the necessary excavation has been completed, and rapid progress is now being made in the excavation and construction of the four tubes under the East river to the Long Island shafts.

About 75 per cent. of the tunnels east of that shaft has been iron lined, while the excavation is nearing completion, so that with the exception of a short distance in and near the terminal it is possible to walk underground from Bergen Hill, N. J., to and under the East river.

The tunnel extension cannot be considered complete without the following extensive improvements for the development of Long Island and New England traffic which are being undertaken in connection with it:

1. Establishment of the eastern terminus to be called "Sunnyside Yard," between Thompson and Jackson avenues in Queens. This yard is necessary not only for the efficient operation of the tunnel extension in Manhattan, but also for the proper care of the additional traffic which will result from the extension and its interchange with the Long Island Railroad and New York, New Haven & Hartford.

2. Elimination of grade crossings and the electrification of the Long Island Railroad within city limits. These changes improve lines from Flatbush avenue station out to the Brooklyn borough line, and from Long Island City station to Jamaica, and from that station by the Manhattan Beach line through East New York around to the Bay Ridge terminal on the southern shore of Long Island.

3. The Pennsylvania freight terminal yard and piers at Greenville, N. J., connecting by the proposed straight and relatively short ferry across the Upper Bay with the Bay Ridge terminal of the Long Island.

4. Enlargement of handling facilities for freight in Brooklyn and Queens, by establishment of many yards, which are necessary to put these boroughs in touch with the rest of the country by rail and for their local requirements.

5. Completion of what is known as the "Atlantic Avenue Improvement" in Brooklyn, which requires the removal of steam railroad tracks from the surface of that avenue, at the joint expense of the railroad and the city, and a large and very expensive improvement at the sole cost of the railroad, of the passenger and freight station at Flatbush avenue. This point will in the future probably be the most important distributing point for passengers in Brooklyn, the improved station and terminal being designed to occupy sixty-one lots. When the New York Connecting is finished residents of Brooklyn and Queens can travel direct by that route to New England and the North and East, and by way of the Pennsylvania Terminal in Manhattan to the West and South.

6. The New York Connecting Railroad is to be 12 miles long, to run through a part of Queens, then by a bridge across the East river at Ward's and Randall's islands, and will be the connecting link for passenger and freight traffic to New England. It will abolish the largest part of the floatage in New York harbor now carried on by the Pennsylvania by delivering and receiving freight at Bay Ridge, Long Island, and will carry all the passenger traffic through the Pennsylvania Railroad tunnels.

7. Construction of the Glendale cut-off between the main line, Montauk division and Rockaway Beach division of the Long Island. This is necessary for the improved passenger service and to give direct connection with the Pennsylvania tunnels.

8. New piers and docks on Newtown creek at its confluence with the East river for traffic to and from the Long Island Railroad.

9. Electrification of United Railroads of New Jersey division from Newark into Jersey City for local passenger traffic.

The accompanying map shows the vast improvements contemplated and their tremendous possibilities to the Pennsylvania System of Greater New York, and, in fact, the entire country.

Summing up, the Pennsylvania's New York Tunnel Extension is a line of railroad from Newark, N. J., to Port Morris, N. Y., through Manhattan and Queens. Reasons for its construction were:

To provide for the future by enlarging the present facilities for freight and passenger traffic, because of its continuous growth, and to accomplish it before the cost became almost prohibitive, or the task impossible because of the construction of other underground transportation lines.

To run passenger trains into a central location in New York instead of to a station on the west bank of the Hudson river.

To open to the people in the thickly populated borough of Manhattan the residential sections of Long Island, and to offer to Newark and other populous towns in New Jersey direct and quick access to the resorts on Long Island beaches.

To provide a better highway for railroad traffic to New England by shortening the water trip across New York harbor from 12 to 3¾ miles.

To give Brooklyn and Queens, with their population of over 1,500,000, direct railroad connection to and from New England, southern and western states, and to supply freight facilities with similar connections in these boroughs, thereby properly serving the entire area of Greater New York through freight stations, suitably located to develop its commercial interests.

To make its Long Island Railroad investment remunerative within a comparatively short period.

To obtain a proper share of the golden future by judicious expenditures in a territory having abundant promise, whether viewed from the growth of traffic in the past or the outlook for the future.

Dedication of the Engineering Societies' Building.

The new building of the United Engineering Societies on West 39th street, New York City, which was presented as a permanent home to the American Institute of Electrical Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the Engineers' Club by Andrew Carnegie, will be formally dedicated on April 16. The dedication services will be held at 3 p.m., Charles Wallace Hunt presiding, and will include an historical address by Charles F. Scott, chairman of the conference and building committees; an address by Andrew Carnegie, and an oration by President Arthur T. Hadley, of Yale University, on "The Professional Ideals of the Twentieth Century." In the evening a general reception will be held in the main auditorium.

On February 14, 1903, Mr. Carnegie offered to give to the three societies and to the Engineers' Club $1,000,000 to provide a suitable home for them all. This was increased a month later to $1,500,000, after it had been found that an adequate building could not be erected with the sum originally named. The only limitation on the gift was that it should be devoted to the erection of a building, the bodies interested buying the land. It was decided to erect two separate buildings, one for the club on 40th street and one for the three professional societies on 39th street, the two buildings to be placed in such relationship that access from one to the other would be easy.

The frontage of the Engineering Societies building on West 39th street is 115 ft. and the depth is 90 ft. It is designed in the French style and rises 13½ stories above the sidewalk to a height

of 218 ft. 6½ in. The exterior is built of limestone up to the auditorium floor, and of gray mottled brick and terra cotta above. As the lower portion is devoted to auditoriums, the middle section to offices, and the upper part to the library, an effort has been made to accentuate these three separate parts of the building, with happy result.

Access to the building is gained by the central entrance on the street level to the first floor, by the western side door leading to the elevators, and by the broad driveway which encircles it completely, so that carriages can enter by the eastern covered arch, set down their occupants at a side entrance and emerge by the western gate. There are three elevator riseways in the main elevator shaft, faced with an iron grill lined with wire glass. On each side of this shaft wide stairways rise to the sixth floor of the building, and one leads thence to the library floor. A freight elevator has been installed on the eastern side of the building, and a commodious service stairway on the north side rises the entire height of the edifice. At the first floor a rear door communicates across the 10-ft. areaway, in the open, with the café of the clubhouse, and on the ninth floor a flying covered bridge connects with the breakfast room on the tenth floor of the club.

The first floor is laid with Tennessee marble tile, having a border in design of colored marble. The central part or main foyer is marked by twelve large columns of Swiss Cipolin marble. A short low flight of steps leads from the foyer to the elevators. The wood work is in dark oak. Large chairs and lounges in red leather furnish the foyer, and similar furniture is used in the writing-room, smoking-room, reception-room and administration-room, which also contains three telephone booths connected with the "private exchange" system. On the foyer walls, facing toward the main entrance, are two large bronze tablets, one bearing a relief portrait of Mr. Carnegie and the words of his second terse letter of gift of $1,500,000, and the other a statement to the effect that the land was given by members and friends of the three founder societies. On this floor also, at the rear, are receiving and shipping offices, through which all freight and goods are handled.

Immediately above the first floor is the coat room, laid out on a sectional plan, so that several lines of persons may be accommodated at once on entering or leaving. Special toilet facilities are also provided on this floor, which virtually occupies the space that would otherwise be left blank by the slope of the main auditorium floor just above it.

The main auditorium extends up through two floors, and with its gallery will seat about 1,000 persons. This chamber had to be arranged primarily for the general meetings of the societies, at which the speaking is from the floor as well as from the platform, and at which diagrams, illustrations or blackboard drawings are often employed. This is quite the opposite from the ordinary audience hall, where the stage is the starting point both for the seating arrangements and for the acoustic and optical necessities. Hence the platform is notably small for so large a hall, accommodating few persons, while any speaker in the audience is easily within range of observation by everybody.

On both the parterre and the gallery floor, at the sides, the auditorium is surrounded by corridors, rendering access to every point very easy, and permitting ready withdrawal for conversation, committees, etc. The corridors assist also in maintaining quiet within the hall. The platform has ante-rooms and is conveniently close to the freight elevator for delivery of apparatus. There is also a fine stereopticon equipped with connections for moving pictures. The seats are fixed opera chairs in red leather with revolvable tops, and the aisles are laid with red carpet. The gallery front is bordered in red plush. Above the auditorium arch is a decorative cartouche bearing the badges of the three founder societies. There are side brackets for lighting, but the main illumination is effected indirectly through the glass ceiling, above which are incandescent lamps controlled from several panel boards. The elevators and stairs open directly upon the two floors of the auditorium, which can thus be emptied very quickly in case of emergency. Practical tests of the chamber have already shown it to be a success in every respect of comfort and convenience.

The next two floors above the main auditorium are devoted entirely to lecture-rooms, of which there are no fewer than seven. Two spacious assembly rooms, 51 ft. by 66 ft. and 29 ft. by 66 ft., occupy the larger part of the fifth floor in such a manner that they can be used independently, or one may be made auxiliary to the other. Two smaller rooms on this floor, 16 by 22 ft. and 18 by 19 ft., can be also used separately, or as annexes for reception purposes, and provision is made with steam tables, etc., for the service necessary for luncheons or light refreshments. All these rooms are agreeably finished in soft light tints and have facilities for water, air, electric connection, etc., for demonstrations and experiments.

The sixth floor is also divided into lecture-rooms, planned somewhat differently, and of smaller dimensions than those on the floor below. The dimensions are, respectively, 22 by 44 ft. 6 in., 30 by 46 ft. 6 in., 30 by 41 ft. and 20 by 28 ft. In this manner the building affords facilities to audiences of every size from 1,000 down to 100, while on occasion every room can be occupied by sections and subdivisions of an engineering or scientific meeting, with independence and without interference.

The seventh and eighth floors of the building have been reserved for the Associate Societies that have engineering or some department of science as their principal object. For these organizations the building affords office areas of varying size, from one room up, with the common facilities of the lecture-rooms, library and other accessories. Among these societies may be enumerated the Society of Naval Architects and Marine Engineers, the Society of Heating and Ventilating Engineers, the National Electric Light Association, the Society of Chemical Engineers, the New York Electrical Society, the Association of Edison Illuminating Companies, the American Street and Interurban Railway Association.

Each of the three founder societies occupies a floor laid out in accordance with its own plans. The American Institute of Mining Engineers has the ninth floor, the American Institute of Electrical Engineers has the tenth floor, and the American Society of Mechanical Engineers has the eleventh floor. These floors are all devoted to administrative and executive work, and the libraries of the three societies have been concentrated in the two top floors of the building.

A crowning detail in the plan of the building has been the reservation of the twelfth and thirteenth floors for the libraries of the three founder societies and of such other collections of engineering literature as may be added. The twelfth floor below the library proper has been devoted to the book stacks, but at the present time the main library is also equipped with one tier of stacks, with provision for a gallery tier later. The stack-room is partly equipped with stacks, and in the library a delivery desk, reading tables and chairs have been provided. The founder societies entertain the ambition of creating and maintaining the finest collection of engineering literature in the world, supplemented by the current periodicals, and all the patents relating to invention in the art and sciences. Provision is being made for special research accommodation, working alcoves, photographic reproduction, drawing and similar library work. The library is retired, quiet, free from noise and dust, and will be open at all times to any reader.

Decision by Judge Speer on the Federal Employers' Liability Act.

The constitutionality of the law passed by Congress last June, enlarging the liability of common carriers for damages in case of injury to employees—which has been decided by two United States Judges in one way and by two others in another way, and which is soon to come before the Supreme Court of the United States—is the subject of a somewhat exhaustive decision by Judge Emory Speer, of the United States Circuit Court for the Southern district of Georgia, which has just been published. This case is that of Snead against the Central of Georgia, which is a suit for damages for the death of a bridgeman who was knocked off the bridge to the ground below by the negligence of other employees. Judge Speer holds the law constitutional. The Judge says that he is aware that nothing short of a decision by the Supreme Court will be generally satisfactory, but he did not feel at liberty to evade the responsibility of making his own determination. Even if he were in doubt as to the constitutionality of the law he would uphold it, for "it is a part of that splendid practical philosophy of government which is intended for the betterment of mankind." The syllabus of the decision says:

The final and common arbiter of all constitutional questions is the supreme judicial authority of the courts of the United States. There is a settled presumption in favor of the validity of every legislative act. Every reasonable judicial doubt must be resolved in favor of the law. The courts will decide that Congress has transcended its powers only when that is so plain that they cannot avoid the duty. Employees of corporations engaged therein are instrumentalities of commerce. Restrictive or benevolent regulation of those employees is within the power of Congress, which may be exercised to its utmost extent, and acknowledges no limitations other than those prescribed in the Constitution. Congress alone by legislation may occupy the whole field of interstate commerce. The words "to regulate" import the right and power to *enact laws*, and not merely to make rules and regulations. When a corporation engages in interstate or foreign commerce the men who control it, and the corps of its employees, become subject to all those legitimate means which Congress may select for its regulation. The reasons now alleged for the rule denying to an employee the right to recover for injuries sustained by the negligence of a fellow-servant, in view of modern conditions, are archaic. The purpose of Congress being legitimate, and expressly relating to employees engaged in interstate or foreign commerce, it is immaterial to the validity of the act that somewhere in its operation it may have a casual or contingent effect upon the domain of state legislation. The Government of the United States, within the scope of its powers, operates upon every foot of territory in its jurisdiction. It legislates for the whole na-

tion, and is not embarrassed by state lines. Here, however, no right proper to the state, or any of its instrumentalities of government, is drawn in question. * * *

The main arguments of the defendant were that the act is not a regulation of commerce within the meaning of the commerce clause of the Constitution; that said act, if it be a regulation of commerce, is not limited to commerce with foreign nations, or among the several states or with the Indian tribes, but extends as well to intrastate commerce; that interstate and intrastate employees are so commingled by this act that it is impossible to make it apply only to interstate employees, unless the court reads into the act something which Congress has not put there, and this the court may not do; that it is a violation of the fifth amendment to the Constitution, which provides that "no person shall be deprived of life, liberty or property, without due process of law."

On the claim that a man engaged in interstate traffic may also handle traffic which is intrastate, and that this should vitiate the legislation of Congress, Judge Speer says that by parity of reasoning this would annul the federal laws which regulate interior waterway nevigation, and would abolish the Interstate Commerce Commission. Were the argument sound, "the shipment of a crate of pigs from Macon to Griswoldville would annul the power of Congress to control the shipment by the same train of a thousand bales of cotton bound from Macon to Liverpool." In the trade mark cases, and others relied on by the defendant, the laws in question contained no reference to interstate or foreign commerce, while the law now in question is clearly declared to be a regulation of interstate commerce.

President Joline on the Railroad Situation.

The following are extracts from the speech of President Adrian H. Joline, of the Missouri, Kansas & Texas, at the annual meeting at Parsons, Kan., on April 4:

In spite of our prosperity we are troubled. I do not mean that we are troubled by the contortions of the stock market. There is no stock ticker in the offices of the M., K. & T. This road is run to serve the public well and thereby to serve its owners well—not to own particular freight carried to just the place where it was intended for and delivered at the moment, without reference to any conditions of weather, track or traffic, and as a result large dividends would be paid to the public out of the public's own pocket. Our experience with the operation of government conducted enterprises, here and in foreign countries, tells us that it would all be as I have said.

I am obliged to take issue with William J. Bryan on the proposition that the public has shown no disposition to reduce railroad earnings to a point which would deny a reasonable return. The public, at least so far as it is represented in the legislatures, has shown exactly that disposition, and as long ago as the Granger agitation it was necessary to invoke the aid of the Supreme Court of the United States in order to check that very disposition. The recent enactment of laws restricting the passenger rate to two cents a mile, without regard to any conditions either as to territory or population, making the same rate for the crowded states of Ohio and Pennsylvania and the sparsely settled states of the West, testify to this disposition.

It will be the policy of this company, so far as I may have anything to do with it, to resist by all reasonable and legitimate methods the enactment of laws which are unjust and unfair; to bring them, if enacted, before the courts for construction and for determination as to their validity and constitutionality, but to obey them honestly and faithfully, if they are ultimately declared to be valid, even if it leads to insolvency and a receiver. It is useless to resort to petty methods of retaliation; they are only irritating and impotent. We may as well make up our minds that if the people of this country have made up their minds to destroy our property and the courts have decided that they have the right to do so, we must submit. But I cannot believe that in any country which calls itself free and enlightened such a thing can ever come to pass.

New Southern Pacific Station at Oakland.

The Southern Pacific is to shortly begin building a new passenger station for its local trains and some of its main line trains at Oakland, Cal. The site is on the city block bounded by Broadway, Franklin, First and Second streets. The main front of the station will be parallel with the main line tracks on First street. From the opposite side of the building roadways for passengers and teams will run north to Second street. The station will be 194 ft. x 60 ft., and will consist of a waiting room and ticket office near the southwest corner of First street and Broadway with an arcade extending along First street the whole length of the block to the baggage room at Franklin street. This is to be in a separate building 55 ft. away. The arcade is to be 14 ft. wide with reinforced concrete columns and a cement wall. The columns are to have cast cement caps, and the roof of the arcade is to be of slate. The waiting room is to be 92 ft. long and to have dark red stock brick walls. A large fireplace with a mantel decorated in bas relief will be an important feature of the general effect. The room is to have tile floors and wainscots. The ornamentation around all door and window openings is to be of quoined cemented brick work; the truss roof will be covered with slate and have a galvanized iron or tin deck. The baggage room is of the same general construction and exterior decoration. It is to have a bitumen floor and cast-iron cornices. The station grounds will be parked, planted with semi-tropical flowers and trees and surrounded by cement walks.



Southern Pacific Passenger Station to be Built at Oakland, California.

Recent specifications for new locomotives for the Prussian State Railroads require that provision be made in the cab for heating food for the enginemen when compelled to eat away from home.

enable some so-called Napoleon of finance to amass a colossal fortune.

The Missouri, Kansas & Texas has produced no plutocrats, as far as I know its history. No one connected with it has ever been guilty of enormously increasing the output of stock and bonds in order to lure an innocent public into incautious investment.

Credit is the cornerstone and foundation of all business; and when you have the cruel and unthinking hammer of the labor unions striking you on the one side and the reckless and unprincipled hammer of the political demagogue striking you even more mercilessly on the other, what becomes of your credit?

We hear a great deal about "co-operating with the government." I am unable to find in the constitution or the laws any provisions which affect or regulate co-operation between the government and the private citizens who carry on their business under the laws. The only way to co-operate with a government is to try to obey the law—however silly the law may be—to obey it not only in the letter, but in the spirit, as well as a law can be obeyed when you consider that you are obliged to trust to many thousands of agents of varying and often limited capacity, who have most of the infirmities of man. No doubt under government ownership with politicians in charge of our roads the operation of our lines would be ideal; there would never be any accidents, any man who wanted a car could have it just when and where he wanted it, and keep it as long as he wanted to; every one could have a train start at his favorite time and stop whenever he wanted to get off; every one could have his

Track Deformations and Their Prevention.*†

BY G. CUENOT,
Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway.

V.

DEFORMATION OF THE TRACK.

The sliding of the track, which is one of the most frequent deformations, and the most prejudicial to operation, is not, however, the principal one; others are produced, by the processes of continual operation so to speak, which cause disorders in the track. While not primarily as grave, they occasion by their repetition serious difficulties. Among them may be mentioned creeping of the track, narrowing of the gage on tangents, or its spreading on curves; the compression of the wood at the supports, tearing out the screw spikes, and, finally, the shock which is produced right at the joint, and which causes the dislocation of the track and the vertical deformation of the rail.

All these deformations are caused by the longitudinal and transverse movements previously described. They are the consequences of them, to such a point that when these movements are diminished, the deformations are reduced at the same time.

(1) CREEPING OF THE TRACK.

Rolling loads produce, in the direction of the movement of the trains, longitudinal displacements of the rails, which are ordinarily called dragging or creeping, and sometimes the entire track is drawn along. The ordinary methods employed for preventing creeping (notching of rails, anti-creepers, joint plates, angle bars) transmit, in a certain measure, the forces producing the longitudinal pushing of the rail to the fastenings as well as to the tie and to the ballast. The movement is more or less retarded, and the advance, whose effects are injurious, as I will show further along, diminished.

The rails are subjected in the longitudinal direction to two forces in a contrary direction; the driving wheels of the engine determine by their adhesion a reaction on the rails directed in an inverse direction to the travel; the carrying wheels of the engine and those of the other vehicles tend on the contrary to push the rail ahead. It is the last effects which are predominant, and experience shows that the longitudinal movement of rails always takes place in the direction of the trains on a double-track line.

But the longitudinal movement is not equal in the two lines of rail, even on tangents; when the road is double track the rail advances more rapidly in the line of rail on the outside (the left line) than in that of the inter-track side (right line).

It results that the joints of the two lines of rail are no longer concordant; ties, especially those which act jointly with the rail, for example, the ties of the even-joint at the following end, are no longer placed normally with the track; the gage of the track narrows; the screw spikes lose their contact with the base of the rail. The overlapping of the joints, which in general are low, no longer allows the fall of the wheels at the passage of the joint to be simultaneous on the two lines of rails, and there must necessarily result from it zig-zagging movements for the engine and cars.

The longitudinal dragging causes as an effect the allowance for expansion at the joints to disappear when the temperature rises, the rails, no longer being able to expand, become compressed, and a zig-zagging movement can produce a lateral sliding of the track.

It is necessary, periodically, to put the rails back in place, and this operation is costly; Mr. Ferry estimates it at $18.80 per mile per year on a line of average traffic. The longitudinal movement is therefore of real importance, and the principal causes which determine this forward movement should be sought.

Mr. Coüard estimates that the creeping (*Revue des Chemins de Fer*, August, 1896) ought to be attributed principally to the shock of the wheels at the passage of joints. It will be seen, further along, that the rails deflect at their extremities at the passage of the wheels, and that the latter fall from each rail on the following-rail, always more or less inflected, and produce a shock the more perceptible, the older the track is and the more deformed the rails are vertically. The wheel would act on the following-rail after the manner of a wedge, and would drive it before it.

This explanation of the advance movement is very proper, and is corroborated by a series of facts which Mr. Coüard has put in evidence in a very neat manner.

Thus, the speed of the trains increases the dragging; the latter is therefore maximum on the grades. Braking produces the same effect, since sliding friction is added, and creeping is very pronounced at the limits of stations.

On curves this movement is accentuated, especially on the line of rail of short radius, since the latter receives a larger part of the load by reason of the inclination calculated for the highest speeds, and since the sliding friction of the tire against the rail acts in the direction of movement. On the line of rail of long radius the movement has a tendency, on the contrary, to be produced in an inverse direction, in consequence of the cutting of the rail by the flange of the engine. This effect is diminished by the employment of the bogie truck, which enters the curves better. On a right alinement, the dragging is produced most thoroughly on the outside line of rail, in consequence of the unequal subsidence of the ties, a subsidence which consequently produces a greater loading on that side of the track. When the line of rail of the short radius is found at the same time on the outside, the two movements are conjoined and the dragging is greater.

The ballast acts equally either for increasing or diminishing the importance of the movement. Mr. Ferry has proved an advance of ⅝ in. per thousand trains on track laid in a very variable ballast, that is to say, deprived of all residue by sifting, and freshly placed.

But the explanation given by Mr. Coüard has not been admitted by all the technicists; the shock which is produced by the passage of wheels from rail to rail doubtless has an influence, since the simple substitution of angle bars for fish-plates has diminished the creeping, but it ought to have other secondary causes, which act in the same direction, and which complicate the study of the phenomena. Thus Professor Johnson, at St. Louis, attributed the creeping of rails to the undulatory movement studied above, which is produced in consequence of the oscillation of the supports.

The resistance, which the friction between the rail and the tie opposes to the return of the points of rest of the rail on its supports, gives consequently a slow creeping of the rail in comparison with the ties.

The shock and the undulatory movement exercise a very serious action on the creeping; they are not, perhaps, the only elements susceptible of producing it. It has been seen, in fact, that, on a line of two tracks, each of which is only traversed by trains going in the one direction, the dragging of the rail is more sensible on the exterior side, that is to say, on the outside space. Mr. Coüard thought that this fact was due to the unequal subsidence of the ties, which tend to incline to the side where the ballast and roadbed present the least resistance. This explanation does not suffice, since the same anomaly is observed on lines with four tracks; it is always the left line of rail in the direction of movement which is submitted to the strongest dragging force. Other explanations have been sought, such as the lack of symmetry of the engine, which would be more heavily loaded on the left, the position of Giffard, etc.; it suffices to cite them, in order not to retain any of them, for they do not rest on any precise observation.

The question then remains intact, and has not been entirely solved, in spite of all the interest which it presents; but it is necessary to retain the influence of the shock and of the undulatory movement, whose effect is of great importance, especially that of shock, as I have shown.

The author will endeavor to show, in the second part of this work, the methods employed for combatting the creeping, and to indicate those which should be adopted to arrive at a better result.

(2) REDUCTION OF THE GAGE OF THE TRACK ON TANGENT AND THE WIDENING ON CURVES.

Mr. Coüard has pointed out, in very precise experiments, of which he has given an account in the *Revue des Chemins de Fer* for July, 1888, that in right alinement the rails are inclined to the interior of the track, and that on curved alinement the same movement takes place to the outside. He has equally proved that at the joint the rail in advance is inclined more than the following rail, and that the wheel falls from the first on the second.

The mean inclination on right alinement is as follows: With a good tamping of the tie, .067 in. on the advance rail, and .028 in. on the following rail (line of rail on the outside).

With a defective tamping, .08 in. on the advance rail and .04 in. on the following rail (line of rail on the outside). The line of rail on the outside should incline more than the line of rail of the inter-track space. The consequence of the unequal inclination of the two rails, advance and following, is to super-elevate the advance rail in comparison with the following rail, to provoke a fall of the vehicle, which withdraws considerable length of the following rail from contact with the wheels, and which increases at the same time as the inclination.

Mr. Coüard considers that this inclination would produce the same effect as if the rail were pivoted about the interior edge of its base. He has established that the jerk which is felt at the passage of joints cannot be attributed to the space left between the two rails for expansion, but to the unequal level produced by the unequal rotation of the two extremities of the rails. "The shock brings about, little by little, the unpacking of the tie at the following end of the even-joint, and the latter circumstance augments still more the jerking at the passage of the joint, the lowering of the following tie tending to increase the unequal level of the two rails."

On a curve, the first axle of the train is that which most deforms the track. The line of rail on the side of the short radius is projected towards the center of the curve; the line of rail on the side of the long radius is, on the contrary, inclined to the interior

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†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.

of the track; the first axle only produces an inclination to the exterior.

Mr. Coüard has analyzed intelligently the phenomena of narrowing and widening of the gage of the track, but he has not perhaps given the exact reasons. If he has indeed seen that the widening of the track ought to be attributed to an exaggerated superelevation given to the rail of long radius on curves, it does not seem that he has found the reason for the reduction of the gage of the track, which is produced on tangents.

I have shown, by numerous experiments, that the wood tie employed on railroads, bends in a very perceptible manner. The rail tends then, in consequence of this flexure, to be inclined towards the interior of the track, and this effect is again augmented by the compression of the supports and their deformation on the interior side, as we shall see further along, since the inclination of one-twentieth given to the rail, and the flexure of the tie, act in the same direction, and bring the weight of the load towards the interior. The unequal inclination of the two rails is also a consequence of the flexure, since the tie at the advance end of the even joint undergoes the maximum flexure and draws over the rail, while the tie of the following end of the even joint has not yet attained its complete deformation, and the imperfect splicing does not induce the two rails to act at the same time.

Besides, Mr. Coüard has implicitly recognized the causes given above, since he has proved that the placing of plates under the rails, distributing the load over a greater surface, diminishes the effect of the reduction of the gage.

(3) Compression of the ties right at the supports.

The rails are fixed on the ties, whether it be directly or indirectly, by means of plates of support; in the first, as in the second case, but especially in the first, the wood is compressed excessively, and finishes by taking a permanent deformation.

In the bending tests of ties the lowering of the rail has been marked, apart from the points taken on the tie. This lowering, which has always been found in excess of that of the neighboring points, gives the measure of the sinking of the rail on its support, and, consequently, of the compression of the wood. In order to appreciate its value, mean figures of the lowering of the points of the tie, situated on each side of the rail, have been taken, and the difference between these figures and those of the lowering of the rail have been given. The table below, which sums up these calculations, brings out the fact that the sinking of the rail in its support is about twice as great with ordinary ties as with composite ties:

Compression of Supports and Inclination of Rail.

No. of ties.	Figures for points observed to the right and left of the rail		Mean figures.	Figures for the rail.	Diff. bet. the figures of cols. 4 and 5
1.	2.	3.	4.	5.	6.
	1. *Wooden Ties (P. M. rails)—Line of long radius.*				
5	14.5	20.0	17.2	18.0	0.8
6	25.0	19.5	22.2	26.0	3.8
7	15.0	21.0	18.0	20.5	2.5
20	13.0	19.0	16.0	17.5	1.5
	Mean compression				2.1
	Line of Short Radius.				
5	24.0	21.0	22.5	26.0	3.5
6	22.0	23.5	22.7	26.0	3.3
7	27.0	24.0	25.5	29.5	4.0
20	25.5	21.0	23.2	27.0	3.8
	Mean compression				3.6
	2. *Composite Ties (P. M. rails)—Line of long radius.*				
7A	23.0	22.5	22.7	23.5	0.8
7B	22.0	23.0	22.5	23.0	0.5
9	12.0	14.5	13.2	15.5	2.3
10	19.5	19.5	19.5	21.0	1.5
11	25.5	26.5	26.0	....	..
12	11.0	12.0	11.5	13.3	1.8
15	12.0	14.5	13.2	13.7	0.5
15	11.0	14.0	12.5	13.5	1.0
16	9.5	10.5	10.0	10.5	0.5
18	19.0	19.5	19.2	19.5	0.3
19	15.5	13.5	13.5	15.5	2.0
	Mean compression				1.1
	Line of Short Radius.				
7A	32.5	37.5	35.0	35.0	..
7B	33.0	33.0	33.0	36.5	3.5
9	19.5	16.0	17.7	23.0	5.3
10	24.0	24.0	24.0	29.0	5.0
11	23.5	24.0	23.7	27.5	3.8
12	19.0	17.0	18.0	19.0	1.0
13	21.0	22.0	21.5	27.5	6.0
14	23.0	24.5	23.7	25.5	1.8
15	17.0	19.5	18.2	21.0	2.8
16	19.5	20.0	19.7	23.0	3.3
17	15.0	14.0	14.5	16.5	2.0
18	23.5	26.0	24.7	26.0	1.3
19	20.0	20.0	20.0	21.0	1.0
	Mean compression				2.8

3. *Recapitulation.*

Wooden ties—line of long radius.	2.1	Wooden ties—line of short radius.	3.6
Comp. ties—line of long radius.	1.1	Comp. ties—line of short radius.	2.8
Difference in favor of Comp. tie.	1.0	Difference in favor of Comp. tie.	0.8

Note.—The figures are expressed in tenths of millimeters.

It is, however, necessary to remark that this reduced sinking is not due entirely to the reduced compression of the wood, but that, apart from this fact, it is also necessary to take account of the flexure of the tie, which increases the compression under the base at the inside edge of the rail, already greater by reason of the inclination of 1 in 20. But this flexure increases but little the effect of the sinking, for the slope of the bent tie scarcely reaches 1 in 400, a negligible quantity in comparison with the inclination.

Whatever the reason may be, the compression of the wood is produced, and it is a maximum on the interior side, because, for the reasons given, the loads are carried on this side. This coincides with the statement of Mr. Coüard, set forth in his article for July, 1888, in the *Revue des Chemins de Fer;* he has claimed correctly that the rail turns about its interior edge, which produces a super-elevation of the advance rail in comparison with the following rail, and determines a drop at the passage of the joint.

The increases of the resistance of ties to compression presents very great interest, and is intimately connected with the question which now occupies us, that is to say, the attempt to find out how to avoid deformations, in order to obtain a better circulation of traffic, and realize more considerable speeds. After the passage of trains, the rail returns to its primitive position; the base reacts on the head of the screw spike, tending to tear it from its socket.

(4) Pulling out screw spikes.

The sinking of the rail in its support, the least bending of the tie, and the elastic reaction which results from it, exercise, slowly but surely, pulling effects on the screw spikes. At the end of a certain time, the screw spikes, which unite the rail with the ties, no longer hold, especially those which on a tangent are located in the interior of the track. They can be readily pulled out of their holes.

That is why a study of the fastenings is necessary; it is necessary to know the limiting force which can be applied to the screw spikes before they can be withdrawn, and that which they can support before a spreading of the track .98 in. takes place, considered as sufficient to put it out of service; finally, the limiting force which can be imposed on it before obtaining excessive turning.

These experiments have been executed with two very ingenious pieces of apparatus devised by Mr. Albert Collet, and which he has named the *extrahomètre* and the *déclimètre.* They have been used, as will be seen later, on ordinary and composite ties, with or without treenails, of which Mr. Collet is the inventor.

(A) Experiments with the extrahometer.

The *extrahomèter* is a very small testing apparatus, with register and with means for measurement, weighing only 13.23 lbs. and able to support a force of 8.82 net tons which is exercised vertically on the head of the screw spike, in the manner for extracting. This force is produced up to the moment when the wood is torn and yields; at that moment there is no more resistance in consequence of more force.

This apparatus (Fig. 13), entirely of steel, is composed of a square pedestal, S, serving as point of support, through the opening of which is introduced the head of the screw spike, which is engaged in the foot of the dog, G. The foot of the dog is in one piece with the traction cheeks, F, and the nut, D, in which travels the motor screw, V, directed at R, by the key for screw spikes. Between the two cheeks is a cylinder, C, whose two flanges, N, rest on the pedestal. The cylinder contains liquid glycerine in T, and above, a piston, P, packed with leather, carrying a small ball, L.

At the extremity of one of the flanges, N, a pressure gage receives and records the pressure exercised on the liquid passing by the capillary conduit, M. B is a release latch, and E a symmetrical arrangement allowing the adoption of a standard, in order to verify the pressure gage in case of necessity. The travel of the foot of the dog is 1.57 in. This apparatus is in use by several railroad companies in France.

The table which follows gives the results obtained on composite ties:

Composite Cross Ties.

Without treenails—Forces on screw spikes of the Middle wedges.	Lateral wedges.	Raise of middle wedges.	With treenails—Forces on screw spikes of the Middle wedges.	Lateral wedges.	Raise of the middle wedges.
13,228 lbs.	.....	0.04 in.	15,873 lbs.	15,983 lbs.	0 in.*
12,235 "	.....	0.02 "	15,983 lbs.	.....	0 "
12,787 "	13,228 lbs.	0.0 " †	.....	.....	..
11,464 "	11,574 "	0.0 " ‡	.....	.....	..
13,228 "	13,007 "	0.0 " ‡	.....	.....	..
11,023 "	12,787 "	0.0 " §	.....	.....	..

Observations:
*Wooden wedges of creosoted oak, but split by frost.
†This wedge was split before the trial.
‡Mean force:—Middle wedge without treenail, 12,324 lbs.; lateral wedge, without treenail, 12,654 lbs.
§Mean force on the two wedges, 12,456 lbs.

The following table gives the results of trials on wood ties:

Nature of ties.	Forces on the screw spikes—Without treenails.	With treenails.
New oak ties, creosoted	13,668.5 lbs.	15,873.1 lbs.
Piece of new good spruce, creosoted	7,936.5 "	11,023.0 "

Apart from the experiments related above, and which were made in my presence, I have embodied the results of similar experiments executed by the employees of the P. L. M. Co., some days before. It was interesting to compare the results obtained with

a more complete series, in which the wood ties tested were with or without treenails. It is not necessary to give here the details of these experiments, it would be, in fact, going beyond the outline of the study which we have undertaken, but it is fitting to remember that the resistance to withdrawal of the screw spikes is the following:

1st.	In pine ties	Approximately	7,716 lbs.
2d.	In pine ties with treenails	"	11,023 "
3d.	In new oak ties	"	13,228 "
4th.	In new oak ties with treenails	"	15,432 "
5th.	In oak ties in service for eight years	"	7,496 "
6th.	In oak ties in service for 8 years, new treenails	"	12,125 "
7th.	In oak ties with old treenails	"	7,496 "

The limit to extraction of the screw spikes in the composite cross ties is raised as an average to 12,456 lbs., that is to say, to a figure which is very near that which was obtained with new oak ties; the wood of the wedges was, however, of bad quality, presenting a good many fissures, and having all the appearances of being split by frost. Their own resistance was certainly inferior to that which it would have been if the material employed had been sound. The central wedge once in place, no longer rises, whatever may be the pressure to which the screw spike is submitted; the fastening is then secured in a certain fashion, and even more efficiently than it is generally, by reason of the compression of the fibers of the wood. The wedging, or rather the squeezing, of the pieces of wood, which one would consider *a priori*, as one of the weak points of a composite cross tie, becomes, on the contrary, one of its principal advantages; it seems that the bringing together of the fibers of the wood arising from the squeezing, gives to that material a resistance superior to that which it would have had in a free state. It is that which explains also the reason why the employment of the treenail in ties gives a superior resistance to that of the wood which constitutes them; the treenail has not, so to speak, any resistance of its own. That which demonstrates it, is that the limit of extraction varies according to the nature of the wood which envelops it, and which latter is, so to speak, the intermediary between the resistance of the treenail and that of the wood, which surrounds the latter. It follows that this resistance ought to hold the fibers of the wood envelope in compression more or less great, since the more fibrous and elastic the wood is, the more considerable is the resistance.

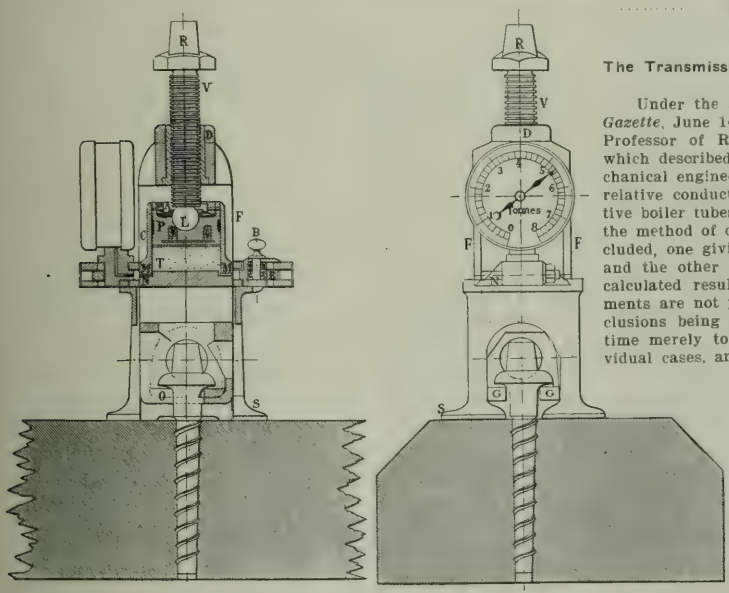


Fig. 13—The Extrahometre. Vertical Section and Front View.

Thus the compression of the wood constitutes one of the principal merits of the tie, and in order to exhibit it, I have provided the wedges with treenails. The result has been what was expected; the compressed horizontal fiber of the blocks reacted on the vertical fiber of the treenail, and the resistance was increased by about 20 per cent., that is to say, that with blocks composed of sound wood, fibrous and elastic, and with treenails introduced at the point where the fastenings are placed, a resistance was obtained which surpassed known limits. It was interesting, consequently, to make new experiments with that idea, and to see how cross ties, composed of wooden blocks of the kind indicated above, would behave. For that effect, cross ties provided with wooden blocks of hornbeam and elm were experimented with like the preceding, but unfortunately, the woods employed were absolutely baked, and the trials offered no more than a relative interest.

In spite of these very disadvantageous conditions, the results have nevertheless been very satisfactory, since there was obtained on a middle wedge a force of 19,621 lbs. (limit of power of the *extrahomèter*), and on the lateral wedges forces varying between 15,432 lbs. and 16,094 lbs. The results of this last experiment are set down in the following table:

COMPOSITE TIES

Forces on the screw spikes of the wedges. In the middle.	On the sides (lateral.)	Raise of middle wedges.	Observations
		1st Hornbeam wedges.	
14,330 lbs.	15,432 lbs.		Mean force on a lateral wedge, 15,300 lbs.
17,637 "	16,094 "	..	
14,110 "	15,432 "	. .	
12,346 "	14,992 "	. . .	These blocks were prepared specially for the tests; they were not creosoted, because they were not to be used in the tracks. they were in full process of decomposition, as we have been able to account for it to ourselves, having broken several of them.
. . . . .	14,110 "	. . .	
. . . . .	15,983 "	.	
. . . . .	14,330 "	. . .	
. . . . .	15,983 "	. . . .	
		2d. Elm wedges.	
12,676 lbs.	13,669 lbs.	. . . .	Wood as above.
13,779 "	12,676 "	. . . .	
11,023 "	13,448 "	. . . .	
10,472 "	13,228 "	. . . .	
. . . . .	11,684 "	. . . .	
. . . . .	13,007 "	. . . .	
. . . . .	11,905 "	. . . .	
. . . . .	12,566 "	. . . .	

(To be continued.)

The Transmission of Heat Through Scale-Covered Boiler Tubes.

Under the above caption there was published in the *Railroad Gazette*, June 14, 1901, an article by Edward C. Schmidt, Associate Professor of Railway Engineering at the University of Illinois, which described a series of experiments made by the railroad mechanical engineering department of the university to determine the relative conductivities for heat of clean and scale-covered locomotive boiler tubes. The apparatus was described and illustrated and the method of conducting the tests explained. Two tables were included, one giving the principal characteristics of tubes and scale, and the other a summary of the data of the tests and also the calculated results. In conclusion it was stated that "the experiments are not yet numerous enough to permit of any general conclusions being drawn from them, and they are presented at this time merely to show what the heat loss may amount to in individual cases, and to indicate also how widely this loss varies with different sorts of scale. It is the intention to continue these experiments and to accumulate enough data to warrant some general conclusions concerning the relations existing between conductivity and the thickness, hardness and other physical and chemical properties of the scale."

Two additional series of experiments have been made since that time, in 1904 and 1905 respectively. The apparatus (Fig. 1) was practically the same as that used in the first series, except that a Le Chatelier pyrometer was used instead of a copper ball to insure greater accuracy in the measurement of furnace temperatures. The data and results of all of the tests form the subject matter of Bulletin No. 11 of the Engineering Experiment Station of the College of Engineering of the University of Illinois, which is now in press. A summary of this bulletin was prepared by Professor Schmidt for presentation to the March meeting of the Western Railway Club. Information concerning each of the tubes tested in the three series and the character of scale on each, and all observed and calculated data for each tube for each test, is given in a set of four tables which are not reproduced here. The last of these is a summary of the other three and from it four diagrams were plotted, which are reproduced herewith (Figs. 2, 3, 4 and 5). What follows is taken from the paper.

The apparatus in which the tubes were tested may be roughly designated as a single-tube boiler or heater. It consisted essentially of a long water chamber, through which the tube to be tested was passed, and through which water was circulated. At one end of this water chamber was fastened a combustion chamber with which the tube communicated. The heat delivered to the tube was supplied by the combustion of gas in this chamber. The heat abstracted from the tube was determined by weighing the water which passed around the tube and through the water chamber, and by noting its rise in temperature. For each series of tests the gas and air needed for combustion were delivered to the burner at constant pressure for all tests, and in approximately the same amounts. The water chamber consisted of a piece of pipe with flanged heads. A stuffing box in each of these heads permitted the tubes to be easily put in position. The tank above the water chamber furnished the water supply and was arranged to maintain a constant head on the water chamber inlet. In the combustion chamber, im-

mediately in front of the entrance to the tube, was placed the pyrometer, and the burner was located at the opposite end. Air and gas were supplied to the burner from the tanks at the left. Each of these was a small gas holder, consisting of an inner tank open at the bottom and floating on water contained in the outer tank. The pressure of the air or gas contained in the inner vessel could be varied at will by weighting the holder.

The purpose of the tests was to determine the number of British thermal units transmitted per hour through each tube. This equals the weight of water circulated, multiplied by its rise in temperature. * * * The conductivity of the tube, or the B.t.u. transmitted per unit of time, varies directly as the range of temperature between the inner and outer tube surfaces. This range of temperature is the difference between the mean pressure of the water and the temperature of the gases. The amount of heat actually transmitted during each test is reduced to what it would have been had this range during all tests been the same as the average range existing during the tests of the clean tube. These derived figures, compared with the heat transmitted through the clean tube, give the effect of the scale in each case. * * * The four diagrams exhibit the loss due to scale in relation to its thickness, its structure, and its chemical composition. Fig. 2 shows the loss due to scale plotted with reference to its thickness. Fig. 3 is identical with Fig. 2 except that the letter H, S or M has been added at each point to indicate that the scale is either hard, soft or medium. In Fig. 4 the loss is plotted with reference to the sum of the percentages of calcium carbonate and magnesium carbonate, and in Fig. 5 this loss is plotted with reference to the amount of calcium sulphate.

In the series of 1901 there were a few tests which indicated

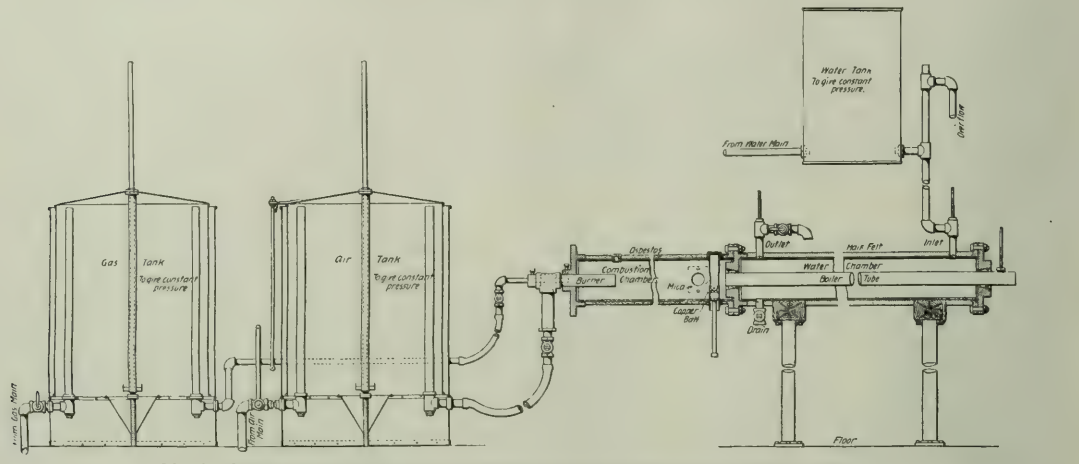


Fig. 1—Apparatus to Show Heat Transmission Through Scale-Covered Boiler Tubes.

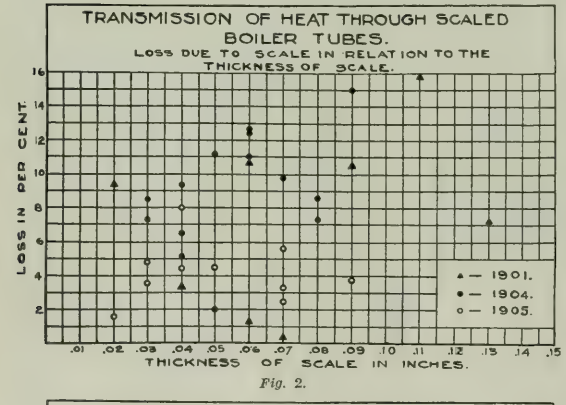


Fig. 2.

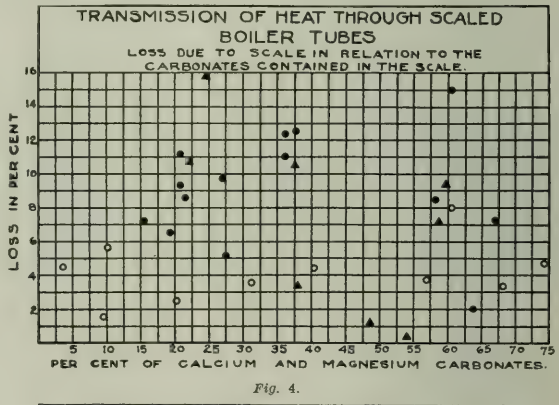


Fig. 4.

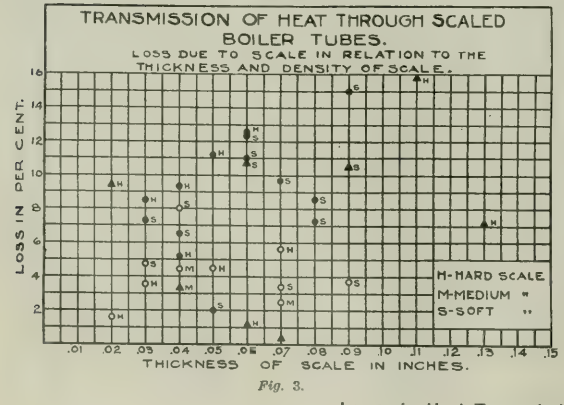


Fig. 3.

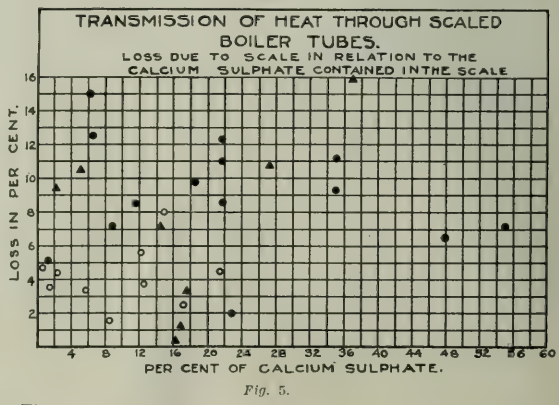


Fig. 5.

Losses in Heat Transmission Through Boiler Scale.

an increase of conductivity of the scaled tube as compared with the clean tube. These were perhaps to be accounted for by errors in conducting the experiments, although they could not be detected at the time the experiments were made. The apparatus used in 1904 and 1905 was improved in some particulars, the most important change being in the means for the measurement of furnace temperatures, as already mentioned. Such discrepancies disappear in the later series.

When the experiments were planned it was considered probable that the transmission of heat through the scale was principally dependent upon two of its characteristics, namely, its thickness and its mechanical structure, and that probably, for such thicknesses as are usually met with, thickness had greater influence than structure. Thickness was therefore carefully determined and structure approximately designated as hard, soft or medium, no more exact characterization of structure being possible with tubes collected from different sources, as these were. It was hoped that the experiments might develop, if perhaps only approximately, some law of variation of conductivity with thickness. After making allowance for possible errors due to the method of conducting the tests, consideration of Fig. 2 shows perhaps a decrease of conductivity with thickness, but certainly no regularity of variation. In Fig. 3 the loss in heat transmission is again plotted with reference to thickness, and the structure of the scale, in so far as it was determined, is indicated as previously explained. No regularity of variation is observable with respect to hardness or softness.

In considering Figs. 2 and 3 it must be borne in mind that the tubes tested were taken from locomotives which had been in service in different parts of the country and that the scale on each tube was made up of the mineral constituents of many different water supplies. What is designated as hard scale in one case may be very different in structure—in porosity, for example—from what is designated as hard scale on another tube. Fig. 3 cannot therefore be considered as providing conclusive evidence concerning variation of conductivity with structure. The results may properly be interpreted as indicating that mechanical structure is at least as important a factor in the change in heat transmission due to scale as is the mere thickness. Such a conclusion is, of course, in accord with the facts concerning other heat insulators.*

Water and vapors are known to be poor heat conductors. Experiments on the conductivity of metals by Fourier and others, in which the heat transmitted was measured by its absorption in water, proved that unless care was exercised to constantly remove the film of water next the metal, the low conductivity of this water layer so affected the results as to make it difficult to distinguish the effect of differences in thickness and nature of the metals themselves. It seems probable that soft, porous scale would more effectively retain against the tube surface such a layer of water or vapor of low conducting power. Such facts seem to indicate that we should accept with caution the assumption that hard scale will cause a greater loss than soft scale.

Figs. 4 and 5, in which the loss in heat transmission is plotted with reference to the principal chemical constituents of the scale, do not warrant the conclusion that its chemical composition has any direct influence on its conductivity.

From the point of view of the physicist the experiments are open to objection as to method. From the engineer's viewpoint it is believed that the possible errors of the experiments do not by any means account for all the irregularity in the plotted results and, considering the controversy upon the subject and the comparatively meager information available, it is deemed proper to publish at this time the results as they stand in the hope that they contribute additional information which may be of interest in some quarters.

CONCLUSIONS.

In so far as generalization is warranted, we may sum up the results of the tests in the following conclusions:

1. Considering scale of ordinary thickness—say of thicknesses varying up to ⅛ in.—the loss in heat transmission due to scale may vary in individual cases from insignificant amounts to as much as 10 or 12 per cent.

2. That the loss increases somewhat with the thickness of the scale.

3. That the mechanical structure of the scale is of as much or more importance than the thickness in producing this loss.

4. That chemical composition, except in so far as it affects the structure of the scale, has no direct influence on its heat transmitting qualities.

The Bavarian authorities announce that since the effort to guard against tuberculosis began in 1878, there has been a great reduction in the number and mortality of the cases among railroad employees, but still 18 to 20 per cent. of the deaths are due to it; and they have issued new regulations, intended to still further prevent the disease.

*In discussing the effect of structure it seems to be quite generally assumed that hard scale will reduce the conductivity of the tube more than soft scale. This assumption, moreover, is generally made without the reasons or data being adduced. It may eventually prove to be correct, but there are reasons for anticipating that, when the matter is settled experimentally, we may find that soft scale will cause the greater loss.

The Sixth Street Viaduct at Kansas City.

BY J. A. LATIMER.
Principal Assistant Engineer, Kansas City Southern.

Kansas City has many hills and hollows. The west bottoms—on the south side of the Missouri river and on both sides of the Kaw river—are occupied by railroad yards and terminals, stock yards and meat packing plants, and other factories and warehouses. Wagon traffic from the uptown district to the west bottoms and Kansas City, Kan., passes over heavy grades and across many railroad tracks, and, during the busy hours of the day, is very congested.

A public viaduct from the west bluffs at Fourth street across the tracks which lead from the north to the Union Depot and adjacent yards, lands at the east edge of the west bottoms. It partly relieved the situation in the early days, but has long been inadequate and in addition is too far north to benefit a considerable portion of the present traffic. The next streets which afford access to the west bottoms are Sixth street and Twelfth street, from which roadways wind to the south and north, respectively, along the west bluffs. These routes are unsatisfactory on account of indirectness, steep grades and numerous railroad crossings.

A municipal viaduct to afford an easy and direct route for wagon and street railway traffic between Kansas City, Mo., and Kansas City, Kan., and the intervening bottoms was advocated in 1902 by William J. Knepp, while he was a member of the City Council of Kansas City, Mo. Approximate estimates of the cost of the structure were prepared and some investigations made as to right-of-way. However, it soon became evident that the two cities had not the necessary funds available, nor were they in a position to issue bonds for the purpose. Mr. Knepp then set about to interest private capital in the enterprise and finally succeeded in obtaining the necessary funds in the East. The Kansas City Viaduct & Terminal Railroad Co. was organized and a toll viaduct built. This structure is known as the Sixth street viaduct, but is also often referred to as the Intercity viaduct. It extends from Sixth and Bluff streets in Kansas City, Mo., to Fourth street and Minnesota avenue in Kansas City, Kan., and for the greater portion of its length is located between the Missouri river and the tracks on the south side of this stream on land which was formed by accretion.

The length of the main viaduct is 8,400 ft., including an earth approach 381 ft. long, at the Kansas end. Beginning at the east end, there is a $1^5/_{10}$ per cent. descending grade for 843 ft.; a $^5/_{10}$ per cent. descending grade for 2,362 ft.; a $^5/_{10}$ per cent. ascending grade for 2,091 ft.; a $^{74}/_{100}$ per cent. ascending grade for 45 ft.; a $1^5/_{10}$ per cent. ascending grade for 1,415 ft., which ends at the east end of the bridge across the Kaw river; a $^5/_{10}$ per cent. ascending grade 609 ft. long across the Kaw river bridge and 1,035 ft. of a $1^8/_{10}$ per cent. ascending grade to the west end of the viaduct. The grades which are shown on the general plan, Fig. 1, are incorrect. It was necessary to eliminate the level grade in order to meet the wishes of the company which provided the paving for the roadway. There are three 3-deg. curves in the alinement, which are respectively 683, 653 and 190 ft. long.

The spans are supported by steel columns which rest on concrete pedestals; the latter in turn rest on piles—12 under each pedestal. The bottoms of the concrete footings under the pedestals are above low water in the Missouri river. It was originally intended to use concrete piling throughout for the purpose of providing satisfactory protection against decay near the surface of the ground. The first plan was to drive hollow metallic forms and fill them with cement as the forms were withdrawn, but on account of difficulty experienced by the contractor in doing work in this manner for a warehouse foundation in Kansas City, this method was abandoned. It was found that where these forms were driven through quicksand, a great deal of the concrete was lost by flowing outside the space intended to be occupied by the pile. Concrete piles were then made in forms on the surface of the ground at the site of the work and jetted into position. The cross-section of these piles is approximately an octagon and they are about 14 in. in diameter at the large end and 10 in. at the tip. It was late in August before the moulding of the concrete piling was started. While the weather was warm, the piles would be strong enough to drive within seven days after making and the driving was effected with but little difficulty. As the fall season advanced, the setting of the concrete became so slow that it required 30 days or more for the piles to become hard enough to drive. After driving about 800 concrete piles, yellow pine piling treated with 12 lbs. of creosote per cubic foot was adopted. The concrete piles are from 30 ft. to 35 ft. long and the timber piles from 35 ft. to 50 ft. long.

The concrete piles consist of four ¾-in. Johnson's corrugated bars wrapped in wire netting and surrounded by a mixture com-

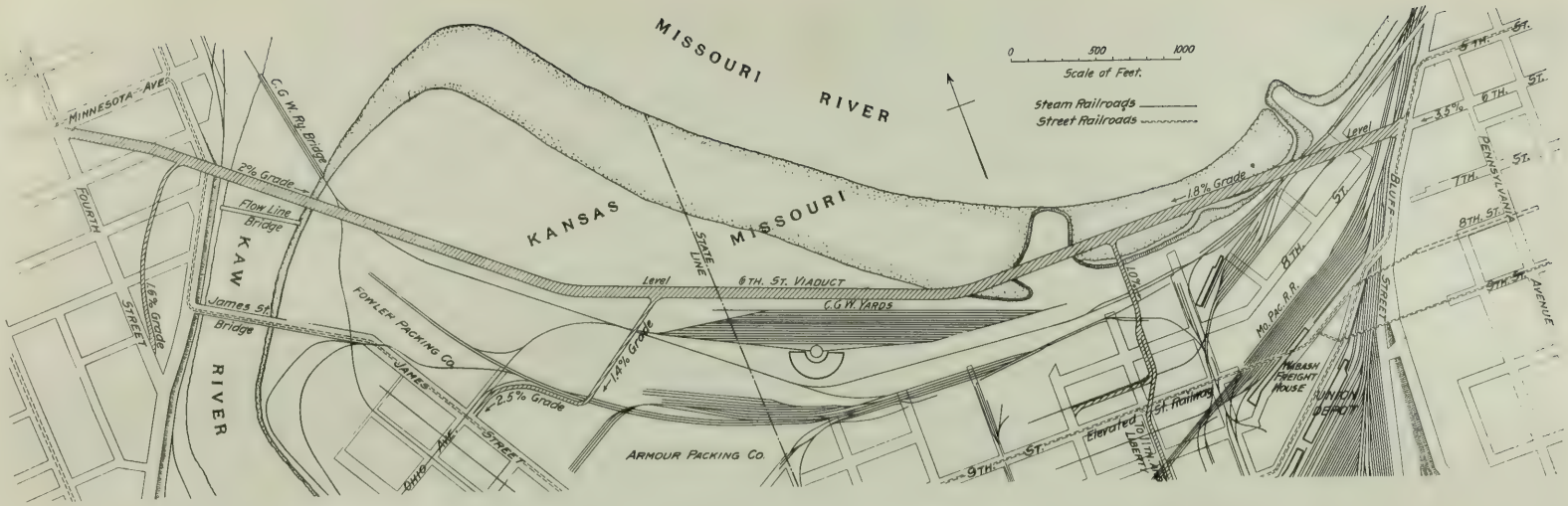


Fig. 1—Map of West Bottoms at Kansas City Showing Location of New Sixth Street Viaduct and Approaches.



Fig. 6—Bird's-eye View of New Sixth Street Viaduct at Kansas City.

posed of one part of Portland cement, three parts of sand and five parts of stone broken to pass through a 1-in. ring. The concrete in pedestals was of the same composition as that in the concrete piling, except that the stone was 2½ in., or less, in size. The concrete in pedestals deposited in water was mixed in the proportion of one, two and three, broken stone to pass through a 3-in. ring. All ingredients in concrete was determined by volume and each mixture contained sufficient water to form what is known as "wet" concrete. The standard footings of pedestals on concrete and timber piles were 9 ft. by 11 ft. 3 in. in plan, with the longer dimension transverse to center line of viaduct and projected 3½ ft. below and 1½ ft. above tops of piles. The footings for pedestals through the flat east of Mulberry street were 9 ft. by 12 ft. and extended 10 ft. below tops of piles and 3 ft. above tops of piles. The neat work of pedestals is 12 ft. high, 6 ft. 6 in. by 7 ft. 6 in. at the base and has a batter of 1½ in. to the foot. The corners are rounded to a 3-in. radius.

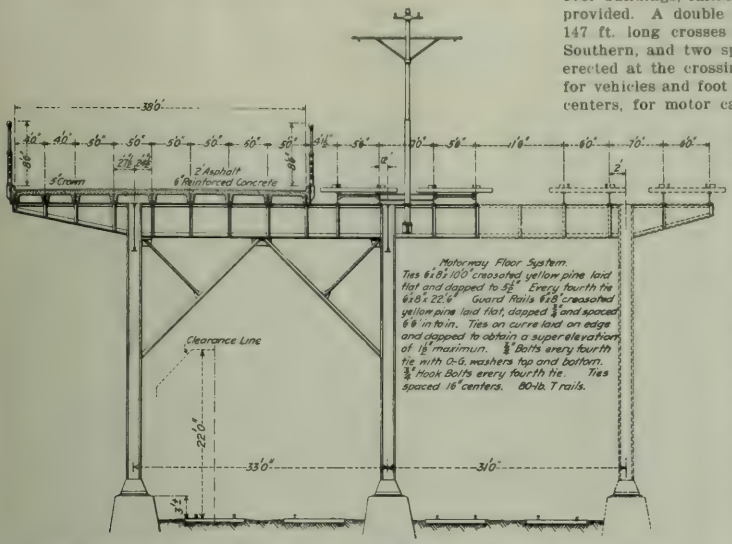


Fig. 2—Cross Section Through Viaduct Showing Future Widening for Additional Tracks.

In general the superstructure is arranged in bays, separated by expansion joints, each bay consisting of seven 45-ft. spans and one 30-ft. tower, thus spacing the expansion joints (shown in Fig. 3), 345 ft. apart. The tower span is well braced longitudinally. All columns are of steel. Where necessary to carry the viaduct over buildings, railroad tracks, streets and alleys, special spans are provided. A double intersection, riveted, Warren deck truss span 147 ft. long crosses a proposed freight yard of the Kansas City Southern, and two spans, each 300 ft. long, of the same type were erected at the crossing of the Kaw river. These carry a roadway for vehicles and foot passengers and two tracks, 12 ft. 6 in. between centers, for motor cars, the center of the inside track being 6 ft. 10½ in. from the hand-rail of the highway. The roadway is 38 ft. wide east of Mulberry street and 30 ft. wide west of Mulberry street. The present structure is built to permit a future addition of a footway 7 ft. 6 in. wide on the south side and another row of columns 31 ft. north of the present north line of columns to support another pair of tracks for motor cars.

A typical section is shown in Fig. 2. The columns of each bent are 33 ft. between centers and vary in height from 27 ft. to 52 ft., to fit the grade, the top of concrete pedestals being level. A column between 27 and 31 ft. high consists of two 15-in. 33-lb. channels, separated by a ½-in. x 16-in. plate fastened to the channels by means of four 5-in. x 3-in. x ⅝-in. angles. For higher columns, the weight of the channels was increased, but the diaphragms remained the same. The floor beams are 15 ft. apart and, between main girders, are 52-in. plate girders having a ⅜-in. web and 6-in. x 6-in. x ½-in. angles. Outside the main girders are cantilever girder arms, which are connected to the floor girders by a plate across the top of columns; the thrust at the bottom is transferred by means of a cast iron block between the outside channels of the columns. At every bent there are angle iron braces across the corners between floor beams and columns. On top of the floor beams there are 12-in., 31½-lb. I-beams, 5 ft. between centers, under the roadway for vehicles, and one 18-in., 55-lb. I-beam under each rail of the tracks for motor cars. Longitudinal bracing is provided in every seventh panel on tangents and every fifth panel on curves, except that in a few instances, on account of undercrossings by streets or tracks.

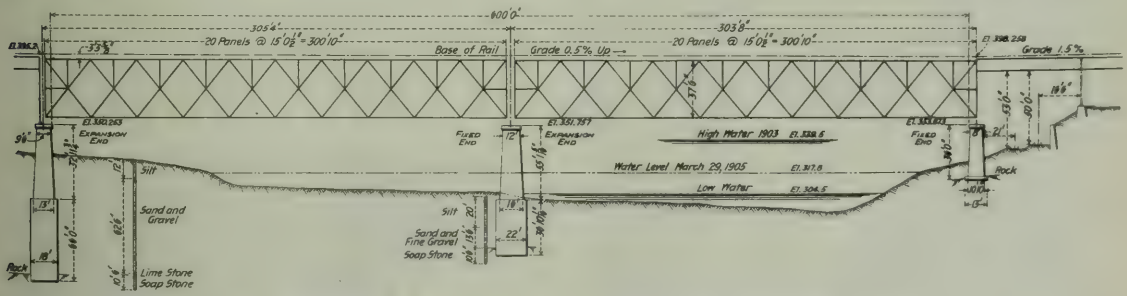


Fig. 4—Elevation of Bridge Over the Kaw River for the Sixth Street Viaduct.

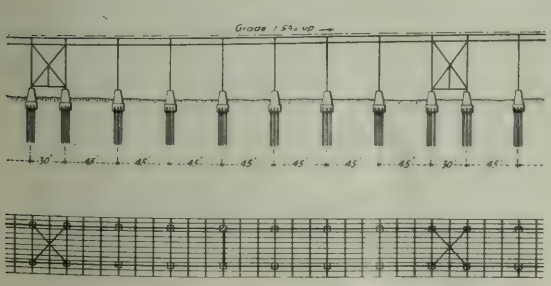


Fig. 5—Part Plan and Side Elevation of Sixth Street Viaduct.

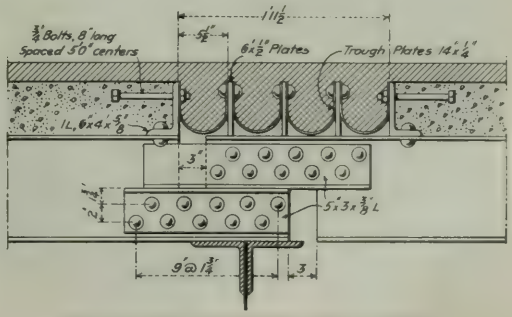


Fig. 3—Detail of Expansion Joint in Floor.

every eighth panel on tangents was braced longitudinally.

The material for the substructure of main viaduct was delivered on surface tracks under or along viaduct. The first metal was erected by the use of a gin pole and the remainder by means of a double-boom traveling derrick.

The floor of the roadway for vehicles consists of a 6-in. layer of reinforced concrete covered by a finishing coat of 2 in. of asphalt. The highway stringers are encased in concrete, as shown in Fig. 2. The four track stringers of the motor-way floor system are braced by a 10-in. channel over each floor beam with diagonals between. The ties are 6 in. by 8 in. by 9 ft., creosoted yellow pine, laid flat and spaced 14 in., center to center, except that every fourth tie is continuous across both tracks. They are fastened to track stringers by means of hook bolts. On curves, the ties are laid on edge and dapped to give super-elevation. Guard rails are also 6-in. by 8-in. yellow pine, creosoted, and are laid flat and dapped 1½ in. Trolley poles are set between tracks.

The viaduct is to be used by cars of the Metropolitan Street Railway Co. and also by cars of the Kansas City Western Railway Co., which operates an electric line between Kansas City, Mo., and Leavenworth, Kan.

The general plan and profile of the bridge across the Kaw river is shown in Fig. 4. These spans are designed for a combined live and dead load of 22,000 lbs. per lineal foot and are examples of long, heavy, riveted spans. Each span is 300 ft., 10 in. long, divided into 20 panels and weighs approximately 1,780,000 lbs. The bottom of the trusses is about 15 ft. above the high water mark of the flood of 1903, which caused such enormous damage at Kansas City and throughout the Kaw valley. Foundations for the east and middle piers were built by the pneumatic process, and that for the west pier by open excavation.

A lateral viaduct leaves the main viaduct in the block east of Mulberry street (in Missouri), and extends south across private property and buildings to a point about 100 ft. south of Eighth street. It divides here and one portion runs thence to Ninth and Mulberry streets, where it will cross above the Ninth street elevated tracks of the Metropolitan Street Railway and will extend on Mulberry street to Eleventh street. The other portion runs westward along the alley and by an incline on a $3^{5}/_{10}$ per cent. grade reaches the grade of the street surface near Ninth and Mulberry streets. The Eleventh and Mulberry street lateral will be about 2,200 ft. long and the Ninth and Hickory street lateral about 450 ft. long.

The city contemplates the construction of a viaduct west from the bluffs at Twelfth street, which would join the Mulberry street lateral of the Intercity viaduct at Eleventh and Mulberry streets. An effort was made by the city to unite with the Metropolitan Street Railway Co. in the construction of a viaduct from Twelfth and Bluff streets, but no agreement has been reached. From present appearances, the Metropolitan will reconstruct its old Twelfth street viaduct on a steeper grade than that contemplated by the city for its viaduct. The Kansas City Viaduct & Terminal Railroad Co. at first figured on a landing for its viaduct on the surface of the street a short distance west of Eleventh and Mulberry streets, but was unable to make satisfactory arrangements for right-of-way. The present plan is to provide elevators at the south end of the Mulberry street lateral to handle traffic between the viaduct and the surface of the street, a vertical distance of about 22 ft. The Mulberry street viaduct will have a clear roadway of 24 ft., but no railway tracks.

The ordinance covering the portion of the Sixth street viaduct which is located in Kansas requires the construction of laterals on Ohio avenue and Ferry street.

Actual construction of the Sixth street viaduct was begun August 9, 1905. The main viaduct was opened for traffic between Kansas City, Mo., and Kansas City, Kan., on January 29, 1907. Work is now in progress on the Eleventh and Mulberry, and Ninth and Hickory street branches.



Bridge Over Kaw River for Sixth Street Viaduct.

The total cost of the main viaduct and its laterals is estimated at $3,000,000.

The general contractor for the substructure was James F. Halpin, of Kansas City, and for the superstructure, the Riter-Conley Manufacturing Company, of Pittsburg, Pa. Thanks for drawings and other information from which this article was prepared are due Mr. Ira G. Hedrick, who on the dissolution of the firm of Waddell & Hedrick, became Consulting Engineer to the Viaduct Company.



Concrete Foundation Pier with Forms Removed.



View Under Viaduct Before Laying Floor.

GENERAL NEWS SECTION

NOTES.

At Olympia, Wash., April 11, there was to be a conference of the state railroad commissions of Oregon, Washington and Montana.

At Appomattox, Va., March 25, the Norfolk & Western was fined $1,100 and costs for 22 violations of the law forbidding the running of trains on Sunday.

The pool of the Western Elevating Association of Buffalo has been established for the present season without the eight railroad elevators, the railroad companies declining to enter on the ground that such action would be contrary to law.

A press despatch from Chicago on Tuesday of this week says that the Brotherhood of Locomotive Firemen has secured from 31 railroads west of that city agreements increasing by 25 cents a day the pay of firemen on all classes of engines.

In the Federal Court in Minnesota, April 6, the Great Northern Railway was fined $1,500 for illegal payment of rebates on freight. The decision was made in pursuance of an agreement between the Government and the railroad to hasten an appeal to the higher court.

The car barn and power plant of the New York City Railway Company at Lenox avenue and 146th and 147th streets, New York City, were destroyed by fire April 8. Loss about $1,000,000. Four hundred cars were burnt up. One person was killed and ten seriously injured.

On Thursday, March 21, the number of freight cars moved over the Pittsburg division of the Pennsylvania Railroad was 7,289, which is 359 above the record of January 5. The detailed record on March 21 was: Eastbound, 127 trains, 3,578 cars; westbound, 92 trains, 3,711 cars.

The roads entering Chicago from the East have agreed to bear four-fifths of the switching charge of $5 a car on freight consigned to private sidings in Chicago on the lines of the Northwestern and the St. Paul roads. Hitherto the eastern roads have paid $3 and the consignees $2.

The executive committee of the Chicago Commercial Association proposes to relieve the congestion of traffic in the streets of that city by securing the adoption of a rule—perhaps by agreement among teamsters—which will keep heavy wagons out of the business district during business hours.

The West River Valley Lumbermen's Association, of Vermont, complains that the Central Vermont furnishes lumber cars for shipments at the rate of about four a day, while the lumber shippers desire to ship many times that quantity. It is claimed that dry lumber amounting to over 7,000,000 ft. is now waiting for cars.

Street car men in Chicago are receiving the increase in wages promised them before election in case the traction ordinances, insuring the consummation of the contract between the street railways and the city, should be carried. The increase is said to be 4 cents an hour to men of less than one year's service and 2 cents an hour to the older men.

The new railroad law which has been passed in Colorado does not go into effect until June 25, and the Governor says that he is not going to appoint the commissioners until about that time. If the appointments were made now the commissioners would be unnecessarily troubled with complaints against the railroads and with application for positions.

Transmissouri roads have agreed to put into use in Kansas on and after May 1 next a 2,000-mile interchangeable ticket, business in connection with the use of which will be handled under the rules of the interchangeable bureau of the Western Passenger Association. Heretofore interchangeable mileage has been limited to the territory east of the Missouri river and to Nebraska.

The New York, New Haven & Hartford has issued an order forbidding permissive block signaling on lines worked by the telegraph or the controlled manual block system, except in case of emergency. If a train in the block section requires assistance another may be moved forward on a regular train order from the despatcher. In case of the failure of wires or bell apparatus a caution card may be issued.

The new union station at Mobile, Ala., is to be opened on Thursday, April 18. The Gulf Terminal is the name of the company organized to operate the new terminal. It is owned by the Mobile & Ohio and the Southern. At the opening ceremony there will be addresses by Mayor Lyons, Governor Comer, President Finley, General Manager Taylor, Colonel Russell and others. A dinner to celebrate the occasion will be given at the Hotel Cawthon following the opening ceremonies.

According to a press despatch from St. Paul the Minneapolis & St. Louis, having given due notice a month ago, is now selling tickets to Chicago in blocks of 100 at the low rate of $6 each. As these tickets are transferable and good for a year, the arrangement would seem to have been designed for the special benefit of the scalpers, and it seems that we are now to see how it looks to have this demoralizing business carried on partly in daylight.

W. O. Jackson, Chief Inspector of Railroads for the Ohio Railroad Commission, acting under a special appointment for the Georgia Railroad Commission, has made an examination of the Georgia Railroad & Banking Company's line, and reports that he finds nothing of the "dreadful conditions" alleged in the complaint on which the examination was ordered. He says the track conditions of the railroad rated 80 per cent. of perfect, compared with railroads with which he has had to do.

It is announced that the Great Northern Railway has decided not to replace the mammoth freight steamer "Dakota," which was wrecked on the coast of Japan a few months ago, and the principal reason for this decision, according to the report, is that the purpose aimed at in building the two great freight steamers has been accomplished. This purpose was to compel the other lines between Puget Sound and Asia to make favorable contracts with the Great Northern Railway for through traffic.

The state railroad commission of Ohio has issued a decision in which new demurrage rules are laid down. The railroads are commanded to allow 72 hours' free time on cars holding 30 tons or more, and to give consignees the benefit of the "average plan" of settlement for demurrage. Under this plan if a man unloads a car in one day less than the allowed free time, he must have a credit of one day on other cars which he detains more than 48 hours, though no car is to be entitled to a credit of more than seven days.

Over eleven million pieces of baggage were handled by the Pennsylvania Railroad in 1906, an increase over 1905 of 188,446 pieces. The total receipts of the baggage department in 1906 (extra baggage, storage, etc.) were $1,084,470. Included in this sum were $114,923 for transportation of newspapers; $63,487 for package transportation between Philadelphia and suburban points; $72,606 receipts at package rooms and $435,648 for the transportation of milk and cream. Of the claims paid in 1906 almost half of the entire sum was paid for nine trunks.

The policy of the principal railroads to postpone many projects for new construction has resulted, according to Chicago reports, in a decided increase in the supply of labor and a decrease in the scale of wages. A year ago none of the western roads could get enough laborers, and wages ranged from $1.50 to $2.25 a day. Now Italian Greek, Austrian and Belgian laborers are far in excess of the demand. They are thronging the labor agencies in Chicago, St. Louis, Kansas City, Cincinnati, Pittsburg and other cities, and gladly paying $3 each to the labor agents for finding work for them. The wages now offered range from $1.25 to $1.50.

The McRae Terminal Company, of McRae, Ga., has asked the Interstate Commerce Commission to direct the Southern Railway and the Seaboard Air Line to make track connections with the line of the terminal company. The application is based on the provision for cases of this kind which was put into the Interstate Commerce Commission law last June, and it is accompanied by the declaration that, although the terminal company, now operating one mile of road, expects to operate a regular line of railway, originating sufficient freight to warrant the construction of the desired connections, the roads named have thus far refused to lay the tracks.

A passenger desiring recently to secure a berth in a sleeping car from Chicago to Philadelphia over the Pennsylvania lines on presentation of two mileage tickets, one for the lines west of Pittsburg and one for the lines east, was refused, the railroad holding that, as the mileage tickets are issued solely for local use in carefully designated territories, it would be an illegal discrimination to consent to the use of such reduced rate tickets for a through journey over a line where the reduced rate had not been posted according to law. Therefore, the combination cannot be honored, either in checking baggage or in the sale of through sleeping car tickets.

The signal department of the Chicago & North-Western has been put under the jurisdiction of the engineering department, and henceforth division engineers in their respective territories will have charge of the construction, maintenance and operation of signals, reporting to and receiving instructions from the Signal Engineer on all these matters. Supervisors of signals will be appointed by the Division Engineer with the approval of the Signal Engineer.

The Signal Engineer reports to the Chief Engineer on important new work; to the General Superintendent on operating questions, and to the Engineer of Maintenance on maintenance and minor construction.

It is announced in Chicago that after numerous conferences the western railroads have agreed to slightly lengthen the schedules of through trains. The minimum time to be made by any passenger train from Chicago to Kansas City and Omaha after June 8 will be 14 hours. This is about the average time now, although a few trains make the run in 13 hours. The minimum time between Chicago and Denver was fixed at 32 hours, which is a little longer than the average time of the best trains now. The minimum schedule from Chicago to San Francisco will be 72 hours. The present time of the fastest trains is 69 hours and 30 minutes. No change was made in the minimum schedule from Los Angeles to Chicago, which is 72 hours.

On May 1 the Pacific Express Company, which operates over the Union Pacific, the Missouri Pacific and the Wabash, will begin service on several electric lines in western Ohio. This is the first advent of an old-line express company into the electric line traffic in that part of the country. Contracts have been made with the Dayton & Troy, the Springfield, Troy & Piqua, the Western Ohio and the Toledo Urban & Interurban line. Through express cars will be put in service on the lines mentioned. The Wells-Fargo Express is expected to establish service on the electric line from Marion to Columbus, connecting at the former city with the Erie. The American Express Company has for a year or two done a heavy express business on street railways in and near New York City.

During the year 1906 the length of lines of the Pennsylvania Railroad was increased only 64.01 miles, but 660.91 miles of new track was built. Energies of late have been devoted to building sidings, terminals, third and fourth tracks and relief lines to take care of the enormous quantity of freight traffic with which the company has been burdened. More than half the increase in trackage during the past six years, or 1,863 miles, is in company sidings. The Pennsylvania is now a four-track line from New York to Pittsburg, with the exception of two short stretches of three-track line in the mountain divisions. To-day the slow freight trains going from Altoona to Harrisburg, a distance of 131 miles, stop only once for coal; the fast freight trains run through without any stop. The Pennsylvania system operates 10,977 miles of line, and 23,109 miles of track. It operates 4.88 per cent. of the total mileage of the country, and 7.2 per cent. of the total trackage of the country.

According to Chicago gossip, President Ripley, of the Atchison, Topeka & Santa Fe, has made an ineffectual demand upon the post-office authorities for the temporary privilege of transporting the mails from the East to southern California, which have been badly delayed by washouts on the Ogden route. Citizens of Pasadena, Los Angeles and other places were complaining because of the irregularity; but the Post Office Department declared that the mails could not be diverted without transgressing all precedents. The mails are now being weighed for the next four-year estimate, and a diversion might work great injustice to the road from which the diversion was made. It appears that the regular southern California mail route was interrupted by a washout on the San Pedro line at Caliente about a month ago, and the Los Angeles Limited train was taken off. Then the southern California mails were taken by the way of Sacramento until washouts interrupted that route.

New Smokeless Locomotive on the Brussels-Ostend Line.

The *Journal des Transports* is authority for the statement that a test is being made of a new type of locomotive on the Brussels-Ostend line in Belgium which possesses the double advantage of being able to haul very heavy trains and of emitting neither smoke nor steam. These usual evidences of the work done by a locomotive, instead of being thrown out of the stack, are caught and turned back into the firebox, where they are burned and decomposed. Further, the cinders, instead of being thrown out on the right of way, are caught and carried on the outside of the machine in the same way. The system is said to resemble, in principle, that of the incinerating plant used in the neighborhood of Brussels. It is said that *if* the process proves to be a success it will be applied to all of the Belgian locomotives.

The Soliciting Agent's Glee.

When freight agents had to hustle for traffic and the railroads were hungry for business, many a shipper inconsiderately allowed them to cool their heels in ante-rooms, but now it's different. Excess of business and car shortage helps more than one agent to get even with those who formerly failed to appreciate the value of his time. The shipper is doing the calling. One agent says:

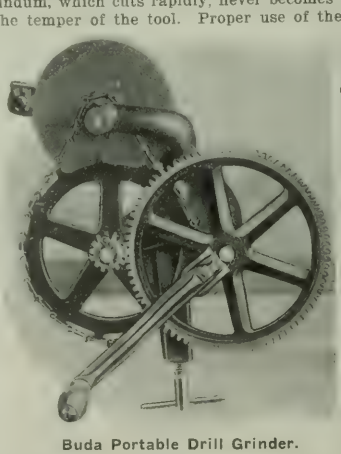
"I readily recall how often when I called at some offices the office boy was instructed to tell me to wait, and I listened with impatience and vexation as the shipper lounged in his private sanctum and laughed and joked with social callers. Now it is our turn. This year will teach many a shipper a lesson in common civility and ordinary courtesy. The telegraph companies meanwhile are reaping a harvest, shippers keeping the wires hot trying to trace their freight. Of course, there are shippers who know how to treat a man, and we about break our necks trying to help such men."—*Selected.*

New Steel Tug for the Lehigh Valley.

The steel sea-going tug "Irvington" was recently received by the Lehigh Valley Railroad from the Burlee Dry Dock Co., Port Richmond, Staten Island, and is being fitted for service. The "Irvington" made her trial trip on March 26. She is a sister tug to the "Wyoming," which was received a month or more ago; these two are the largest in the company's service, and will go into service between Perth Amboy and Boston and other eastern ports. The "Irvington" is 152 ft. long, 28 ft. 6 in. beam, and the depth of hold is 16 ft. She has a four-furnace Scotch boiler 15 ft. in diameter and 12 ft. long, with a working steam pressure of 180 lbs. The engines are triple expansion, 17-in., 25-in. and 43-in. x 30-in., and will develop 900 h.p. Her towing capacity is 6,000 tons. The bunkers hold 300 tons of coal.

The Buda Portable Drill Grinder.

A strong and efficient portable grinder is illustrated herewith. Designed primarily for railroad work, it is claimed that it will do any work reasonably required of it. The grinding wheel is carborundum, which cuts rapidly, never becomes "dull" and does not affect the temper of the tool. Proper use of these grinders requires that they be driven at high speed and the metal applied with only the lightest touch. Slow speed and heavy pressure injure both wheel and tool. These wheels really cut instead of grinding, differing in that respect from emery wheels, for example. They are claimed to be far superior to grindstones in every way, and that one man with one of these grinders can do as much as 20 men with the ordinary grindstone.



Buda Portable Drill Grinder.

The grinders are fitted with suitable attachments for grinding drills, as a part of the outfit. They are given wide bearings, securely protected from dust. The chain is the Locke steel-belt type, oil tempered, with provision for taking up the slack. They are geared to attain a speed of 3,500 r.p.m., and for hand-power driving have an adjustable malleable iron clamp for securing to any convenient bench, timber, etc. They are made in two styles, Nos. 1 and 2, the former being shown in the illustration. No. 2 is similar except that it is smaller and is intended for lighter work. The Buda Foundry & Manufacturing Co., Chicago, is the maker.

State Reductions of Passenger Fares.

The law limiting passenger fares to 2 cents a mile, which was recently passed by the Legislature of Pennsylvania, was signed by the Governor on April 5. It goes into effect on September 30, and the penalty for violation is $1,000. The Legislature is likely to pass a bill exempting roads less than 40 or 50 miles long. President McCrea, of the Pennsylvania, wrote a letter to the Governor complaining of the injustice of the bill. This letter has been made public, but seems to have had no effect with the Governor. A passenger fare bill has been passed by the upper house of the Michigan Legislature. The limit is 2 cents on all roads in the lower peninsula earning over $1,200 a mile, net. On the upper peninsula 4-cent rates are reduced to 3 cents. The 2-cent rate in Indiana goes into effect on a date to be fixed by the Governor; it was expected that the Governor's proclamation would be issued this week. The railroads of Mississippi, with the exception of the Louisville & Nashville, which works only 74 miles in that State, have decided to comply with the order of the State Railroad Commission to sell 2,000-mile books at 2 cents a mile. A 2-cent fare law has been passed by both houses of the Minnesota Legislature. The lower house of the Pennsylvania Legislature has passed a bill permitting interurban railroads to carry freight and limiting the

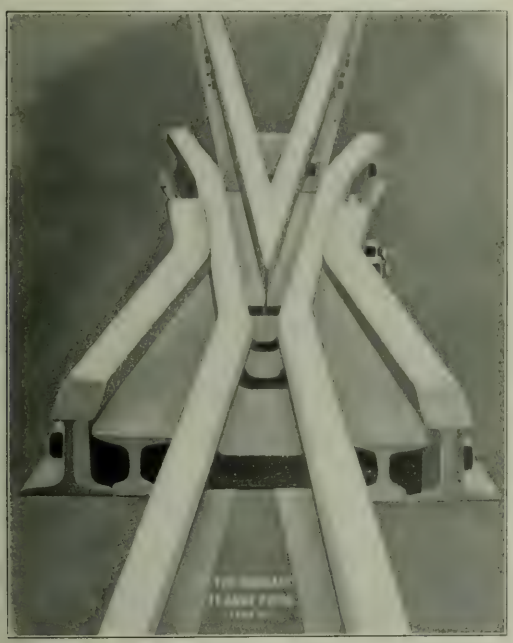
prices for berths in sleeping cars. For lower berths the limit is one-half cent a mile, for upper berths three-eighths cent, and seats in parlor cars, one-third cent.

Bids for Arthur's Pass Tunnel in New Zealand.

The time for submitting bids for boring a tunnel five miles long at Arthur's Pass through the range between Canterbury and Westland, on the line of the New Zealand Midland Railway, has been extended from March 18 to July 1, 1907. Bids will be received at the office of the High Commissioner for New Zealand, Westminster Chambers, 13 Victoria street, London, England, as noted on advertising page 22.

The Graham Flange Frog.

The Graham flange frog shown in the accompanying illustration is designed to do away with the use of a guard rail opposite the junction of the two tracks. The flange of the wheel is guided past the point of the frog by the outside flange rails which project up high enough above the top of the running rails to provide a guide for the outside edge of the tread. These flange rails extend well



The Graham Flange Frog.

beyond the point of the frog so that the flange must take the proper opening corresponding with the direction in which the truck is moving. The frog is rigidly constructed of pieces of rail and suitable fillers, the whole being bolted together with heavy bolts; compensating fillers are provided to allow for any excessive wear of flange rails. The principal advantage claimed for this frog is that it provides a positive guide for the wheel which is actually passing over the frog, whereas with a guard rail opposite the frog, the guiding effect is obtained through pressure on the back of the flange of the wheel at the other end of the axle. In case an axle is bent, or the outside wheel is loose, the opposite wheel is likely to take the wrong groove. It is also difficult to maintain the guard rails to gage, and the constant resetting and respiking soon requires the renewal of the ties to which the guard rail is spiked. Another objection to the guard rail is that a truck is likely to run askew, and when a truck in this position passes over a frog, the guard rail is depended upon to return it to its normal position. This subjects the guard rail and the wheel flanges to pressures which are often excessive and which result in broken flanges or badly worn guard rails.

One of these flange frogs has been in use for nearly a year in the Roanoke yard of the Norfolk & Western. It has been subjected to heavy train movements in both directions. It is claimed that it has required no attention and no expense for maintenance or repairs. There have been no derailments on it as yet. It is made by the American Flange Frog & Railway Improvement Company, Roanoke, Va.

Wages Raised in the West.

The long negotiations concerning wages between the railroads centering in Chicago and representatives of the conductors' and brakemen's brotherhoods were terminated on April 4 through the mediation of Martin A. Knapp, chairman of the Interstate Commerce Commission, and Charles P. Neill, United States Commissioner of Labor, who had been asked by the railroad managers to come to Chicago. The terms of agreement provide for higher rates in some cases than were originally offered by the managers. Chicago reports say that this advance will approximate $300,000 a year, which, added to the original increase offered by the railroads, will add about $6,000,000 a year to the payrolls of the forty roads involved, benefiting 50,000 employees. Both sides to the controversy yielded to the urgent appeals of the federal mediators and made concessions in the interests of peace and the welfare of the general public. The greatest concession made by the employees was the waiving of the nine-hour day.

In consideration of this the general managers agreed to grant a further advance in wages to the brakemen, baggagemen and flagmen in passenger service and an increase of 10 per cent. to employees on work trains who are now working under a ten-hour schedule. The men on work trains who now are on a twelve-hour schedule are to be put on a schedule of ten hours a day without a reduction in wages.

In the final offer of the general managers before they appealed to the government conductors on passenger trains were granted an increase of $10 a month, baggagemen $6 a month and flagmen and brakemen $5 a month. Overtime at the rate of 35 cents an hour for conductors and 20 cents an hour for other employees was offered. Men on work trains were given no increase in wages.

By the terms of the settlement baggagemen on passenger trains will receive an advance of $7.50 a month and brakemen and flagmen $6.50 a month, with overtime at the rate of 23 cents an hour. This increase averages 10 per cent., but on some of the roads it amounts to about 12 per cent. to the brakemen and flagmen. The scale for passenger conductors, averaging about 8 per cent., remains the same as originally offered by the managers.

All classes of workmen in through and irregular freight train service are granted a flat increase of 10 per cent. over the rates now in effect. In addition to the increase in pay the conditions of employment on some of the roads are materially improved.

The demand of the men in yard service in Denver and other western points for a differential of 2 cents an hour over the Chicago scale is referred without prejudice back to the separate roads to be adjusted between each road and its own employees. The railroads agree not to reduce the number of crews or increase the tonnage of trains so as to offset the increase in wages granted the employees.

The agreement was brought about without a conference between the representatives of the two sides. After discussing the whole subject with both sides, Mr. Neill and Mr. Knapp drew up the compromise agreement, and the latter laid it before the labor delegates Wednesday afternoon. He urged them to accept the proposition and told them that he believed the managers would do the same. On Wednesday evening the Government officials held a conference with the managers and paved the way for the acceptance of the modified demands of the employees.

A press despatch from Chicago the day before the settlement said that the conductors and trainmen were losing in their conference with the general managers; that "as a body the employees are beaten, and their leaders practically acknowledge it. They have put up a big bluff, had it 'called,' and have been unable to make good on their strike threats. It has been claimed by the leaders that 97 per cent. of their men had voted to strike unless their demands for a higher wage scale and shorter hours were acceded to. In reality, only 16,000 out of the membership of 50,000 claimed by the trainmen's and conductors' orders voted for a strike, the others refusing. The men have been told in plain words by Labor Commissioner Neill that they would be defeated, as they were only a small proportion of the working interests of the country; that the public were against them, and that the railroad managers would like to have them strike. They recognize that the 136 delegates sent here from all parts of the West made too large a body to be handled, and that the leaders are not large enough for the job they have undertaken."

A Wrong Principle.

A recent collision on account of failure of an inferior train to observe signals displayed for a following section by a superior train met, brings up afresh the question whether standard practice in the matter of displaying signals is not somewhat at fault. It may be worth considering whether such collisions would be so likely to occur under a practice requiring last sections and single trains representing a schedule to display a distinctive signal indicating them to be the last (or only) train running on their respective schedules. As it is, that fact is indicated by the absence of signals, while

railroad practice in all other cases regards the absence of signals as an indication of danger.

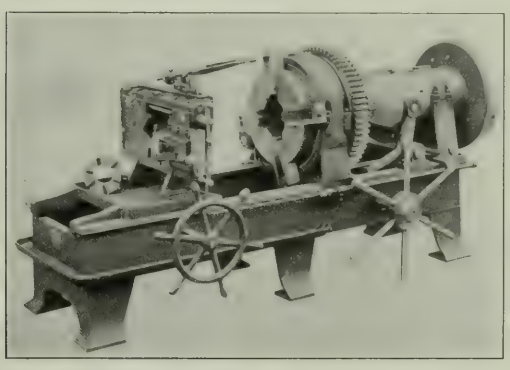
The present practice of displaying signals for following sections has become so firmly imbedded in the experience of railroad men that there would be a certain amount of danger in reversing it. What men have been accustomed to do through long years of practice, is what they may be expected to do instinctively. How far habit might outrun observance of a new practice is a question to be carefully considered.—*Train Dispatchers' Bulletin.*

Terminal Railroads' Wants.

The Buffalo Union Furnace Company, which controls the Buffalo Union Terminal Railway, has complained to the Interstate Commerce Commission that the railroads connecting with its short railroad do not make it proper allowances, and the amount demanded from each of the companies is named, as, for example: New York Central, $14,620; Lehigh Valley, $245; Erie, $6,193. It appears that the only legal ground offered to justify these claims is that these same roads pay $2.50 a car to similar industrial terminal railroads in other cities.

A New Size Pipe Threading Machine.

The Bignall & Keeler Manufacturing Co., Edwardsville, Ill., have placed on the market a new size pipe threading machine known as the P. D. Q. C. No. 6. It has a quick operating chuck, worked by a handwheel and pinion engaging a rack on the end of the cone



Bignall & Keeler Pipe Threading Machine.

shifting arm. The cone slides freely on the arbor, and as it is moved forward the chuck arms, having rollers in the ends, roll up on the large diameter of the cone, thereby tightening the jaws on the pipe. When the cone is moved back, springs draw the jaws away from the pipe. The steel jaws in the chuck are graduated and when once set for a size of pipe the entire lot can be threaded without stopping the machine. The rear chuck is provided with three independent jaws with which fittings can be made up; also bushings for keeping the pipe centered without gripping it. Eight changes of speed are obtained through a four-step cone pulley and shifting gears. The Peerless die-head is used. The machine has a range of 10 sizes, 1¼ in. to 6 in., inclusive.

Rules for Tracing Freight.

The Freight Bureau of the Business Men's League of St. Louis, after conferences with the principal railroads, has adopted the following recommendations concerning the tracing of freight:

1. That no tracers should be started until a complaint has been received from the consignee on account of non-arrival of the whole shipment or part thereof, and after a reasonable time has elapsed for consignment to reach destination.

2. That a printed form of tracer should be used, indicating: Name of consignee, destination, description of articles, number of packages, at what depot delivered, by whom dray ticket was signed, if possible; date on which shipment was receipted for; or in lieu thereof, an exact copy of dray ticket showing information as indicated above.

3. That tracers should state whether the entire shipment or part thereof has been unreasonably delayed, and, if part shipment, what item or items are short. This should be shown conspicuously, preferably in red ink, so as to be readily observed by the tracer clerk.

4 That all tracing for less than carload shipments forwarded from St. Louis should be done through one office of each railroad; said office to be designated by the individual carriers.

In accordance with the fourth recommendation, the railroads have designated certain offices through which tracing should be done.

Train Wreckers on the Pennsylvania.

The malicious wrecking of passenger trains on the Pennsylvania Railroad on March 22 and March 27 was followed by somewhat similar attempts on the lines of the same company in Ohio April 6 and 8, and at East Brady, Pa., April 7; and the company has announced further rewards for the apprehension of the guilty persons. The officers of the company are engaged in strenuous endeavors to stimulate the police and public and private detectives throughout the threatened territory to the utmost possible exertions, looking to the discovery of the culprits. The company proposes to put watchmen on every quarter mile of the line if necessary.

Manufacturing and Business.

The Chicago office of the Pantasote Co. has been moved from the Monadnock block to 707 Fisher building.

The Crocker-Wheeler Company, Ampere, N. J., has opened a branch office in the Woodward Building, Birmingham, Ala., in charge of B. A. Schroder, who hitherto has been in charge of the New Orleans territory of the company.

Reuben Wells has resigned as General Manager of the Rogers Locomotive Works (American Locomotive Co.). Fred. W. Cooke, who is Manager of the Cooke Works of the American Locomotive Co., will hereafter have charge of the Rogers Works also.

The B. F. Sturtevant Co., Boston, Mass., has just received from the Interborough Rapid Transit Company, New York, a repeat order for standard economizers. The previous order was for the equipment of 26,000 boiler horse-power. To complete both orders 11,200 tubes will be needed.

The offices of the Goldschmidt Thermit Co., New York, have been moved to the West street building, 90 West street, between Cedar and Albany streets, New York. The company has opened a Pacific Coast branch at 432-436 Folsom street, San Francisco, under the management of L. Heynemann, for business in California, Oregon, Washington and Nevada.

The Cincinnati Planer Co., Cincinnati, Ohio, has broken ground for its new plant at Oakley, Ohio, a suburb of Cincinnati, where an eight acres tract has been secured. The first building will be brick and steel, 140 ft. x 200 ft.; this will be equipped with new machinery throughout, and will be operated as an addition to the company's present plant, it being planned to build all the larger sizes in this new building. A second building, 140 ft. x 200 ft., will be erected as soon as the first addition is finished and put in operation; then the entire plant will be removed to the new location.

The Atlas Engine Works, Indianapolis, Ind., has been awarded the contract for the water-tube boilers for the new central power station to be built by the Government at Washington, D. C., which is to furnish heat, light and power for the capitol, the congressional library and the new senate and house office buildings. The station will be at Garfield Park, four blocks south of the capitol, at the intersection of New Jersey and E streets, and, it is said, will be the largest and most modern operated by the United States Government. J. G. White & Co., New York, are the consulting engineers on the work, the Government also having its own board of experts. The equipment will include sixteen 600 h.p. Atlas high-pressure water-tube boilers, equipped with Roney stokers, and four 2,000 k.w. Westinghouse-Parsons turbines and generators. Power and light will be distributed through four sub-stations, one being located in each of the buildings supplied. Deliveries are to begin August 1 and the plant is expected to be finished by the first of the year. The order for boilers is said to be the largest ever placed by the Government.

Iron and Steel.

The Canton-Hankow Railroad has ordered through Mitsui & Co., New York, 175 tons of 70-lb. rails.

There is no disposition to allow options on pig iron to lapse, leading consumers are closing contracts for a large tonnage every week, and no concessions in prices are considered. In addition to regular rates substantial premiums are paid for spot iron when it can be obtained. The supply of finished steel continues limited, the sheet mills only being able to make deliveries in from four to six months, and other sections of the market are not up with orders. Spring building is bringing out the expected demand for structural shapes, contracts for an enormous tonnage being now under consideration. Railroad bridge and terminal work is a prominent feature, and the mills do not experience the cancellations of orders that

were predicted, the money in most cases having been provided for the work under contract. Pipe mills cannot make deliveries within two months or more, and one new contract pending calls for 30 miles of 12-in. or over riveted steel pipe for irrigation in Nevada. Throughout the iron and steel industry there is a better tone than existed a few weeks ago, owing to the belief that the reaction in securities will go no further.—*Dun's Review.*

OBITUARY NOTICES.

R. X. Ryan, General Freight and Passenger Agent of the Northwestern Pacific, died recently of pneumonia at Oakland, Cal., after two months' illness.

William K. Niver, formerly Vice-President of the Boston & Maine, died at Syracuse on March 31. Mr. Niver was 72 years old. He began railroad work as Assistant Superintendent on the Delaware, Lackawanna & Western; he then went to the Syracuse, Binghamton & New York, now part of the D., L. & W., as Superintendent, and was afterwards General Superintendent of the Western district of the Lehigh Valley. After serving as Vice-President on the Boston & Maine, he organized a coal company. He was at one time Mayor of Syracuse.

E. J. Yard, the late Chief Engineer of the Denver & Rio Grande, who died last month, was born in Texas in 1860. He graduated from an eastern university and came to Colorado in 1880, where he began railroad work on the construction of the Denver & Rio Grande. He later went to Utah and then to the Rio Grande Western. He was afterwards appointed Chief Engineer of the Rio Grande Western, and was in charge of nearly all of the rebuilding of the road when it was made standard gage. In 1902 he was appointed Chief Engineer of the Denver & Rio Grande and of the Rio Grande Western.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Association of Transportation and Car Accounting Officers.

The Secretary announces that at the request of a large number of the members of this association, the date of the annual meeting at St. Paul, Minn., has been changed to June 25-26, 1907.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Astoria & Columbia River.—C. M. Levey, Third Vice-President of the Northern Pacific, and President of the Portland & Seattle, which is under construction, has been elected also President of the Astoria & Columbia River.

Beaumont & Great Northern.—M. C. Booth has been appointed Auditor, with office at Onalaska, Tex.

Delaware & Hudson.—L. F. Loree, Chairman of the Executive Committee of the Kansas City Southern, has been elected also President of the Delaware & Hudson, succeeding David Wilcox, resigned.

Kansas City Southern.—See Delaware & Hudson.

Missouri, Kansas & Texas of Texas.—R. N. Roach has been elected Treasurer.

New York, New Haven & Hartford.—T. E. Byrnes, Vice-President, with office at New Haven, has been transferred to Boston, succeeding F. S. Curtis, who has been elected President of the Old Colony Railroad, succeeding C. F. Choate, resigned.

Northern Pacific.—See Astoria & Columbia River.

Panama Railroad.—Major G. W. Goethals, Chairman of the Isthmian Canal Commission, has been elected also President of the Panama Railroad, succeeding T. P. Shonts, resigned. E. E. Drake, Secretary, Treasurer and Assistant to the President, has been elected Vice-President. T. H. Rossbottom, Assistant Secretary, has been elected Secretary. Sylvester Demming, Assistant Treasurer, has been elected Treasurer. R. R. Rodgers has been elected General Counsel. The following new directors have been elected: G. W. Goethals, D. DuB. Gaillard, W. L. Sibert, W. C. Gorgas, Jackson Smith, H. H. Rosseau and J. C. S. Blackburn.

Portland & Seattle.—See Astoria & Columbia River.

Operating Officers.

Boston & Albany.—J. B. Stewart, General Superintendent, who was recently given leave of absence on account of ill health, has resigned, effective June 1.

Canadian Pacific.—See Grand Trunk Pacific.

Chicago, Indiana & Southern.—George Hannauer, Superintendent of the Wiggins Ferry Company, has been appointed Superintendent of the Danville division of the C., I. & S., and of the Indiana Harbor Belt.

Colorado & Southern.—J. D. Stack has been appointed Acting Superintendent of the Trinidad & New Mexico districts, with office at Trinidad, Colo., succeeding to the duties of J. D. Welsh, promoted.

Denver & Rio Grande.—A. F. Vick Roy, Assistant Superintendent of the Wyoming division of the Union Pacific, has been appointed Superintendent of the Colorado division of the Denver & Rio Grande.

Grand Trunk Pacific.—O. O. Winter, Superintendent of Terminals of the Canadian Pacific at Fort William, Ont., has been appointed General Superintendent of the Grand Trunk Pacific, with office at Winnipeg, Man.

Gulf, Colorado & Santa Fe.—K. S. Hull, Superintendent of the Texas & Gulf, has been appointed Superintendent of the Gulf, Colorado & Santa Fe at Temple, Tex., succeeding T. B. Coppage, resigned to go to the St. Louis & San Francisco.

Illinois Central.—J. F. Porterfield, Superintendent of the Yazoo & Mississippi Valley at Vicksburg, Miss., has been appointed Superintendent of the Louisiana division of the Illinois Central, with office at McComb City, Miss.

Mexican Central.—W. T. East has been appointed Acting Superintendent of Terminals at Tampico, Mex., succeeding to the duties of R. N. Elliott, who has been given leave of absence. L. W. Miller has been appointed General Track Inspector, with office at Mexico City, reporting to the General Superintendent.

Mobile, Jackson & Kansas City.—J. D. Patterson has been appointed Superintendent of the Mobile and Louisville divisions, with office at Laurel, Miss., succeeding J. G. Glazier, resigned to go to the Seaboard Air Line.

New York Central & Hudson River.—H. E. Brown, Trainmaster of the Hudson division, has been appointed Assistant Superintendent of that division, succeeding F. T. Slack, promoted. E. F. Wright, chief train despatcher of the Hudson division, has been appointed Trainmaster of that division.

Rio Grande Western.—E. Stenger has been appointed General Superintendent, with office at Salt Lake City, succeeding A. E. Welby, who remains General Superintendent of the Denver & Rio Grande.

St. Paul Union Depot.—J. W. Morrison has been appointed Superintendent, succeeding J. Strawhorn, resigned to go to another railroad company.

Seaboard Air Line.—J. G. Glazier, Superintendent of the Mobile division of the Mobile, Jackson & Kansas City, has been appointed Trainmaster of the Fourth division of the Seaboard Air Line, with office at Savannah, Ga.

Southern Pacific.—See this company under Traffic Officers.

Tehuantepec National.—C. Greene, Superintendent, has resigned and the office has been abolished.

Texas & Gulf.—M. T. Pratt, resident engineer of the Atchison, Topeka & Santa Fe at Temple, Tex., has been appointed Superintendent of the Texas & Gulf, succeeding K. S. Hull, transferred to the Gulf, Colorado & Santa Fe.

Union Pacific.—W. C. McKeown, Assistant Superintendent at Denver, Colo., has been appointed Assistant Superintendent of the Wyoming division, with office at Cheyenne, Wyo., succeeding A. F. Vick Roy, resigned to go to the Denver & Rio Grande.

Yazoo & Mississippi Valley.—A. C. Ferguson has been appointed Superintendent at Vicksburg, Miss., succeeding J. F. Porterfield, who has been appointed Superintendent of the Louisiana division of the Illinois Central.

Traffic Officers.

Atlanta, Birmingham & Atlantic.—J. R. Rowland, Traffic Manager of the Brunswick Steamship Company, has been appointed to the new office of Traffic Manager of the A. B. & A., with offices at New York and Atlanta, Ga.

Erie.—A. C. Hilton, General Agent at San Francisco, has been appointed General Agent at Cincinnati, Ohio, succeeding H. E. Huntington, transferred.

Mexican Central.—H. J. Snyder, Assistant General Freight Agent, has been appointed General Agent at San Francisco.

New York Central & Hudson River.—The authority of J. F. Fairlamb, General Passenger Agent of the New York Central & Hudson River, has been extended over the West Shore, C. E.

Lambert, General Passenger Agent of the West Shore, having retired on a pension. The authority of L. F. Vosburg, General Eastern Passenger Agent of the N. Y. C. & H. R., has been extended over the West Shore, H. B. Jagoe, General Agent, having resigned to go into other business.

Pennsylvania Lines West.—J. B. Modisette, Assistant General Passenger Agent at Cleveland, Ohio, has been appointed Chief Assistant General Passenger Agent, with office at Pittsburg, Pa., succeeding F. Van Dusen, deceased. J. K. Dillon, District Passenger Agent at Pittsburg, succeeds Mr. Modisette.

Rutland.—Clare Hartigan has been appointed General Agent at Montreal, succeeding Frank Barbour, promoted.

Southern.—W. C. Harrison, New England Agent, has been appointed General Agent at New York, succeeding J. B. Munson, promoted.

Southern Pacific.—F. W. Hoover has been appointed Industrial Agent in charge of San Francisco Bay territory, and such other territory as may be assigned to him. He will co-operate with the traffic department, and will report to the General Manager.

Engineering and Rolling Stock Officers.

Cumberland Valley.—Tabor Hamilton has been appointed Master Mechanic, succeeding J. B. Diven, transferred to the Pennsylvania. See Pennsylvania.

Lehigh Valley.—A. C. Adams has been appointed Master Mechanic of the Pennsylvania division, succeeding John McMullen, resigned.

Northern Pacific.—L. S. Oakes has been appointed Division Engineer of the Idaho and Pasco divisions, with office at Spokane, Wash., succeeding T. H. Croswell, transferred. The authority of F. J. Taylor, Division Engineer at Livingston, Mont., has been extended to Trout Creek, Wash. L. M. Perkins has been appointed Division Engineer at St. Paul, in charge of the lines east of Staples. The title of resident engineer has been changed to Assistant Engineer.

Pennsylvania.—J. B. Diven, Master Mechanic of the Cumberland Valley, has been appointed Assistant Engineer of Motive Power of the New Jersey grand division of the Pennsylvania.

LOCOMOTIVE BUILDING.

The Tidewater is reported to be figuring on additional locomotives.

The Philadelphia & Reading is said to have ordered 10 Atlantic (4-4-2) type locomotives.

The Quitman Lumber Co., Quitman, Ga., is said to be in the market for one 18 to 30-ton locomotive.

The Tidewater, as reported in the *Railroad Gazette* of April 5, has ordered four locomotives from the Baldwin Locomotive Works for July delivery, and four 10-wheel (4-6-0) type passenger locomotives from the American Locomotive Co. for May and June delivery.

The Spokane & Inland has ordered eight 72-ton single phase electric locomotives from the Westinghouse Electric & Manufacturing Co. Each will be equipped with four 250 h.p. motors, the engines being of the same type as those built for the New York, New Haven & Hartford.

CAR BUILDING.

The Quitman Lumber Co., Quitman, Ga., is said to be in the market for logging cars.

The Northwestern Pacific is in the market for 10 passenger coaches and one baggage car.

The El Paso Electric has ordered four interurban cars and four open cars for delivery by June 1.

The Woeber Carriage Co., Denver, Colo., is asking prices on equipment for four electric cars.

The Texas Central, it is understood, has ordered 100 box cars from the American Car & Foundry Co.

The United States Steel Corporation's subsidiary railroads are understood to be in the market for 8,000 cars.

The Sierra Madre Land & Lumber Co., New York City, has ordered 150 box cars from the Pullman Company.

The National Tube Co., Pittsburg, Pa., it is reported, has ordered six steel flat cars from the Youngstown Car Manufacturing Co.

The Tonopah & Goldfield has ordered six cabooses from the Pullman Company, and is reported to be in the market for 150 box cars.

The Chicago & Illinois Western, as reported in the *Railroad Gazette* of February 8, has ordered 300 gondola cars of 100,000 lbs. capacity from Haskell & Barker.

The Mobile & Ohio has ordered 1,000 box cars of 60,000 lbs. capacity, and 750 gondola cars of 80,000 lbs. capacity from the American Car & Foundry Co. for October, November and December delivery.

The St. Louis, Rocky Mountain & Pacific has ordered 300 gondola cars of 80,000 lbs. capacity from the American Car & Foundry Company. These cars will weigh 32,000 lbs., and will measure 35 ft. 7 in. long, 9 ft. 4 in. wide and 3 ft. 11¾ in. high, inside measurements. The special equipment includes:

Brakes	Westinghouse
Brake-beams	Monarch
Couplers	Tower
Draft rigging	Miner
Dust guards	Harrison
Journal boxes	McCord

The Mississippi Central, as reported in the *Railroad Gazette* of February 22, has ordered 100 box cars of 60,000 lbs. capacity, for June, 1907, delivery, from the American Car & Foundry Co. These cars will weigh 33,500 lbs., and will measure 36 ft. ½ in. long, 8 ft. 6⅛ in. wide and 9 ft. ⅜ in. high, inside measurements, and 36 ft. 10 in. long, 9 ft. ¾ in. wide and 13 ft. 11⁹/₁₆ in. high, over all. Bodies and underframes will be of wood. The special equipment includes:

Bolsters	Scullin & Gallagher
Brake-beams	Simplex, inside hung
Brake-shoes	American Car & Foundry Co.
Brasses	Ajax plastic bronze
Couplers	R. E. Janney
Door fastenings	National Malleable
Draft rigging	Miner
Paint	American Car & Foundry Co.
Roofs	Chicago, old style
Springs	Phoenix
Trucks	Wolff truck frames
Wheels	American Car & Foundry Co.

RAILROAD STRUCTURES.

BUCYRUS, OHIO.—The Toledo & Ohio Central, it is said, has started work on a shop building 80 x 800 ft.

CALGARY, ALB.—The Alberta Government will put up steel bridges this year as follows: Medicine Hat, to cost $82,000; Old Man river north of Pincher, $20,000; Bow river, Calgary, $25,000; over the same river south of Gleichen, $35,000; Old Man river near Kipp, $15,000; Red Deer river at Red Deer, $25,000; Sheep Creek in High river district, $25,000; over the north fork of the same creek, $8,000; Red Deer river, Rosebud district, $30,000. Hon. W. H. Cushing, Calgary, may be addressed.

JACKSONVILLE, FLA.—The Seaboard Air Line shops at this place will include a machine and erecting shop 117 ft. x 380 ft. Other buildings include one 66 ft. x 260 ft., with a 60-ft. x 66-ft. extension; another 61 ft. x 181 ft. A car shop 90 ft. x 300 ft., axle and smith shop 28 ft. x 150 ft., boiler and engine room 63 ft. x 122 ft., and planing mill 50 ft. x 176 ft. There is also to be a large roundhouse.

LEWISTON, IDAHO.—The Northern Pacific and the Oregon Railroad & Navigation Company are building a union passenger station here to cost about $100,000, and are also extending the yards. It is thought that upon the completion of the yards the Northern Pacific will make Lewiston a division point for all traffic north as far as Garfield, Washington. This is taken to mean that grain will be sent via Lewiston to the coast, as was announced by Vice-President Levey some time ago.

MOOSE JAW, SASK.—The Canadian Pacific, it is reported, has bought about 30 acres of land as a site for new yards. Plans have also been made for putting up a large hotel by the railroad to cost $175,000.

OTTAWA, ONT.—The Trans-Continental Railway Commission is asking bids May 1, for six steel bridges as follows: Wabijon and Winnipeg river, Canadian Railway crossing, Whitemouth river, Brokenhead river (east and west branches). Address the Chief Engineer at Ottawa.

PIERRE, S. DAK.—The Chicago & North-Western is planning to put up a new station here to cost $125,000, and has plans made for shops, roundhouses and other improvements to cost an additional $175,000.

ST. CLAIR, PA.—The Philadelphia & Reading, it is said, is planning to at once put up new shops and establish a yard at this place.

SCRANTON, PA.—The Delaware, Lackawanna & Western has started work on its shops here to cost about $2,000,000. The buildings include: A foundry, 120 ft. x 400 ft.; blacksmith shop, 125 ft. x 300 ft.; storehouse and office, 65 ft. x 325 ft. Other buildings to be built later but included in the original plans are: Machine, boiler and tank shop, 346 ft. x 582 ft.; paint shop, 90 ft. x 162 ft.; repair shop, 80 ft. x 250 ft.; power house, 90 ft. x 160 ft.; laboratory, 40 ft. x 70 ft., and scrap platform, 40 ft. x 400 ft. In addi-

tion there will be a roundhouse and some smaller buildings. These shops are being built on a tract of about 25 acres.

Winnipeg, Man.—Plans are being made for a combined station and hotel to be built here for the Grand Trunk Pacific and the Canadian Northern. The estimated cost is $3,500,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Alabama Terminal.—Incorporated in Alabama, to build from Birmingham, Ala., to Gate City, 10 miles. L. C. Bradley is President, and A. W. Brazelton, Secretary, Birmingham.

American Railroad of Porto Rico.—An officer writes that this company has finished its new connecting line from the western end of the line on the north coast at Camuy west, thence south to Aguadilla, 27 miles, to the line south along the west coast and thence to Ponce.

Work is under way on a cut-off from Hormigueros, state of Mayaguez, south to Lajos, 12 miles; also on an extension of the main line from Ponce east to Coamo, 23 miles. (March 15, p. 379.)

Baltimore & Ohio.—The Maryland Court of Appeals recently rendered a decision that the legislation enacted in 1906 to prohibit this company from building its proposed line around Baltimore, was inoperative. According to reports, the company will at once begin the work. (March 15, p. 380.)

Brunswick & Middletown (Electric).—Contracts, it is reported, are to be let early in June for building this proposed line from Brunswick, Md., to Middletown, 15 miles. Preliminary surveys made and almost the entire right of way secured. John S. Mallette, Brunswick, Md., Chief Engineer.

Canadian Northern.—According to reports from Winnipeg, this company will shortly resume work on the line from Brandon, Man., west to Regina, Sask.; from Etoimami, Sask., northeast to the Pas, and on the Rossburn branch northwest from Neepawa.

Chicago & North-Western.—Work has been started on track elevation within the city limits of Chicago, which is to be finished this year at a cost of over $2,000,000. The most extensive project is the extension of elevated tracks from Balmoral avenue north to the Chicago-Evanston line, through Rose Hill, High Ridge, and Rogers Park, three miles. This will cost $1,250,000, not including a new station to be built at Rose Hill for about $30,000, and also a new station at High Ridge. When this work is completed the company will have three tracks elevated from the river to the northern boundary of the city, seven miles. Eighteen under crossings will be made in the three miles to be elevated. Nearly 400 men are now at work, and the number is to be increased to 1,000 shortly.

Work has also just been started elevating the tracks from the east line of Loomis street to the west line of Canal street, 1.14 miles. The estimated cost of this work is $875,000, including a retaining wall of solid masonry 800 ft. long and 16 ft. high.

Denver & Rio Grande.—Preliminary surveys are reported being made by this company for an extension from Farmington, N. Mex., south to Gallup, about 100 miles, which is on the Atchison, Topeka & Santa Fe.

Galveston Terminal.—This company, which is controlled by Rock Island-Frisco interests, has taken the first step toward the improvement of its property on Galveston island which is to serve for the extensive terminal facilities of these lines. Bids have been invited for the placing of about 600,000 cu. yds. of filling. These bids were to be opened this week and the contracts awarded soon. Commencing at Twenty-ninth street, the filling will extend to the south end of the bay bridge, 4½ miles. The company expects to build the largest cotton transferring platform in Texas, just outside the city limits. It will be 1,200 ft. long and 200 ft. wide.

Grand Trunk.—Contract is reported let to McRae, Chandler & McNeil for double-tracking this road between St. Lambert and Ste. Rosalie, 33 miles. The work to be completed this fall.

Illinois Traction.—According to reports from St. Louis, this company, otherwise known as the McKinley Syndicate, has organized the St. Louis Electric Terminal, and will make improvements in St. Louis to cost about $5,000,000. The plans call for a bridge over the Mississippi river, from St. Louis to Venice, Ill., to consist of three central spans of 521, 523 and 521 ft. respectively, with two shore spans each 300 ft. long, all to have a clearance of 75 ft. above low water. It is to have two tracks for street railroads with roadways and sidewalks on each side, and is to cost about $2,500,000. Three passenger stations and one express station are to be put up at a cost of $200,000, and other buildings to cost $1,600,000. The land for the stations will cost about $700,000.

Kansas City, Oklahoma & Gulf.—Incorporated in Texas with a capital of $125,000 and office at Athens. The company proposes to build a line from Athens, Tex., in Henderson County, north to the Red river, in Lamar County, about 110 miles. The incorporators are: A. C. Springs, of Kansas City, Mo.; J. E. Owens, of Wills Point; J. W. Davidson, of Grand Saline; John A. Underwood, E. E. Blocker and W. S. Evans, all of Honey Grove; J. T. LaRue and J. B. Wofford, of Athens, and I. Jalonick, of Dallas, Texas.

Lake Erie & Youngstown.—Incorporated in Ohio, to build a line from Conneaut, Ohio, south to Youngstown, 60 miles. G. M. Brown, W. F. Stanley, G. J. Chapman, F. J. Cheney, J. H. Ruhlman, W. H. Ruhlman and A. W. Jones, incorporators.

Long Island.—A special committee appointed by the New York City Board of Estimate and Apportionment has filed a report on the application of this company to move its tracks on the section of its road from Manhattan Beach Junction to Manhattan Beach, to the embankment on which are the four tracks of the Brighton Beach line. This part of the Bay Ridge improvement for the elimination of grade crossings is being carried out under the direction of the Brooklyn Grade Crossing Commission. If permission is granted there will be six tracks on the same embankment. The original plans provided for two parallel embankments three miles long and 500 ft. apart. The Grade Crossing Commission favors the use of one embankment for both roads.

The Bay Ridge waterfront station of the Sea Beach Railway, between Sixty-third and Sixty-fourth streets, Brooklyn, has been finished, and the company is now ready to start work there on a large freight terminal. This is to be the western terminus of the New York Connecting Railroad, where cars are put on boats to be sent to the Pennsylvania yard at Greenville, N. J. Contracts for piers and float bridges are reported let, and work is to be started at once. The yard will have a frontage on the upper bay of 565 ft., extending to Fifth avenue between Sixty-fourth and Sixty-fifth streets. About 40 parallel tracks are to be laid, west of First avenue, to have a capacity of 1,800 cars. There is to be a pier 600 ft. long with four tracks.

Manufacturers' Terminal.—This company, recently chartered with $200,000 capital at Harrisburg, Pa., to build a 20-mile belt line connecting the various railroad lines in Erie, has begun active work on surveys. The proposed route is from a junction with the railroads at Four-Mile creek, south to the old Mill road, and to Glenwood, skirting the foot of the hill, thence west to where it again connects with the railroads. This circuit will connect the Lake Shore, Nickel Plate and Pennsylvania roads on the east, and the Bessemer, Pennsylvania, Lake Shore and Nickel Plate on the west, and will prove of great advantage to manufacturers. The Directors are George R. Metcalf, Frank Connell, George T. Bliss, Benjamin J. Walker, Ed. G. Germer, Charles E. Shenk, Henry E. Fish and John R. McDonald. President, George R. Metcalf; Vice-President, Frank Connell; Secretary, John S. Rilling, and Treasurer, John R. McDonald.

Missouri, Arkansas & Southwestern.—An extension of time has been granted this company to complete its road, now building from Batesville, Ark., northeast to Black Rock, 52 miles. (March 15, p. 387.)

Missouri Pacific.—Reports are being revived in Memphis, Tenn., that this company is to begin work this summer on a 50 mile cut-off between Memphis and Marianna, Ark. Surveys between these points were made several years ago. If this line is built it will shorten the distance to New Orleans over this road by about 50 miles. The present route from Memphis includes a long detour west by way of Wynne, Ark., thence south to Marianna, about 100 miles. The rights of way have all been secured and cleared off.

New York Subways.—The Rapid Transit Board of New York City has received a plan from the Interborough Company for a change of track at the Ninety-sixth street subway station. The plans call for the removal of certain tracks and for building three additional tracks. The city will be asked to pay for the improvements, which will cost about $850,000.

Bids are wanted April 25, by the Board of Rapid Transit Railroad Commissioners, 320 Broadway, New York, for the construction of rapid transit railroads (subways) for the Lexington avenue line, and for the Seventh and Eighth avenue lines. See *Railroad Gazette*, Jan. 4, 1907, p. 22.

Oregon & Southeastern.—An officer writes that this company is building with its own men, an extension from Disston, Ore., southeast to Bonita, 6½ miles.

Parral & Durango.—This company, it is said, has completed grading on an extension of its road, from Mesa de Sandia, Durango, Mexico, for about 12 miles. R. M. Dudley, Chihuahua, Mex., is the contractor.

Pensacola, Alabama & Western.—See Pensacola & Northeastern.

Pensacola & Northeastern.—Surveys are reported being made by this company for its proposed line from Andalusia, Ala., south-

west to Pensacola, Fla., 100 miles, and it is said that construction work is soon to be started. The promoters include: J. L. Miller, C. M. Gordon, W. F. Scott and J. E. Habach, with office at Pensacola. The same interests, it is said, are promoting the Pensacola, Alabama & Western, projected from Pensacola to Meridian, Miss., and Memphis, Tenn.

Perkiomen Traction.—Under this name a company is being organized in Pennsylvania to build an electric line through the Perkiomen valley, 11½ miles. I. H. Bartman, of Schwenkville; H. T. Hunsicker, of Ironbridge; G. Dunn, S. E. Hughes and J. H. Dager, of Norristown, are interested.

Plum Valley Railway.—Incorporated in South Dakota, with $500,000, to build from Pepin, Wis., north to Plum City, 22 miles. P. M. Ingold and H. A. Platt, of Plum City, Wis.; S. A. Cockerill and E. Dufond, of Washington, D. C.; P. L. Dotson and A. Dugellay, of Pierre, S. Dak., are incorporators.

Rockingham & Caswell.—Under this name a company is being organized in North Carolina to build from Yanceyville, N. C., west through Rockingham County, via Reidsville and Wentworth to Stoneville, 45 miles. R. T. Williams, Reidsville, is interested.

St. Louis Electric Terminal.—See Illinois Traction.

Sandusky, Fremont & Southern.—A contract is reported let to George Kinney, of Fremont, Ohio, to build this proposed line from Fremont to Vickery, 10 miles. The line is projected from Sandusky, Ohio, to Fremont, 30 miles. The contract calls for the completion of the work by June 1, 1907. (March 15, p. 391.)

Saskatchewan Central.—This company, which proposes to build a main line from the Manitoba boundary west through the southern part of the Cannington district, via Willow Bunch to Alberta, has asked permission to build lines from the main line south of Regina, in a north and westerly direction through the Goose Lake country. J. H. Sheppard has introduced a bill for this purpose.

Seaboard Air Line.—Surveys are reported being made by this company between Norlina, N. C., and Hamlet, to shorten the line and reduce grades and curves. Contract reported let to the E. L. Propst Contracting Co., of Charlotte, N. C., for five miles of passing tracks between Norlina and Raleigh.

President Garrett is quoted as saying that contracts for improvements amounting to $12,000,000 have been let. About $250,000 is to be spent at Wilmington, N. C., in terminal facilities. About $1,000,000 will be spent in North Carolina.

Toledo, Wabash & St. Louis (Electric).—This company proposes to build a line from Toledo, Ohio, via Defiance, Fort Wayne, Ind.; Indianapolis and Terre Haute to St. Louis Mo., about 400 miles. An officer writes that they propose to start work abut July 1. C. D. Whitney, Toledo, Ohio, is President. (April 5, p. 500.)

Velasco, Brazos & Northern.—This company, it is reported, is planning to build an extension of its road from Anchor, Tex., north. Work is to be started this summer.

RAILROAD CORPORATION NEWS.

Baltimore & Ohio.—See Washington Terminal.

Boston & Maine.—See Maine Central.

Buffalo & Susquehanna.—The New York Stock Exchange has listed $2,408,000 additional first refunding mortgage 4 per cent. bonds of 1951 of this company, making $11,256,000 outstanding. The greater part of these additional bonds were issued for the following purposes: $1,164,000 for additional equipment and $1,240,000 for buying and developing coal lands.

Buffalo, Rochester & Pittsburg.—A special meeting of the stockholders has been called for April 25 to authorize $35,000,000 50-year consolidated mortgage bonds drawing not more than 4½ per cent. interest. The purposes of the new issue are said to be as follows: $3,000,000 for present corporate uses; $18,145,000 for refunding; and $13,855,000 to be issued after July 1, 1908, in amounts not exceeding the rate of $1,500,000 per year unless the stockholders specially authorize a larger issue in any one year. The $3,000,000 is to provide for construction under way or projected and equipment not provided for otherwise.

Central Vermont.—See New York, New Haven & Hartford.

Erie.—This company has sold to J. P. Morgan & Co., $5,500,000 one year notes. The notes were resold to other bankers, who offered them to the public at 93. As it is understood that J. P. Morgan & Co. sold them for 91, it is evident that they were sold by the railroad company for not more than 90, so that the company got less than $5,000,000 cash, and the cost of the note issue to it is about 11 per cent. The notes were used in part to refund $3,000,000 notes which fell due on April 8, and it is supposed that the remainder will be used to take care of $2,000,000 notes maturing within a few months.

Gainesville & Gulf.—See Tampa & Jacksonville.

Grand Trunk.—See New York, New Haven & Hartford.

Houston & Brazos Valley.—This company has been incorporated with $120,000 capital stock to take over and operate the Velasco, Brazos & Northern, which runs from Velasco, Tex., to Anchor, 20 miles, and to extend it northeast to a connection with the Houston & Texas Central, about 120 miles.

Houston & Texas Central.—See Houston & Brazos Valley.

Maine Central.—This company is to buy the Somerset Railway for a price said to be $600,000. The Somerset owns 42 miles of road from Oakland, Me., on the Maine Central, to Bingham, and has finished 35 miles of a 54-mile extension from Bingham to Birch Point. The extension makes a connection with the Canadian Pacific near Moosehead. The capital stock is $736,649 and the bonded debt is $1,261,500. The Boston & Maine controls the Maine Central through stock ownership.

New York Central Lines.—Gross earnings for the month of March, 1907, were as follows:

New York Central & Hudson River	$7,814,163	Inc.,	$289,801
Lake Shore & Michigan Southern	3,700,694	Inc.,	116,484
Lake Erie & Western	405,400	Dec.,	47,782
Chicago, Indiana & Southern	271,456	Inc.,	32,405
New York, Chicago & St. Louis	958,686	"	131,515
Michigan Central	2,350,704	"	147,295
Cleveland, Cincinnati, Chicago & St. Louis	2,014,521	"	105,667
Peoria & Eastern	231,870	Dec.,	17,445
Cincinnati Northern	76,586	"	3,177
Pittsburg & Lake Erie	1,077,048	"	92,244
Rutland	221,901	Inc.,	20,263
Total	$19,123,029	Inc.,	$682,782

New York Central & Hudson River.—The annual report for the year ended December 31, 1906, shows gross earnings of $92,089,969, an increase of $5,994,167; betterments and new equipment to the amount of $1,308,261 are included in operating expenses, making the net earnings $25,827,813, an increase of $1,232,962. Other income increased from $6,523,499 to $7,707,738, due mostly to the increased Lake Shore and Michigan Central dividends. The surplus after dividends was $3,134,762, an increase of $1,021,414: from this amount $2,800,000 was set aside as a special fund for new equipment and betterments.

New York, New Haven & Hartford.—This company is surveying a line from Southbridge, Mass., to Palmer, where a connection will be made with a line of the Central Vermont, which is controlled by the Grand Trunk. Traffic agreements have been made between the New York, New Haven & Hartford and the Central Vermont, which will, when the connecting line is built, give the New Haven an outlet to the west over the Grand Trunk.

Pennsylvania.—See Washington Terminal.

Somerset Railway.—See Maine Central.

Tampa & Jacksonville.—This is the new name of the Gainesville & Gulf, which runs from Sampson City, Fla., to Fairfield, 48 miles, and is building extensions from Sampson City northeast to Jacksonville, 50 miles, and from Fairfield south to Tampa, 150 miles.

Toledo Railway & Terminal.—The United States Circuit Court at Toledo, Ohio, has ordered the foreclosure of the mortgage for $3,773,598 held by the Commonwealth Trust Co. of St. Louis. The minimum selling price is to be $2,000,000. The company was put into the hands of a receiver early in January, 1906, as a result of the C., H. & D. and Pere Marquette receiverships. The two last named companies guaranteed the bonds issued under the above mortgage.

Velasco, Brazos & Northern.—See Houston & Brazos Valley.

Wabash.—This company has sold to Tailer & Co., New York, $6,160,000 two-year 5 per cent. notes to refund $6,160,000 three-year collateral 5 per cent. notes maturing on May 10. It is believed that the notes were sold at a price which made the cost of the money to the company 8½ per cent. The old notes were secured on the $10,000,000 stock of the Wabash-Pittsburg Terminal and on $6,600,000 of the $29,500,000 50-year first mortgage 4 per cent. bonds of that company. The new notes are secured on the same collateral and also on $4,800,000 Wabash refunding mortgage 4 per cent. bonds of 1956.

Washington Terminal.—The syndicate formed in February, 1905, to underwrite the $10,000,000 3½ per cent. first mortgage bonds of 1945 has been dissolved. The bonds, which are guaranteed by the Baltimore & Ohio and the Pennsylvania, were taken by the syndicate at 96⅜, and offered to the public at 97½. The present market value is about 90. The syndicate sold only 47 per cent. of the securities, and the remainder will now be distributed among the participants.

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EDITORIAL ANNOUNCEMENTS.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

CONTENTS

EDITORIAL:
- Bettering Environment of Railroad Labor 533
- Fifty Cent Per Diem Rate Adopted 533
- Savings Bank Side of Railroad Baiting 533
- Economics of Railway Location 534
- British Practice in Accident Investigation 534
- Train Accidents in March 535
- A Texas Story 536
- Delaware & Hudson 536
- New Publications 538

ILLUSTRATED:
- All-Steel Pullman Sleeping Car 541
- Government Report on the Block System 544
- Track Deformations and Their Prevention 550
- Smith & Perkins and Their Locomotives 552

CONTRIBUTIONS:
- Capitalization Reckoned on a Ton-Mile Basis 538
- Shop Output 539
- American Railroads Not Overcapitalized 539
- Superelevation 540

MISCELLANEOUS:
- March Railroad Law 540
- Economics of Railway Location 542
- The Nevada Railroad Law 543
- British Practice in Railroad Accident Inquiries and in Railroad Inspection 548
- Increasing the Earning Capacity of Freight Cars 549
- The Case of the Walschaert Valve Gear 556

Foreign Railroad Notes:
- German Baggage Charges 541
- French Earnings in 1906 542
- European Rail Syndicate 542
- Proposed Electrification in Prussia 556

GENERAL NEWS SECTION:
- Notes 557
- Trade Catalogues 561
- Obituary 562
- Meetings and Announcements 562
- Elections and Appointments 562
- Locomotive Building 562
- Car Building 563
- Railroad Structures 564
- Railroad Construction 564
- Railroad Corporation News 566

VOL. XLII., No. 16. FRIDAY, APRIL 19, 1907.

For a number of years, good progress has been made in this country in providing relief departments for railroad employees; reading rooms, lodging houses, technical instruction for shop apprentices, etc. However, in a letter recently received, a well-known chief engineer of a large western system expresses the opinion that one group of railroad employees do not receive the recognition and attention that they deserve. These are the men who live in the thinly settled, and the so-called desert regions, of the western country—chiefly section and bridge men and station agents—who perforce have pretty lonesome, monotonous existences. This officer had long desired to ameliorate, so far as possible, the living and surroundings of this class of employees on his own road, and his first efforts were directed to providing the most comfortable possible places for them to live in. The good results of this made themselves apparent, and the next idea was to provide a means of entertainment as well as of personal improvement by giving them suitable books and papers to read. This involved the formulation of a circulating library scheme and he personally worked out the details of a plan; but before it could be put into effect he went to another road and the plan was not carried out. His interest in the matter has not lessened, however, his letter evincing his desire still to see the condition of this class of labor in the localities described made as pleasant as possible under the circumstances. Ideas and efforts of this sort deserve every encouragement, for aside from the humane phase of the matter, which is the primary one, the results confer material benefit to employer and employee alike; for the appreciation of the latter manifests itself in greater loyalty to the road and increased interest in his work, with consequent improvement in quantity as well as quality of service performed.

The number of freight cars owned and controlled by the companies in the American Railway Association has now passed the two-million mark, and from the first day of next July the handling of these cars in interchange traffic is to be improved and simplified by the adoption of a rate of 50 cents a day for the use of each car when off from its own road, and by the abolition of the rule providing for an increased rate after a car has been away from home 30 days. Fifty cents is to be the uniform rate without regard to dates. As the reader will remember, this rate has already been put in force by a number of important roads, but now, by formal letter ballot, the other roads in the Per Diem agreement have agreed to adopt it. The exact number of cars reported is 2,003,235 (United States, Canada and Mexico), and the number of members in the association is 319. All of these voted except 21 companies, representing 35,131 cars. In accordance with a resolution passed at the October meeting each member, in voting, expressed a first and a second choice, and in counting the first choices it was found that 95 members, controlling 910,978 cars, were in favor of a rate of 75 cents, but no proposition was to be carried, except by a majority vote of members and a two-thirds vote of cars, and under this rule none of the propositions was adopted; but under the provision for first and second choices the secretary had the power to recount in such a way as virtually to take a second vote; and, pursuing this course, and counting both first and second choices, he was able to show for the 50-cent rate 231 roads, controlling 1,625,041 cars, and so this rate will prevail. This matter being settled, the principal business to be attended to at the spring meeting of the Association at Chicago next week will be the report of the Committee on Car Efficiency, which, we understand, will show that considerable progress has been made in clearing the way toward agreement on some action looking to the cure of the more flagrant freight car abuses. With a view to clearing the air before the association gathers in formal meeting on Wednesday all roads have been invited by the committee to attend an informal meeting at the Auditorium Hotel on Monday for the purpose of discussing the problems which are before the committee.

In the "free silver" presidential campaign of 1896, of McKinley against Bryan, when the leading issue was the fiscal one of the capitalist against the debtor, probably no argument was more effective in the result than the appeal to the great class of voters having deposits in savings banks. It was urged with forcefulness on the stump and in print that the savings bank depositor was himself a capitalist, a member of the creditor group, and that impairment of the purchasing power of his principal and dividends by depreciation of the currency directly smote his interests. In the look ahead, in the present exigency, at the forces to be aroused that must safeguard honestly vested capital against radical attack, has this savings bank element in the body politic been considered or, indeed more than dimly hinted at. Stated in rough figures, with returns somewhat incomplete, the savings banks of the United States now contain $3,300,000,000 of deposits, or almost three per cent. of the

estimated total wealth of the country. Of their deposits about $350,000,000, or more than 10 per cent., are invested in railroad stocks and bonds and, particularly in the Eastern states, that branch of savings bank investment has, of late years, increased rapidly as compared with other branches. The number of savings banks depositors in the country number somewhat more than 8,000,000 with an average of about $425 to each depositor. It is true that each deposit is returned as a depositor, and that some depositors have several deposits; but allowance for the fact would still leave the number of depositors at stalwart figures and well up in the millions. It is also true that many of the depositors are women; but the women have husbands, fathers, brothers and sons, most of whom have votes. In this vast group, for all practical purposes representing railroad investment however indirect—a group powerful, responsive and with a pocket nerve—investors, chilled by attacks on railroad corporations, may find comforting assurance that railroad baiting has its limits.

ECONOMICS OF RAILWAY LOCATION

The committee of the American Railway Engineering and Maintenance of Way Association on "Economics of Railway Location" has without doubt the most important work to perform of any committee in the history of the association. It was formed "for the consideration of all questions connected with railroad location, grades, lines and improvements of grades and lines affecting the economic operation with relation to traffic, tonnage ratings, speed, density of traffic and financial considerations, with the special aim in view of establishing uniform methods and unit values for investigating and analyzing the relative changes and costs of comparative routes or proposed grade reductions and line corrections."

Wellington's classic of similar title is now more than 20 years old, and although it is still a standard reference for railroad engineers on certain broad fundamentals, conditions and practice have so changed, the art of railroading has grown and advanced so tremendously, since its production, that this splendid work is in most respects far out of date. And although there have been later attempts to cover this same field, it may safely be asserted that the great work on railroad economics is still to come. It would seem that no better way could possibly be found for the production of such a work than that which has been adopted by the American Railway Engineering and Maintenance of Way Association; for in the first place it will be evolved step by step with the intelligent and painstaking care which characterizes the proceedings of this association; and it will be the composite work, primarily of a corps of the country's most capable engineers, who have had wide and valuable practical experience in the questions to be considered, and secondarily, of a body made up of practically the entire railroad engineering talent of the North American continent. Such conditions can hardly fail to produce a work which will meet present needs as nearly as it is practicable to do so.

The field embraced by the scope of the work is so vast that it will probably require several years for the committee to complete its labors. The report submitted at the recent convention, as stated therein, was preliminary in character, and indicated the first steps in the study of the broad problem embodied in the subject. It is understood that the work which the committee has laid out for itself at present embraces the subjects of train resistance—which was considered in the first report—the maximum capacity locomotive to be adopted under given conditions, and the economical limit of grade reduction. The last-named of these is among the most difficult and important of the problems confronting American railroad engineers at the present time and therefore one on which light is most earnestly desired. It will be remembered that the paper of Mr. J. B. Berry, then Chief Engineer of the Union Pacific, presented to this Association in 1904, placed this economical limit at 0.4 per cent. Many roads have adopted a 0.3 per cent. minimum. Of course, these extreme reductions involve in practically all cases a large increment in additional cost for each additional 0.1 per cent. reduction. Whether or not the operating results have in any instance justified the added outlay beyond a certain limit will be a part of the committee's work to determine, assuming that the proper co-operation will be accorded by the roads in all instances.

A further troublesome feature of the grade reduction problem is the failure in many instances to realize the expected results in the matter of maximum train load which the preliminary theoretical estimates, or the dynamometer car experiments, promised. Numerous instances of this sort can be cited. One which we have in mind at the moment is that of a line projected through a rugged country requiring the exercise of the greatest care in location. As a result of the most careful study by skilled engineers, based on dynamometer car experiments and other essential factors, a certain ruling gradient was determined, to permit trains of a given maximum tonnage to be hauled in the direction of greatest traffic movement. When the line came to be operated, it was found necessary to reduce the maximum loading appreciably in order to get the trains over the road satisfactorily. As the project was comparatively a recent one we have not learned whether the causes for this failure to realize expected results have been ascertained. Another instance of similar character was cited by Mr. Byers, of the Missouri Pacific, in the discussion of the committee report, the reduction in this instance being necessary to avoid excessive overtime. The Missouri Pacific engineers' study of the situation impressed them with the fact that distances between side tracks are an important consideration on single-track lines in the matter of getting the best results from grade reduction.

The complete success of the undertaking will depend in large measure on the co-operation of the different roads, both in the matter or furnishing the experimental data desired by the committee, and in giving freely and as fully and accurately as practicable the results yielded by any work which has been done along the line covered by the committee's researches. In this latter case, where an expected condition has not been realized, where the results have not justified the expenditure, a railroad company may prefer not to make known its figures for reasons of financial policy. It must be borne in mind, however, that only in this way can the association fully accomplish its valuable purpose, the successful attainment of which is of vital importance to all existing roads, as well as those of the future. Furthermore, supplying such information to the committee does not mean that the name of the road need be made generally known; for where this would be objectionable the essential data can be presented in the report and the name of the line withheld without detracting materially from the value of the figures. But even though it should mean the risk of some present criticism and possible temporary unfavorable financial effect, any data which will contribute to the advancement of this great common cause should be given without hesitation.

BRITISH PRACTICE IN ACCIDENT INVESTIGATION.

We print in another column a clear and comprehensive statement of British practice in railroad accident inquiries, by Lieut.-Col. Yorke, Chief Inspecting Officer of the Board of Trade, Railway Department. This memorandum shows that the Regulation of Railways Act, passed in 1842, obliges every British company to give notice to the Board of Trade of its intention to open for passenger traffic any railroad or section of railroad, whereupon the Board of Trade is required to inspect the line, and if the officer performing the inspection is of the opinion that the opening of the road would be attended with danger to the public using it, the opening can be postponed a month at a time until the requirements of the inspector are satisfied. After a railroad has been opened the department has no further power to inspect, except in the case of some alteration or addition being made. Moreover, after the original inspection has been made, although it is the duty of the company to maintain the line in accordance with the original standard of efficiency, the Board of Trade has no power to enforce this, but the Act of 1871 requires railroad companies to report with great fulness any accident which may occur on or about the railroad or its works, provided that this accident is attended with loss of life or personal injury; that it was a collision in which one of the trains was a passenger train; that any passenger train or part of it left the rails, or that the accident was likely to have caused loss of life or personal injury and was of a type specified on that behalf by any order made by the Board of Trade. The Board of Trade, upon receiving such notice, proceeds to investigate the accident in the fullest manner, the details of which are shown in Colonel Yorke's memorandum.

Attention has been called to the Board of Trade method of inspection and inquiry, because the task is not undertaken by the Railway and Canal Commission (corresponding in a broad sort of way to our Interstate Commerce Commission), but is performed by a branch of the Board of Trade, an entirely distinct organization which is itself a branch of the government. Moreover, the inspectors are chiefly derived from the engineering department of the army. Colonel Yorke is of the opinion that this was originally

accidental but that, as it seems to have worked well, it has been continued. The earliest inspections of railroads and investigations of accidents in Great Britain were held in the year 1840, at which time there was no body of railroad men available from which the advisors of the government could be drawn, while the organization of the civil engineering profession was also at that period deficient. At that time, the military engineers were the only engineers who had to pass any examination to prove their aptitude for their profession.

In the light of the experience of the past two generations, it seems clear that this original accident of circumstance, which caused the inspection body to be drawn from the army, was a fortunate one. The British press, always keen and observant in its criticism of public matters, finds no cause for complaint in the judgments given by this inspecting board. The explanation of an accident, as derived from the hearings of the inspectors, may very likely fail to convince the trained railroad man, but the main thing is that the inspection is made surely, quietly and intelligently by a fixed body of men detailed for that purpose, who have behind them so great a force of public opinion that their recommendation carries almost the force of statute. A Board of Trade inquiry into an accident is, theoretically, supplementary to and independent of any proceeding by the coroner or magistrate. The Act of 1871 confers upon the coroner—when holding an inquest on the death of a person occasioned by a railroad accident—the right to request the Board of Trade to appoint an inspector or some person possessing special knowledge to assist, and this is sometimes done. On the other hand, the Board of Trade is empowered to hold what is called a formal investigation, if it so desires, in addition to the less formal inquiry which we have mentioned. This formal investigation adds to the Board of Trade inspecting body a trained lawyer, or the co-operation of a judge, and combines the ordinary court powers with the special inspecting powers of the Board of Trade, but these formal inquiries are seldom made. The informal inquiry is generally quite sufficient, and although it does not carry the force of law, it carries a prestige which serves all useful purposes.

An important point to be observed is the distinction that the inquiry by the Board of Trade is made for the purpose of ascertaining the cause of the accident with the view of preventing a recurrence of it, and not for the purpose of penalizing anybody. "Vengeance is mine, saith the Lord." The importance of this distinction is considerable, for it enables the inspector and the railroad officer to work together in entire sympathy and co-operation, instead of pitting one against the other in a contest of wits; one seeking to find evidence, the other to hide it.

We have taken occasion to point out more than once in these columns the extremely loose and unsatisfactory mode of procedure following an accident in this country. The coroner, the state railroad commission, the district attorney, the newspapers and the officers of the road all conduct their examinations at the same time. Each investigator views the others with suspicion, and the chances are that only one of the five parties at interest, that is to say the railroad party, is concerned more in an intelligent effort to understand and to prevent repetition than in an effort to lay hands on the particular person at fault and make an example of him. In other words, while British examinations of the causes of an accident are preventive, American examinations are almost entirely punitive. It follows as a matter of course that the true cause of the American accident is often never known by a responsible inspecting body; a state of affairs which is genuinely unfortunate for all concerned. The superintendent or general manager is probably anxious to make his operating practice better, but an improvement immediately following upon an accident only gives the press, eager for scandal, the opportunity to say that the improvement should have been made long ago; moreover, it may well be that the superintendent or the general manager is blocked in his efforts at reform by the fact that the powers above him do not see the matter as clearly as he does, and are unwilling to make the necessary appropriation. Both of these difficulties are obviated in Great Britain by the straightforward report of the Board of Trade inspectors, who avoid all sensationalism in their efforts to get at the real cause of the trouble, and then place that cause before the governing body of the railroad, where, as we have said, the report carries almost the force of statute.

The highly discreditable conflict between authorities that attends the investigation of American accidents, the diverse reports made by the different parties at interest, likely to be strongly marked with sensationalism and given broadcast to the newspapers, half studied and half understood, with the underlying idea that of revenge instead of reform, stand in sharp contrast to the methods in use for the last 36 years in Great Britain. The need for some such inspecting body in this country is surely a great one, and we think the desirability of having that body entirely independent from the Interstate Commerce Commission, non-political, and above suspicion as to its disinterestedness, will appear plain to all.

Train Accidents in March.[1]

Our record of train accidents occurring on the railroads of the United States in March includes 19 collisions, 25 derailments and three other accidents, 47 accidents in all. This record is not published in full, as was formerly done, except in the cases of the few accidents which are especially prominent—in the present instance five collisions, four derailments and one explosion. The record of "ordinary" accidents—which term includes, for our present purpose, only those which result in fatal injury to a passenger or an employee or which are of special interest to operating officers—will henceforth be given as below, in the shape of one-line items, for each accident, showing date, location, class and number of deaths and injuries.

This record is based on accounts published in local daily newspapers, except in the cases of accidents of such magnitude that it seems proper to send a letter of inquiry to the railroad manager. The official accident record published quarterly by the Interstate Commerce Commission is regularly reprinted in the *Railroad Gazette*.

The 10 prominent accidents in March are distinguished in the list by printing the name of the road in italics. Following are condensed accounts of the circumstances of these 10 accidents.

The collision near Powder Springs, Ala., on the 1st was due to a runaway. Passenger train No. 38 collided with a string of freight cars and the whole passenger train and five freight cars took fire and were burnt up. The freight cars, 22 of them, all loaded, were being backed in on a siding to clear a passenger train. A cut-off cock blowing off from the air pipe, it was necessary to use hand brakes. While backing in the train broke in two and the second car derailed the engine, a drawhead having been pulled out. This left the caboose and 20 cars in the hands of conductor alone on a 1 per cent. descending grade. He started from the rear to set up the brakes, and succeeded in setting 16, but was unable to control the cars until they had run some distance on the main line. When the cars stopped they had got beyond the flagman and the conductor was only able to get back six car lengths from the rear before No. 38 came in sight around a 3 deg. curve obstructed by a cut. The engineman was killed.

The collision at Colton, Cal., on the 1st, was due to a combination of a misplaced switch, an uncolored switch target and, apparently, a heedless engineman. Passenger train No. 55 of the Atchison, Topeka & Santa Fe collided with a freight train of the San Pedro, Los Angeles & Salt Lake, both trains being on the same railroad. It appears that the freight had entered the side track and that the man or men in charge had neglected to straighten the switch. When the passenger train approached hand motions were made to stop it, the error having been discovered, but the engineman says that although he saw the motions, he thought they were made in connection with switching movements, and were intended for the engineman of the freight. He says that he did not see the switch target in season, because it had no distinctive color, having been long exposed to the weather. A coroner's jury held that he was running at excessive speed. The fireman of the passenger train was not keeping a lookout, but as soon as he heard a shout of alarm he stopped the flow of oil from the tender to the firebox, and, thus, probably prevented the burning of the cars. Both of the engines were wrecked as were the first two cars of the passenger train. One passenger was killed, the

[1]Abbreviations used in Accident List:

rc.....Real collision.
bc.....Butting collision.
xc.....Other collisions: as at crossings or in yards. Where only one train is mentioned, it is usually a case of a train running into a standing car or cars, or a collision due to a train breaking in two on a descending grade.
b.....Broken.
d.....Defective.
dr.....Defect of roadway.
eq.....Defect in car or engine.
n.....Negligence.
unf.....Unforeseen obstruction.
unx.....Unexplained.
derail....Open derailing switch (negligence of engineman or signalman).
ms.....Misplaced switch.
acc. obst..Accidental obstruction.
malice....Malicious obstruction of track or misplacement of switch.
boiler.....Explosion of boiler of locomotive on road.
fire.....Cars burned while running.
Pass.....Passenger train.
Ft.....Freight train (includes empty, engines, work trains, etc.).
*Wreck wholly or partly destroyed by fire.
†One or more passengers killed.

fireman was fatally injured, and 30 passengers and trainmen were less severely hurt.

The butting collision near Naugatuck, Conn., on the 1st, was between a northbound regular passenger train and a southbound special train carrying a military company accompanied by the Governor of the state. It occurred about 1 a.m. One engineman and both firemen were killed and two passengers and two employees were injured. The special train had run about 40 rods beyond the point at which it should have taken the siding for the regular train.

The butting collision of freight trains on the 3d at Maugansville, Md., wrecking both engines and several cars, was due to the failure of the operator at Mason and Dixon to deliver an order to one of the trains. This operator, 18 years old, was held under $500 bail on a charge of manslaughter.

In the butting collision at Los Angeles, on the 23d, four passengers were killed and 20 or more injured. Both trains were running at good speed and both of the engines were wrecked. The reports say that the collision was due to disregard of a train order by the engineman of the overland express, who ran 600 ft. past a station where he should have stopped. It appears that this engineman had taken someone's word as to what was required by his order and had not carefully read it himself. Both the conductor and the engineman of this train were arrested and held in $5,000 bail each.

The derailment at Warsaw, Ohio, on the 2d, was due to the engineman being asleep while standing in his place in the cab. The train consisted only of the engine and a caboose. It ran off a derailing switch and both the engine and the caboose were overturned. The fireman, who was also asleep, was instantly killed. It is said that these men had been on duty only 7½ hours, and the entire crew had been off duty 14 hours before starting on this trip. The men in the caboose were only slightly injured.

The malicious derailments of the 22d and 27th are notable as having occurred within a few miles of each other and apparently at the hands of the same persons. The cases were reported in the *Railroad Gazette* of April 5 and April 12. In both cases rails were loosened, but care was taken to leave the bond wires at the joints unbroken so that the automatic block signals should continue to indicate a clear track.

The derailment at Colton, Cal., on the 28th, about 4 p.m., the second disaster in this town in the month of March, the third in southern California, and by far the worst in this record, was due to a misplaced switch. The westbound Sunset Limited, running about 11 hours behind time, approached the station at very high speed, and the engine was overturned and the first three cars badly wrecked. Of the killed 18 were Italian laborers. The switch had been left open by the men operating a switching train. Evidently there was flagrant disregard of rules by a number of different men. The men in charge of the switching train went on duty at 5 a.m., and at that time saw a despatcher's order saying that passenger train No. 9 would run eight hours late, making it due at 1:45 p.m. Receiving no further information about the train they assumed, about 3 p.m. (having been off for luncheon between 11 and 12) that train No. 9 had passed. At 3 o'clock the blackboard at the yard office had notes concerning other trains behind time, but nothing relative to No. 9. From this it would appear that the yard conductor or foreman had no regular hours for calling at the yard office or elsewhere for orders and that the despatcher, or the operator, or both, had failed to notify him that the train was later than had been specified in the first order. Whatever the cause, these men about 3:45 went in on a private track some distance from the main line, leaving the switch open and unguarded. The passenger train, consisting of a large engine and 14 cars, approached on a descending grade at a high rate of speed, said to be about 60 miles an hour, though the rule appears to be that passenger trains behind time must run under control within yard limits. This train had been within the yard limits for nearly a mile before reaching the point of collision. The target of the misplaced switch was in plain view and could have been seen by the engineman. Some one on the switching engine in the siding saw or heard the express some seconds before it reached the spot and sounded the whistle of the switching engine as an alarm, but no one succeeded in reaching the switch in season to set it straight. Both the engineman and the fireman of the passenger train were severely injured. The fireman had succeeded in shutting off the flow of fuel oil before reaching the switch, thus, no doubt, preventing the burning of the wreck. One of the brakemen of the switching crew had worked in this yard only three weeks; the engineman of the switching engine only three days, and the fireman only one day; and he had had only two weeks' experience as a fireman. The yardmaster testified before the coroner that it was not his duty to see that the foreman of switching had information about delayed trains, though if he happened to see the foreman he usually told him about such trains.

The accident at Cumberland, Md., on the 31st, in a car of an eastbound freight train, wrecking several cars, was an explosion of railroad torpedoes. In the same car were tanks of carbonic acid, and it is said that the cylindrical tanks rolled against a case of torpedoes while the train was in motion and thereby caused the explosion.

TRAIN ACCIDENTS IN THE UNITED STATES—MARCH, 1907.

Collisions.

Date.	Road.	Place.	Kind of Accident.	Kind of Train.	No. persons reported Killd.	Inj'd.
*1.	*Seaboard Air Line*	Pwdr Spgs., Ga.	xc.	P. & Ft.	1	2
1.	*Atch., Top. & S. Fe*	Colton, Cal.	bc.	P. & Ft.	2	36
2.	N. Y., N. H. & Hart.	Naugatuck.	bc.	P. & P.	3	4
3.	*Cumberland Valley*	Maugansville.	bc.	Ft. & Ft.	1	0
6.	Tol., St. L. & Westn.	Neoga, Ill.	bc.	P. & Ft.	0	14
7.	Chi., M. & St. P. and Chic., Burl. & Q.	Bettendorf, Ia.	bc.	P. & P.	1	4
7.	...	Geneva, Ill.	bc.	Ft. & Ft.	2	3
9.	Mo., Kan. & Texas	Lorena, Tex.	xc.	P. & Ft.	3	0
12.	Boston & Maine	Williamstown.	bc.	Ft. & Ft.	1	3
12.	Chesapeake & Ohio	Sewell, Va.	rc.	Ft. & Ft.	1	1
12.	New York Central	Hyde Park.	xc.	Ft. & Ft.	2	0
12.	Gulf, Sab. & R. R.	Fields, La.	xc.	Ft. & Ft.	2	0
*12.	Chicago, Burl. & Q.	Merino.	rc.	Ft. & Ft.	1	0
13.	Louisville & Nashville	Rockland.	bc.	Ft. & Ft.	1	2
16.	Grand Trunk	Bancroft, Me.	xc.	P. & Ft.	0	10
21.	Norfolk & Western	Crewe, Va.	xc.	P. & Ft.	1	4
*23.	*Atch., Top. & S. Fe*	Los Angeles.	bc.	P. & P.	4	20
25.	St. Louis, I. Mt. & S. and St. L. & S. F.	Jonesboro.	xc.	Ft. & Ft.	1	3
31.	Baltimore & Ohio	Fairmount	bc.	P. & Ft.	0	1

Derailments.

Date.	Road.	Place.	Kind of train.	Cause of derail't.	No. persons reported Killd.	Inj'd.
1.	Chic., Rk Isld & Pac.	Enid, Okla.	Pass.	ms.	1	3
2.	*Chic., Okmd & Col.*	Warsaw.	Ft.	derail.	1	0
2.	Alabama Gt. Southn.	Powers.	Ft.	ms.	1	2
3.	San Pedro, L.A. & S.L.	Los Angeles.	Pass.	ms.	2	5
5.	New York Central	Barrytown.	Pass.	b. rail.	0	9
6.	Pennsylvania	Warren, Pa.	Pass.	derail.	0	9
*8.	Great Northern	Ojata, Minn.	Pass.	unx.	3	4
11.	Pennsylvania	Metuchen, N. J.	Ft.	boiler.	3	1
12.	Chesapeake & Ohio	Hinton, W.Va.	Pass.	landslide.	2	0
13.	Pennsylvania	Harmansville	Ft.	flood.	3	0
14.	Cin., Ham. & Dayton.	Jamestown.	Pass.	d. track	2	0
15.	Erie	Meadville.	Ft.	unx.	2	3
15.	Chic., Rk. Isld. & Pac.	Cuneo.	Pass.	ms.	2	7
18.	Pitts. & Lake Erie	Fallston.	Ft.	landslide.	0	4
20.	Denver & Rio Grande.	Osier.	Pass.	unx.	0	7
22.	*Pennsylvania*	Stewart.	Pass.	malice.	0	14
22.	C., C., C. & St. Louis.	Avon.	Pass.	acc. obst.	1	11
26.	Wabash.	Pendleton.	Pass.	d. track.	0	16
27.	*Pennsylvania*	Wilmerding.	Pass.	malice.	0	0
27.	Northern Pacific	Carlton.	Pass.	unx.	2	2
27.	Louisville & Nashville.	Thomaston.	Pass.	unf.	3	0
27.	Pitts. & Lake Erie	W. Middlesex.	Pass.	washout.	0	1
28.	Lake Shore & M. S.	Lockwood.	Ft.	boiler.	1	2
28.	*Southern Pacific*	Colton.	Pass.	ms.	22	58
29.	Chic., Rk. Isld. & Pac.	Oklahoma C.	Pass.	unf.	3	8

Other Accidents.

1.	Chic., Rk. Isld. & Pac.	Shawnee, Okla.	Ft.	boiler.	2	2
25.	Atch., Top. & S. Fe	Onava, N. Mex.	Ft.	boiler.	3	0
31.	*Baltimore & Ohio*	Cumberland.	Ft.	explosion.	0	0

A press despatch from Galveston says that the railroads of Texas have made an offer that, if the passenger fare is not reduced to 2 cents, they will expend $15,000,000 in extensions and improvements in Texas within the next fourteen months. This is important if true. A Texas railroad officer tells us however that it is not true. We regret to find it false. Nothing could be more rational than to thus put in concrete form an argument which railroads are all the time using in the abstract, that is to say, in a form so very abstract and shadowy that nobody cares anything about it. The difficulties are great, however, and our Texas friends have, no doubt, found them insurmountable. Who shall make such an offer? Only in a very limited way can a half dozen railroads adopt a uniform policy as regards improvements. To whom shall the offer be made? No legislature is likely to bind its successors. Who could make the details of such an arrangement clear, so that the public could form an opinion of it intelligently? Without an intelligent public opinion anything like a bargain between the railroads and the state would be mischievous. The Galveston news mill is to be congratulated on its ability in the department of fiction, but the realization of this attractive scheme will probably come with the Channel tunnel and the Chicago & Englewood six-track passenger subway.

Delaware & Hudson.

A number of happenings have marked the past year as important in the history of the Delaware & Hudson. Most noteworthy probably is the election of Mr. Loree as President. This brings to the road as executive head a highly trained and successful operating railroad man. His influence, which in his short tenure of office thus far on the Kansas City Southern has been so strikingly shown in actual results is likely to be strongly felt.

Next in importance, particularly because it is a new policy, is the expansion of the road in Canada. In the past the Delaware & Hudson has owned no road north of the international boundary, entrance to Montreal being gained by 50 miles of trackage rights over the Grand Trunk from Rouses Point. In future the Delaware & Hudson is to have, with only 16 miles of leased trackage, not only its own entrance into Montreal, which will give it the shortest line between Albany and Montreal, but a line to Quebec, which will give it the shortest line between Montreal and Quebec and, with the

New York Central between New York and Albany, the shortest line between New York and Quebec. This is throwing down the gage in the Quebec-Montreal territory to the three dominating Canadian systems and the Canadian government's own road, the Intercolonial, all of which have lines between the two cities. The beginning of this development was the purchase late in 1905 of the Quebec Southern, a bankrupt road in the province of Quebec with 145 miles of line, part of it along the south shore of the St. Lawrence river below Montreal. This has been taken over by a new company, the Quebec, Montreal & Southern, of which the Delaware & Hudson owns all the capital stock. To connect with the new property, arrangements are to be made for running rights over five miles of track from Rouses Point to Noyan Junction, where the Quebec, Montreal &



Delaware & Hudson.

Showing new lines owned, building and projected in Canada.

Southern's line begins. From its present northeastern terminus at Pierreville the local road is to be extended northeast along the south bank of the St. Lawrence toward the city of Quebec. During the present year it is to be carried 48½ miles and as soon as the Quebec bridge is finished, 43½ miles further to the southern end of this bridge, over which arrangements will no doubt be made for direct entrance to Quebec. For the Montreal entrance, the Napierville Junction Railway has nearly finished a line from Rouses Point to St. Constant, 27 miles, and arrangements have been made for running rights over the Grand Trunk from St. Constant to St. Lambert, opposite Montreal, and across the river into Montreal with the use of Grand Trunk terminal facilities in that city. With these two additions the Delaware & Hudson will have a mileage of 263½ miles of lines owned and 16 miles of trackage rights, making 279½ miles in all, as against nine in Canada previously. The new Canadian lines as already built or projected are shown for the first time on the accompanying official map.

Particular reasons for these Canadian extensions are not far to seek. On the northern divisions of the D. & H.—the Saratoga and Champlain—passenger traffic is more important than its usual proportion on most railroads. In particular the through travel to the Adirondack mountains and Montreal, much of which comes north from New York over the New York Central to Troy, has been profitable. With its own lines, and the short lines from New York to Montreal and Quebec, the Delaware & Hudson will have great advantages over other routes on through passenger business. Another reason is that there are many paper mills on the present lines of the road, whose pulp wood supplies, south of the border, are beginning to fall short. These extensions into Canada will make it possible for the company to transport over its own rails the supplies of pulp wood necessary for operation of these mills.

Other important events of the year were the increase in the annual dividend rate from 7 per cent., which it has been since 1900, to 9 per cent. in 1907, and purchase of the Hudson Valley Railway, the road's most important long-distance electric competitor. From a physical and operating standpoint, probably the most important work was the beginning of construction on a new, larger and more efficient connection with the Pennsylvania at South Wilkesbarre, Pa., which is ultimately to cost some $1,500,000, and on which $237,000 was spent during the year. This involves a new line from South Wilkesbarre, on the Sunbury division of the Erie grand division of the Pennsylvania, to the main line of the Delaware & Hudson at Moosic, 13 miles north of Wilkesbarre. A new interchange yard also is to be established at South Wilkesbarre. This new 15-mile line is shown on the map.

This connection is particularly important to the prosperity of the Delaware & Hudson, especially in anticipation of the time when its own anthracite coal tonnage shall have been exhausted, for it marks the growing importance of a traffic agreement made about two years ago with the Pennsylvania, by which freight destined to New England and Canadian points is received from that road and carried northeast over the Delaware & Hudson line instead of going around by way of New York harbor. The most important item of freight received in this way is bituminous coal, and the effect of the traffic arrangement can probably be seen in the increase from the 904,362 tons of this carried in 1902, by steady gains each year, to 1,657,871 tons in 1906. The tonnage of coke also has increased from 45,897 tons in 1903 to 153,641 tons last year. It will be many years before the anthracite coal deposits of the D. & H. will be exhausted, but when they are, the function of the southern divisions will probably be that of a connecting line for through freight between western Pennsylvania and points west and south thereof, and New England and Canada. All such traffic which can be developed is likely to be specially profitable, for it traverses in the one case half, and in the other case the whole of the company's through line, and gives it an element of strength in through traffic which, as a largely local road, it has always lacked.

The suspension of work at the mines for six weeks during April and May alone prevented the company from showing the largest earnings in its history in all departments. The *net* income for these two months was less by $1,120,000 than for the corresponding months of 1905—a suggestion of the loss. Although the amount of coal produced was 5,400,000 tons, against just short of 5,700,000 tons in 1905, and gross earnings of the coal department were $18,570,000, against $20,200,000 in 1905, the decrease in railroad earnings from transportation of coal was more than made up by increased merchandise and passenger traffic, so that railroad gross earnings were over $17,000,000, larger by more than $600,000 than in the record year 1905. The decrease in coal freight earnings was $224,000, the gain in passenger earnings $214,000 and in merchandise freight earnings $672,000. Railroad operating expenses rose to a new high record, $10,670,000, an increase of nearly $500,000 over 1905. The operating ratio, however, increased only slightly.

Owing to the custom of giving brief returns of operations by divisions, it is possible to get a much clearer idea of the traffic than if the whole were lumped in total figures. This is particularly of interest in the passenger earnings. The Delaware & Hudson has had to meet the competition of electric railways on both the southern and northern sections of its line. Its most profitable passenger territory on its Pennsylvania division is that between Wilkesbarre and Scranton. The Lackawanna & Wyoming Valley, a Westinghouse third rail, high speed interurban line, was put in operation at the end of 1903 between these two cities, and has seriously affected the earnings of the steam road. A reduction of nearly one-half in passenger fares was made to meet this competition, and in 1905 there was an increase in passenger earnings on the Pennsylvania division, but last year on this one alone of the four divisions passenger earnings were less than in 1905.

In the rich passenger territory in New York State about Albany, Saratoga and Lake George the company has taken the bull by

the horns by large purchases of electric railways. In 1905 the Schenectady Railway, operating the lines in that city, was acquired jointly with the New York Central. In 1906 the entire capital stock of the United Traction Company, which operates the electric lines of Albany, Rensselaer, Troy, Watervliet, Cohoes and Waterford, N. Y., in all 82 miles, was acquired, and this company later bought the Hudson Valley Railway, the most important long-distance electric competitor of the Delaware & Hudson, with 130 miles of high-speed lines running from Albany, Troy and Saratoga north to Lake George. As no new company has any reasonable chance of securing an entrance to the territory about Albany and Troy except over the United Traction lines, the Delaware & Hudson, probably with the New York Central as a close ally, now has complete control of the electric development of that territory.

Including all freight traffic, there were only 215,346 more tons carried than in 1905, a small addition to the previous year's total of over 18,000,000 tons. The average rate received per ton, however, increased nearly 1.7 mills, which largely accounts for the increase in total freight earnings. There were small increases in the freight earnings per train mile and in the trainload, which latter rose from 455 tons to 460 tons. Over 24 tons were carried in each loaded car. This high trainload and carload for a road so much of whose interests are local is, of course, due to its heavy and steady coal traffic.

Maintenance of way expenditures per mile of road were less than they were two or three years ago, due no doubt to completion of certain particularly heavy improvements. Per mile operated, excluding trackage, they were $1,778 last year, against $1,869 in 1905, $2,206 in 1904 and $2,018 in 1903. There was, however, $885,000 charged to income for maintenance of way betterments. Under maintenance of equipment account, per unit of equipment, repairs of locomotives cost $1,917 in 1906, $1,886 in 1905, $1,744 in 1904 and $1,186 in 1903; repairs of passenger cars, $311 in 1906, $377 in 1905, $381 in 1904 and $321 in 1903, and repairs of freight cars, $55 in 1906, $58 in 1905, $43 in 1904 and $41 in 1903. In 1906, $1,592,683 was charged to income for equipment expenditures. The unit maintenance figures are not in themselves remarkably liberal, but liberal maintenance of the property is gained by annual large appropriations out of earnings for betterments, the total of which, last year, including the coal department, were $4,259,666, against $4,168,699 in 1905. This includes $238,338, the regular sinking fund of 5 cents a ton on coal produced. The good condition of the railroad lines may be judged from the fact that the installation of automatic block signals has been steadily under way since 1904, and since that time 253 miles of track, which includes 113 miles of double track, have been so equipped at a cost of $626,000. This, with work now in progress and to be finished this year, will cover the whole main line and the two most important branches. On completion of double-tracking now under way, the main line will be double-tracked from Wilkesbarre to Mechanicsville, 217 miles, and from Albany to Whitehall, 78 miles, in all 295 miles of double track.

In view of the present serious criticism of American railroads for their killing of passengers the record of the Delaware & Hudson in this respect during the last 12 years is given. In this time about 75,000,000 passengers have been carried, with three passenger fatalities, all of which occurred in the same accident, which was due to an engineer's running past a signal. The Susquehanna division, with 233 miles of line, has been in operation more than 30 years without any passengers at all being killed.

The results of the year's operation are summarized below:

	1906.	1905.
Mileage worked	843	843
Coal freight earnings	$6,665,732	$6,889,765
Merchandise freight earnings	6,949,898	6,277,855
Total freight earnings	13,682,232	13,233,954
Passenger earnings	3,299,337	3,014,840
Gross railroad earnings	17,050,029	16,382,074
Maint. way and structures	1,388,884	1,459,345
Maint. of equipment	2,016,386	1,884,725
Conducting transportation	6,504,653	6,094,763
Railroad operating expenses	10,670,628	10,183,960
Railroad net earnings	6,379,401	6,198,114
Gross earnings from all depts.	36,669,235	37,331,629
Net earnings from all depts.	8,331,278	7,695,923
Net income	5,156,138	4,679,594

NEW PUBLICATIONS.

Proceedings Fourteenth Annual Convention, Traveling Engineers' Association. W. O. Thompson, Secretary, Oswego, N. Y. 414 pages. Leather.

The last convention of this association was held at Chicago in August, 1906, and it appears that it is following in the footsteps of the Master Mechanics' Association in a way, as indicated by the general range of the subjects that were presented, though they deal more directly with the methods of operation than of construction. At this last meeting papers were presented upon the Drafting of Locomotives; the Latest Methods of Tonnage Rating; the Handling of the Air-Brake in Passenger Service; the Walschaert Valve Gear, and Oil Burning Locomotives. In view of the recent work at Purdue the paper on drafting is interesting principally from the records of road tests that it contains, rather than for the amount of data given or because it will serve as a guide for practice. The other subjects are handled from the standpoint of the engineer and relate to the details of the several topics. Reports were also presented on the Care of Locomotive Boilers at Terminals; the Air-Brake; the Future Engineman and Regularly Assigned vs. Pooled Engines. The last seems unlikely to ever see the end of the discussion upon it. The position taken by the committee making this report is that pooled engines are less likely to be well cared for than those that are assigned, and that it is well not to resort to the pool except where time and freight are crowding and it is necessary to keep the engines moving all of the time, or where the enginemen's contracts require that they shall be run out in turn. The other reports are full of practical suggestions of value to the maintenance and operating departments, and this is especially true of the one on the Care of Locomotive Boilers at Terminals.

Light Locomotives. Published by the American Locomotive Company, New York. 6 x 9 in.; 32 illustrations; 76 pages.

This booklet, which is uniform with the others which have been issued describing separate types of engines built by this company, illustrates and describes small locomotives driven by steam or by compressed air for special service to which ordinary road or yard engines are not suited. It presents types adapted to the use in contractors' work, mines, logging roads, plantations, industrial plants and any service where light rails, poor roadbeds and small clearance must be taken into account. The usual weights and dimensions of each type illustrated are given. Three compressed air locomotives are described. The advantages of this form of motive power lie in its safety in mines, where an explosion of gas must be guarded against, and in its small clearance. This security against fire also creates a demand for the engines for plantation service, where, at certain seasons of the year, the fields are so dry that there is constant danger of fire. The cost of installation of the air compressors is about the same as that of installing an electric traction system of the same size, but the cost of operation of compressed air motors is less. There is a saving in maintenance cost as compared with steam locomotives, in that there are no boiler tubes and staybolts to be renewed.

Three Acres and Liberty. By Bolton Hall, assisted by R. F. Powell, Superintendent of the Vacant Lot Cultivation in Philadelphia, with an introduction by George T. Powell, of the Agricultural Experts' Association. The Macmillan Co., New York, 1907. 435 pages; 5x7¾ in.

This quite unusual book is designed to show the city dweller how he can support himself in the country; what a little farm costs; where to go, what to raise, and how to do it. The study is made along purely practical lines, and is exceedingly interesting and instructive.

CONTRIBUTIONS

Capitalization Reckoned on a Ton-Mile Basis.

New York, April 16, 1907.

To the Editor of the Railroad Gazette:

The subject of capitalization of transportation companies is one of the live questions of the day. For the sake of comparison between properties located in the same section of the country, it is generally conceded that an impartial analysis is made upon a mileage basis. Is this, in fact, a just way of making comparisons?

It would seem that there is a great similarity between a transportation company and an industrial concern. Both are manufacturers. The former enhances the value of goods through transportation from the place of production to the place of consumption; the latter enhances the value of goods by converting them from a crude state into a finished state, ready for transportation.

When figuring his cost of production and probable profit, the manufacturer takes into account the quantity of goods produced. The larger the output the smaller the relative amount of fixed charges per ton.

It would seem that a railroad would be equally justified in applying the same method of calculation. In the latter case the more ton-miles per mile of road (that is the greater the volume of traffic) the lower its fixed charges will be per ton-mile (the commodity produced by a transportation company).

For the purpose of emphasizing the above argument, the following two properties are being compared for the reason that they are located in the same section of the country.

	Year ending June 30, 1905.	
	Mo., Kan. & Tex.	Kan. City Southern.
Average mileage operated	3,043	827
Ton-miles per mile of road	460,359	1,061,064
Fixed charges	$4,924,795	$1,131,900
Per ton-mile per mile of road	35 cts.	13 cts.

It makes some difference whether the interest charges of a corporation are at the rate of 4 per cent. per annum, or whether the

company's debt consists of 3 per cent. bonds, but the principal item of the calculation is the volume of business transacted in each case (in other words the freight density).

Both companies are now paying 4 per cent. dividends on their preferred stock, and by applying the same method of calculation, the M., K. & T. increases its charges per ton mile per mile of road by 4 cents, and the Kansas City Southern by 10 cents. This makes an aggregate charge of 39 cents for the M., K. & T. and of 23 cents for the Kansas City Southern; a difference of 41 per cent. in favor of the latter.

Suppose, for the sake of argument, both roads were paying 4 per cent. dividend on their common stock. In that case the M., K. & T. would add 18 cents and the Kansas City Southern 14 cents to fixed charges per ton-mile of road. The aggregate charges would then be 57 cents for the M., K. & T.; 37 cents for the Kansas City Southern. Once more a difference of 35 per cent. in favor of the latter.

These deductions lead me to believe that it is not fair to compare the capitalization, also fixed charges and other disbursements on a purely mileage basis. It seems to me that due consideration should be given to the volume of business transacted by a company.

D. G. BOISSEVAIN.

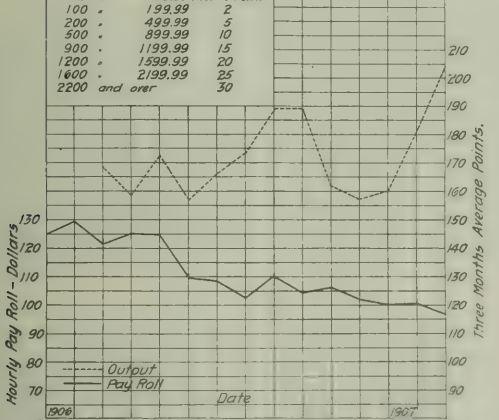
Shop Output.

Fort Madison, Iowa, April 8, 1907.

To the Editor of the Railroad Gazette:

The main essential to a well organized mechanical department is to have the correct data promptly furnished to the man in charge; and in such a form that he may see at a glance the condition of his various shops.

Payroll and output are the important factors. The attached



Graph Showing Pay Roll and Engine Output.

graph, which is self-explanatory, furnishes the necessary information concerning engine output. The hourly payroll, represented by the lower line in the graph, is obtained by dividing the total roll of the month by nine or ten hours, as the case may be, for each working day of that month. By this method the "overtime evil" results in a high hourly roll. Each engine turned out during the month is given a value in credit points according to total cost of repairs, and the total points for that month are averaged with those of the two preceding months to determine output line, or the upper line in the graph. One will readily see that there is no cause for complaint when the distance between the two lines is becoming greater. An increase in payroll should result in an increase in output. If one of these graphs, on the same scale, is furnished for each shop, the Mechanical Superintendent is enabled to make comparison between his different shops.

I attach two forms which make a good output report, and from which the graphs are made up.

G. D. SIEMANTEL.

American Railroads Not Overcapitalized.

New York, April 12, 1907.

To the Editor of the Railroad Gazette:

As supplementing my letter printed in your issue of April 5, a comparison of the capitalization of European railroads indicates that the railroads of the United States have issued very much less capital per mile than those of European countries, as clearly shown by the following figures which are copied from a report on the transportation routes and systems of the world, issued by the Department of Commerce and Labor, Bureau of Statistics, Washington, D. C.:

	Year.	Capital or cost per mile of railroad.
United States	1904.	$55,261
Canada	1904.	60,504
Uruguay	1899.	52,756
Venezuela	1904.	70,972
Germany	1903.	98,443
Austria	1903.	128,334
Hungary	1903.	74,056
Belgium (State roads only)	1903.	160,893
France	1902.	137,601
Switzerland	1903.	194,969
United Kingdom	1904.	272,737
Russia	1902.	78,553
Finland	1902.	32,189
Norway	1904.	38,371
Sweden (State railroads)	1904.	44,669
Sweden (private railroads)	1902.	22,006
Italy	1902.	108,212

The capitalization of the railroads of a number of countries in addition to those mentioned above are given in this report, which also states that the average capital or cost per mile of the principal railroads of the world as given is $77,730 a mile. The cost of the railroads in the United States as given, $55,261, could be increased about $10,000 a mile were the stock owned by railroads in other companies not excluded.

It would appear that the capitalization of the railroads of this country is over $20,000 a mile less than the average of the principal railroads of the world, and as this $20,000 amounts to over 35 per cent. of the total capitalization of the railroads of this country, it is important.

In considering the capitalization of railroads, it is always well to remember that in building a railroad the bonds are sold for what they will bring—possibly as low as 60, again on a strong property they may bring over 100 or above par, but in many cases in addition to selling bonds at a very large discount a bonus of stock has been added. Were not practices of this kind resorted to only the most profitable of the railroad propositions could be carried out, and the capital for many desirable improvements or new railroads could not be raised because it would not be possible to issue their securities at par.

The Interstate Commerce Commission in its report for 1905 shows that the total net income available for dividends on the railroads of this country was $373,263,523, and there were declared as dividends $188,175,151, leaving $185,088,372 available for improvements, adjustments or for the support of lines showing a deficit, and as the total amount of capital stock of the railroads of the United States is given as $6,680,473,280, their total earnings available for dividends amounts to 5.58 per cent. on the stock, and the amount of dividends actually declared amounts to $2.82 per cent.—surely not an excessive amount and the amount of money devoted to improvements out of earnings or set aside as surplus or for the support of weaker lines amounts to 2.77 per cent. on the stock. Practically all of this latter sum adds to the money invested in the railroads against which no capital is issued and tending, in a few years, to make the actual investment in money equal to the

..... *Engine Output.* ..... *Shop, March* ..... 1907.

Eng. No.	Date out of service.	Date in shop.	Date in service.	Days deten.	Cost of Labor.	Cost of Material.	Cost of Total.	Class reprs.	Points
65.	2/4	2/4	3/9	32	$529.96	$654.06	$1,184.02	H	15
180.	2/5	2/12	3/5	28	107.88	20.64	128.52	L	2
267.	1/29	2/9	3/21	50	637.14	632.90	1,270.04	G	20
287.	1/19	3/6	3/31	69	442.60	468.47	911.07	H	10
398.	3/14	3/14	3/21	7	130.09	508.82	638.91	H	10
507.	2/28	3/5	3/9	9	85.26	276.52	361.78	L	5
511.	2/25	2/25	3/8	11	130.07	19.96	150.03	L	2
517.	3/17	3/17	3/24	7	49.70	2.93	52.63	L	1

..... *Engine Output. Summary, March* ...., 1907.

Date.	Light—Under $100.—Average—No.	Light—Under $100.—Average—Days detention	Light—Under $100.—Average—Cost, repairs.	Light—Over $100.—Average—No.	Light—Over $100.—Average—Days detention	Light—Over $100.—Average—Cost, repairs.	Heavy—Average—No.	Heavy—Average—Days detention	Heavy—Average—Cost, repairs.	General—Average—No.	General—Average—Days detention	General—Average—Cost, repairs.	Totals—No.—Lghts.	Totals—No.—H & G.	Totals—No.—Tot'l.	Points—For month.	Points—Av'ge 3 mos	Payroll.—Hourly.	Payroll.—Total.
Oct., 1906	3	6.0	$71.33	12	12.0	$290.26	1	21.0	$1,150.56	2	39.5	$1,314.37	15	3	18	112	80	$901 58	$24,672.94
Nov., 1906	2	5.5	88.05	6	15.0	285.08	6	27.5	795.88	2	45.5	1,222.29	8	8	16	128	104	105.41	23,716.13
Dec., 1906	3	6.7	77.53	8	18.7	292.87	4	22.2	634.91	1	50.0	1,317.97	11	5	16	107	116	104.11	23,480.32
Jan., 1907	5	6.0	76.73	10	19.0	266.90	7	24.5	804.09	0	....	.....	15	7	22	123	119	103.35	24,180.76
Feb., 1907	6	4.4	57.17	13	9.8	177.08	3	28.3	1,032.81	0	....	.....	19	3	22	84	105	106.04	22,000.27
Mar., 1907	25	2.6	71.94	14	10.6	186.76	7	34.2	944.76	3	61.2	1,447 37	39	10	49	218	142	101.90	23,830.00

amount of the outstanding securities of any railroad, even though they were issued at a very large discount and a stock bonus was given. Besides this gain is the natural increase in the value of the properties, amounting to possibly 4 or 5 per cent. a year, and in many cases, where terminals in large cities have been acquired, they could not be duplicated for any consideration; their present value being many times greater than their original cost to the railroad company.

There is little doubt that from these two causes any water that there may have been in the capitalization of American railroads has been very much more than made up, and that their value to-day is greater than their present capitalization, and that they could not be replaced or duplicated without greatly exceeding the present capitalization.

That the capitalization of the American railroads has not affected their charges for transportation of freight is in a measure indicated by the following comparisons:

Average Railroad Freight and Passenger Rates of the United States Compared with those of European Countries.

Country.	Year.	Railroad freight rate per ton per mile.	Railroad p's'ger rate per passenger per mile
United States	1905.	0.766 cts.	1.962 cts.
Germany	1904.	1.352 "	0.992 "
France	1904.	1.428 "	1.133 "
Austria	1904.	1.503 "	.....
Russia, European	1903.	1.018 "	0.722 "
Russia, Asiatic	1903.	1.157 "	0.458 "
England (Unit. Kingdm)	1903.	2.160 "	.....

These figures were obtained from the Department of Commerce and Labor, Bureau of Statistics, and are from the British Statistical Abstract of Foreign Countries, published by the Board of Trade, London, the Interstate Commerce Commission and the London *Statist*. The Board of Trade figures as to the English railroads not giving the average rate per ton per mile, the figure used, 2.16 cents, was found by using the average haul of English railroads assumed by the London *Statist* to be 24.86 miles.

The figures show quite clearly that the railroad freight rates in foreign countries are about twice as great as those in effect on the railroads of the United States. The passenger rates in this country, however, are very much higher than the European rates. Assuming that the rates in Germany are about an average of the European rates and that they had been obtained by the railroads of the United States, our freight earnings for 1905 would have been increased $1,109,841,221, and our passenger earnings would have been decreased $233,747,545, making a gain in net earnings of $876,093,676, or enough to have paid 13.11 per cent. on the $6,680,473,280 stock of the railroads of the United States. This vast saving in money to the people of this country amounts to $10.53 for each of the 83,143,000 people of the United States. The railroad rates in European Russia appear to be lower than those of other European countries, and had they been obtained by the railroads of this country our freight earnings would have been increased $477,304,264, and our passenger earnings decreased $298,790,340, and our net earnings increased $178,513,924, or enough to have paid a dividend of 2.67 per cent. on the total stock of the railroads of this country.

Of course it is fully realized that the very high European freight rates could not have been obtained by the railroads of this country, and that if our rates had been held up to the European average, the business of the country would not have been developed. Does this not bring us back to the fact that the very low railroad freight rates in the United States have, to a great extent, caused or brought about the vast development of this country? Clearly, these conditions do not show the necessity for any feeling on the part of the American public towards its railroads other than the most kindly. The very low European passenger rates are largely due to the dense population and to the low rate of pay of the laboring classes.

C. S. SIMS.

Superelevation.

New York, April 13, 1907.

To the Editor of the Railroad Gazette:

The communication in your issue of April 12, entitled "Fallacies of Superelevation," seems to merit some attention because of the assumption, which one meets quite frequently of late, that the object of superelevation is to generate a *centripetal* force intended to balance the centrifugal force of trains moving on curved track. It may be worth while to call attention to the fact that this assumption is a fallacy.

The correct statement would be to say that the object of superelevation is to place the plane of the track normal to the resultant of the force of gravity and the centrifugal force, acting on the train. Assuming that this be accomplished, the element of centrifugal force, acting in the plane of the track, is wholly eliminated from the problem of lateral pressure against the outer rail, and we have to deal only with pressures and frictional resistances due to deflecting the wheels from the straight line in which they tend to move to a curved line.

The conception that the object of superelevation is to provide an inclined plane of such inclination that the tendency of the train to slide down it shall be sufficiently in excess of friction to balance the centrifugal force is wholly wrong.

It is true that superelevation performs practically the same service as would a centripetal force in counteracting the effect of the centrifugal force; but the analogy stops here. S. W.

March Railroad Law.

The following abstracts cover the principal decisions in the federal courts during March:

Automatic couplers.—The federal statute requiring automatic coupler equipment on cars moving interstate commerce is violated when such equipment although attached to cars as commanded is so defective and out of repair as to make it necessary for men to go between the ends of the cars to make the couplings. The same liability to the statutory penalty is incurred where the parts of the coupler, although in perfect condition, are not connected. United States vs. Great Northern Railway Co., 150 Fed. Rep. 229.

Maintenance of flagmen.—The duty of a railroad company to maintain a flagman at a crossing is not to be inferred alone from the fact that it runs its trains over the crossing at a high rate of speed. Latham & Long Island Railway Co., 150 Fed. Rep. 235.

Construction of Pennsylvania statute as to injury to employees.—Pennsylvania has a statute which provides that where any person shall sustain personal injury or loss of life while engaged or employed on or about the roads, works, depots and premises of a railroad company or on or about any car or train therein or thereupon, of which company such person is an employee, the right of action and recovery in all such cases against the company shall be only such as would exist if such person were an employee. It is now decided that this statute is without application to an action for the death of an employee of one railroad company while rightfully using the tracks of another company and the catastrophe is caused by the negligence of the emplyees of the latter company. Baker vs. Philadelphia & Reading Railroad Co., 149 Fed. Rep. 882.

Dismissal of condemnation proceedings.—Under Tennessee rule of procedure a railroad company, having appealed in condemnation proceedings, may not after judgment on the appeal dismiss the proceedings as to a portion of the land sought to be condemned on the sole ground that in its opinion the damages assessed were too high. Union Railway Co. vs. Standard Wheel Co., 149 Fed. Rep. 698.

Burden of proof of injury to passenger.—It is a rule of law that the burden of proof of negligence is always on the plaintiff and it cannot be shifted to the defendant without showing that the injury in question was caused by some person or thing connected with the carrier's railroad or business of transportation. The court of appeals of the third circuit applies the rule in a case of injuries to a passenger struck by a missile coming through a window near which he sat. The plaintiff's evidence was that the missile came from the side next a passing freight train, that it was a bolt with a nut on the end of it and that such bolts were largely used in building ordinary freight cars. On the other hand there was evidence that the missile was thrown through an open window on the opposite side of the car by one of several boys who were pelting the train as it went by. It was concluded that the evidence as to whether the missile came from a source for which the carrier was responsible was unsufficient to sustain a verdict in the plaintiff's favor. Pennsylvania Railroad Co. vs. McCafrey, 149 Fed. Rep. 404.

Safety appliance law.—The safety appliance law is violated where an interstate carrier hauls cars considerably damaged by derailment so that the coupling devices are nearly gone for nearly 400 miles past three or more places where repairing is done, in order to make the repairs at larger and better equipped shops. United States vs. Chicago, Milwaukee & St. Paul Railway Co., 149 Fed. Rep. 486.

Reasonableness of rates.—A schedule of railroad rates established by state authority is not unreasonably low as to a particular road because it will not enable the company to accumulate from its net earnings a sinking fund for the payment of its indebtedness. Houston & Texas Central Railroad Co. vs. Storey, 149 Fed. Rep. 499.

Sleeping car companies.—A sleeping car company is not a common carrier of passengers. Its liability to persons seeking its accommodations rests solely on the breach of its implied obligation to furnish such accommodations as it holds itself out as offering to the public. It follows that the agent of a sleeping car company is without authority to inform a prospective passenger that his railroad ticket entitles him to ride without validation as required by its terms. Calhoun vs. Pullman Palace Car Co., 149 Fed. Rep. 546.

Employers' liability act.—The employers' liability act of 1906 is prospective only in its operation and does not apply to causes of action existing at the time of its enactment. Hall vs. Chicago, Rock Island & Pacific Railway Co., 149 Fed. Rep. 564.

Recovery of excess charges by consignee.—The circuit court of appeals of the seventh circuit decides that a consignee who after accepting perishable freight with a full knowledge of the facts,

paid without objection the charges of the carrier, including a charge for icing in transit, in addition to the published tariff rate for transportation cannot thereafter recover back the icing charge on the ground that it was illegal. Kundsen-Ferguson Fruit Co. vs. Chicago, Minneapolis & Omaha Railway Co., 149 Fed. Rep. 973.

Passes.—The federal anti-pass law does not have the effect to invalidate a contract previously made by a railroad company with an injured person to issue him a free pass for his natural life. Neither does the statute authorize the railroad company to refuse to issue such passes beyond the boundaries of the state. Mottley vs. Louisville & Nashville Railroad Co., 150 Fed. Rep. 406.

Express companies are common carriers.- Under the South Dakota statute providing that every one who offers to carry persons, property or messages is a common carrier of whatever he offers to carry, an express company offering to carry money for hire is held a common carrier and subject to the rules of liability applicable to other carriers. The law gives this character to the business whether the express company is incorporated or not. Platt vs. Le Cocq, 150 Fed. Rep. 391.

All-Steel Pullman Sleeping Car.

The Pullman Company has built a sleeping car that is as near all-metal construction as is now practicable to make it. In general arrangement as well as in appearance it corresponds to the present standard twelve-section car, except for the rectangular windows and the smooth outside finish. The framing is composite structural steel and the inside finish includes paneled steel and aluminum, brass and composite board.

The center sills are 15-in. I beams, with ½-in. top cover plate, which extend through the body end sills. Each beam is trussed with a 1⅞-in. truss rod. The bolsters, which are the usual double type, are cast steel, being part of one large casting which includes the draft sills, platform beams, body end sill, center and side bearings and bridge. The platform end sills are cast steel, riveted to this larger casting. There are four cross ties or bearers of cast steel, which pass under the center sills. Floor beams formed of 4-in. channels with flanges downward are placed between cross-bearers and between the latter and the bolsters. The side sills are 6-in. x 6-in. x ½-in. angles and form the lower members of the side girders. The web of each girder is a ¼-in. steel plate, spliced in three lengths, continuous from end to end of car, and forming the side sheathing of the car below the windows. The rivets are countersunk and filed to a smooth finish. The depth of the side girder is about 30 in. and its upper member is a 3-in. steel bar secured to the side posts. These members are 4-in. I beams, continuous from side sill to deck sill, the upper part forming the car lines for the lower deck. These posts are offset to clear the side sills, belt rail, plate and other continuous members. There are two posts to the wide piers and a single one for the narrow piers, and their webs are punched full of holes to lessen the weight and form passages for electric wires. The end posts are likewise 4-in. I beams, two in number, secured to the deck sills and body corner post at the top, and to a 4-in. x 4-in. angle, riveted to the body end-sill casting, at the bottom. The deck sill is a T-iron secured to the ends of the side posts, which, as already mentioned, form the car lines of the lower deck. The upper deck car lines are $^{1}/_{16}$-in. pressed steel, of channel section, and also form the deck posts at the wide piers. At the narrow piers the deck posts are flat bars. The purlins are



All-Steel Sleeping Car "Jamestown" Built by the Pullman Company.



Interior of Pullman Steel Sleeping Car.

similar in form to the upper deck car lines. The roof covering is galvanized iron with copper flashing, and the hood covering is copper.

The floor is ¼-in. steel plates with corrugated galvanized iron above and 1 in. of hair felt between. Monolith floor covering is laid on the galvanized iron, and on this, in the passageways, men's saloon and smoking room, rubber tiling. Between sheathings, in the sides and ends of the car, extending from side sills to plates, are two thicknesses of asbestos board to deaden noise and provide insulation.

The inside finish of the ceiling of the upper deck is aluminum and of the lower deck composite board; in the hallways, saloons and annex and ladies' toilet room it is steel. The seats and backs have steel frames, and the ends are steel and brass. The upper berths are pressed steel. The window frames are brass. The interior is painted a light gray and the decoration is in gold and colors. The seat covering is old rose velvet and the floor covering old-rose Wilton carpet. The lighting fixtures are combination electric and Pintsch gas mantle lamps for the ceiling, and electric bracket lamps for the berths. The car is wired for the axle-light system. It is mounted on six-wheel cast-steel trucks, these and the other cast steel members already mentioned being furnished by the Commonwealth Steel Company.

The car has been on private exhibition at several points and is said to ride comfortably and with little noise. It is named "Jamestown" and will be exhibited at the Jamestown Exposition.

Foreign Railroad Notes.

The protest against the baggage charges of the German uniform passenger tariff, which is to go into effect April 1, led to its modification. As given in the *Railroad Gazette* of Feb. 15, rates were to be charged for every 25 kilograms and for every "zone." By the change the rates are lowered for 25 kilograms or less (the

allowance of free baggage heretofore in the North German states). The charge of 20 pfennigs, which by the original scheme applied only to the zone one of 25 kilometers or less, is made to cover zones one and two, that is, all distances up to 50 kilometers, and the charge of 50 pfennigs which originally applied only to distances from 50 to 100 kilometers, will be good for all distances up to 300 kilometers. A mark will pay for all greater distances while originally it was to pay only for 200 kilometers or less; and for more than 800 kilometers 5 marks were to be charged. There is also introduced a weight over 25 kilograms up to 35 (77 lbs.), and for this the charges are those originally made for 25 kilograms, as we published them. Greater weights follow the original tariff, that is, will be higher—for long distances much higher—in proportion than the charges for 25 kilograms.

The European international syndicate of manufacturers of rails has been renewed for five years.

The French railroads in 1906 earned 4.4 per cent. more than in 1905, which is an unusually large increase, though small in comparison with gains of railroads in countries of large coal and iron production.

Economics of Railway Location.*

The committee on economics of railway location was formed for the consideration of all questions connected with railroad location, grades, lines and improvements of grades and lines affecting the economic operation with relation to traffic, tonnage ratings, speed, density of traffic and financial considerations, with the special aim in view of establishing uniform methods and unit values for investigating and analyzing the relative changes and costs of comparative routes or proposed grade reductions and line corrections.

The first report of progress submitted herewith is indicative of the vast field embraced by the scope of work relegated to its consideration, rather than as conclusive of any one of the several details set forth in the instructions to the committee.

It will be realized that much of the matter proposed to be investigated depends largely upon the relationship of the financial question and the economics of trade, to the purely engineering features, and that the true economics of the latter depend in a considerable degree upon the results arrived at by experiment.

The conditions under which experiments have hitherto been made, as well as those at present governing actual practice on the existing lines, are so varied, that, without further investigation, your committee is, as yet, unable to formulate or definitely recommend any set rules or empirical formulas that will accurately cover any of the sub-features embraced in this province of its work.

Generally, and with special reference to the work of this committee, it may be said without question that, viewed from a modern standpoint, much of the railroad construction in the early days of the development of the North American continent was of an inferior character. Great distances had to be traversed, the population of the country was sparse and scattered, and the gradients and curvature were, therefore, too frequently determined by the amount of money to be expended per mile of road rather than by a consideration of the probabilities for future traffic and the economic value of grade and alinement features.

Commercial progress of the country, however, followed the introduction of the railroad, and the financial problem of how to make a dollar earn most began to receive greater consideration.

For a number of years past, the larger railroad organizations have been spending large sums of money in improving the properties under their charge; but while there has already been an immense outlay in this respect, it may be said confidently that betterments in the future, both in new locations and in revision work, will be on a much greater scale than those of either the past or present.

The general situation necessitating such changes may be said to be the outcome of circumstances. It is due in a great measure to a realization of the saving in operating expenses resulting from such betterments, to the increasing demand for cheaper rates and better service, the competition of railroads with one another, and, more especially, to the construction of new lines designed on better economic principles.

In the effort to reduce train mileage, locomotives and rolling stock generally have been greatly increased in size, weight and capacity; and the effect of such changes has been: bridge structures of increased strength, heavier rails, securer joints, more and better ballast, wider roadbed, and, consequently, an improved railroad.

Besides changes of this nature, however, it soon became recognized that many improvements might be made in the distance, gradients and alinement of the earlier construction which would effect a reduction of train mileage, independent of the class of rolling stock used. The province of this committee is, therefore, to investigate certain economic principles, in order that, eventually, helpful suggestions may be made to railroad engineers and railroad managers engaged in the construction of new lines, as well as of grade and alinement revisions.

It is usually comparatively easy to estimate the cost of a projected railroad or an improvement to an existing one. The actual cost, however, of operating such a line, or the value of the saving in operating expenses which is rendered possible by any proposed physical change in the road or in the method of operating its trains, due to a modification of alinement, distance, or gradients, is more uncertain.

Before the proper location or re-location of a railroad can be decided intelligently, it is necessary that the factors governing its earning power be properly understood, and the relations between the purely engineering and the financial features thoroughly grasped. Railroads are built as commercial undertakings for profit, and a railroad that can furnish the most economical transportation, time as well as money being considered, will finally show the best net earnings.

The three principal factors which affect profits, viz.: gross earnings, operating expenses and fixed charges, are, in a great measure, dependent upon the location of the road with regard to the sources of traffic. With a gross amount of traffic and proper location and construction, the greater the first expenditure (with its consequent improved road) the less will be the operating expenses, but the greater the fixed charges. Increasing one decreases the other. With a given volume of traffic, the economic location is the one in which the sum of fixed charges and operating expenses is the least; and a more economical location is obtained when interest and renewal charges on additional expenditure for construction are saved in decreased operating expenses, or when increased operating expenses are saved in reduced interest and renewal charges on cost of construction. The most economical location is secured when every gain possible has been effected, both by decreased cost in the one case and decreased operating expenses in the other. In grade reduction, it is the saving in number of trains, even if each train costs somewhat more.

The effect of differences in location on such factors must be understood before a proper and economic location can be determined. If it can be computed that by physical alterations in alinement or gradients, or by any change in the method of operating trains, the expense of each train over a proposed line or the number of trains to handle a given traffic can be reduced, then the only problem remaining is the financial study of the relative values of the proposed expenditure and the expected annual saving. A general and purely academic discussion of some features of this question may profitably precede the future consideration of details.

It is often stated that any really meritorious proposition can command the requisite capital, provided that it is properly exploited. Although there is considerable truth in this statement, it is also true that there is a wide difference in the amount of effort necessary to raise money, depending on the status of the corporation making the effort. It is perhaps unfortunate that the financial standing of many railroad corporations is so unlimited, that many changes, which probably could not be justified by any rational method of computation, are recklessly made after slight consideration. There may be little or no reduction in operating expenses and certainly not enough to justify the capital expenditure, but the financial strength of the company is so great that there is no reduction in dividends. There may be an actual increase in dividends, which only means that the financial strength of the road is so great, and is growing so rapidly, that the comparatively insignificant loss, due to fixed charges on an unjustifiable expenditure, is utterly swallowed up. On the other hand, the road which is financially weak must show unquestionable justification for any proposed improvement, and even then the financial reputation may be so limited that a really meritorious project may fail for lack of funds.

There can be no question regarding the justification of providing for traffic that may reasonably be expected for a considerable period after the plans are made.

A railroad is not built for a day's work. There will be an interval of a year or more after the plans are made before the road is built. Several years more may elapse before the normal traffic is obtained. If the increased traffic cannot be economically handled with the facilities provided, then the railroad is confronted with the choice between an uneconomical handling of traffic or an immediate additional expenditure with its accompanying loss and waste of work already done.

Of course, much depends upon the character of the change and the amount of the waste. In territory where the topographical features are extreme and the financial aspect a governing element, cases may arise in new construction in which it is necessary to temporize with the profile in regard to limiting grade; that is, to construct a temporary line with grade steeper than the limiting one, a line which will be used until future traffic conditions war-

*Abstract of a report presented at the annual meeting of the American Railway Engineering and Maintenance-of-Way Association at Chicago, March 19, 20, and 21, 1907.

rant the construction on the alinement as projected. In such cases, in the consideration of the economic value of reducing the grade, it must be taken into account that the cost of any temporary work thrown away must eventually be borne by the permanent line. This fact should emphasize the desirability of avoiding temporary work whenever the finances of the company warrant the immediate construction of the permanent line.

It is conceivable that a considerable improvement may be made by merely heightening a fill in a sag without altering the horizontal alinement. The additional work in this case will cost but little more than it would have cost originally, with the advantage of saving several years' interest on the added cost. In the other extreme it might be necessary to utterly abandon a considerable section of the line, and in such case the road would become perpetually burdened with an interest charge on both lines. The very patent fact that improvements, especially when not planned during the original construction of the road, so frequently require the abandonment of considerable old work the cost of which will be perpetually represented in the fixed charges, causes a delay in the reconstruction for a number of years until the disadvantages of uneconomical operation become so great as to be intolerable.

The possibility of permanently utilizing the temporary line as a branch line, or even as a mere freight track by which to reach factories and other industries, may exclude all permanent loss from the question. It may happen that the line can be used to handle the local traffic, and one more direct for through business built later; the temporary line could then be used as a second track if the gradients are favorable in one direction. In this case one would be enabled to "eat his cake and keep it, too." The cheap temporary line serves its original purpose and saves the immediate construction of the expensive permanent line, and yet both the preliminary and the later expenditure are fully justified by their utilization.

As a practical result, it may be taken for granted that a much heavier traffic is needed to justify the abandonment of a temporary line than would justify the construction of a permanent line designed for heavy traffic.

A very interesting collection of figures has recently been brought to the notice of the committee. The name of the road and the exact location of the improvement need not be stated, but the essential facts and figures are given. A section of the road over 83 miles long was built originally with very sharp curvature and heavy grades in order to reach certain coal fields.

It was considered imperative to reach the coal fields at once, and therefore the construction of an alternative shorter low-grade line was deferred. About two years ago, the low-grade line was completed, at a cost of nearly five million dollars for 59 miles of road. Over 24 miles of distance is saved by the new line. The limiting grade against eastbound traffic has been reduced from 0.91 per cent. to 0.05 per cent. The limiting westbound grade on the old line is 1.15 per cent. On the new line, with the exception of a 0.24 per cent. grade on the approach to a bridge, there is no grade against westbound traffic. The total rise against eastbound traffic was reduced from 687 ft. to 69 ft., and against westbound traffic from 438 ft. to 17 ft. The maximum rate of curvature was reduced from 12 deg. to 6 deg., and the total curvature from 19,783 deg. to 5,075 deg. The average degree of the curve was reduced from 7 deg. 50 min. to 3 deg. 19 min. This required 10,222 ft. of tunnels as against 4,096 ft. on the old line. In this case, however, the old line was not abandoned. It is still used for trains of eastbound empty coal and coke cars. But all the westbound business and also the eastbound time freight passes over the new line. The two lines may virtually be considered as a double-track line.

The results of this improvement are given by a comparison of the business of the year 1904, handled entirely on the old line, and that of 1905 handled on both lines as described above. Notwithstanding an actual growth in business of 22 per cent., the work was done with an economy of 2 per cent. in freight engine mileage, besides the disuse of three pusher engines, with a mileage of 138,816 miles in 1904. Again, in spite of 22 per cent. increase of business, the freight train wages were actually 19 per cent. less than in 1904. On account of the relief of the congestion of the old line, the overtime of the freight trains was reduced from $80,000 to less than $43,000, a saving of 46 per cent. The average time of freight train runs was reduced from 18 hours 28 minutes to 12 hours 35 minutes, a saving of 32 per cent.

After allowing for the increase of 22 per cent. in traffic over the figures for 1904 and comparing these figures with the actual figures for 1905, it was estimated that the saving in operating expenses resulting from the construction and operation of the new line amounted to nearly $238,000, which is nearly 5 per cent. of the total cost of the new line. It is also claimed that the $238,000 does not fully measure the true saving owing to the fact that the old line was already being worked to nearly the limit of its capacity. But even accepting that figure as correct, a saving of 5 per cent. during the first year after construction may be considered a remarkable justification of the construction of the new line.

While the committee realizes that all the facts bearing upon this comparison are not stated, and are not available at this time, nevertheless it considers that what is given may be of considerable interest and value to the members.

In regard to the period for which future traffic should be discounted, by the very nature of the case it varies with the character of the temporary line, the capital which will be wasted in abandoning the temporary line and the probable rapidity of growth of the traffic. It also depends upon the very variable and almost indeterminate annual loss due to uneconomical handling of traffic. Even the temporary line is supposed to be so designed that the existing meager traffic is handled as economically as is justified by such traffic. The growth in traffic is literally a growth, and does not increase by leaps and bounds. The justification of the larger expenditure changes from zero at the beginning of the period to some larger amount at which a change is imperatively demanded. Even the change, although gradual, is not necessarily at a uniform rate. There can be no empirical rule for determining the number of years in advance that it is desirable to provide for, but if the actual tonnage for a considerable period of years is plotted to form a curve, the extension of the curve will give probably the best obtainable prophecy of future traffic. Where changes can be cheaply made afterwards a small number of years seems proper, but where alterations suitable for increased traffic would mean the entire disuse of much expensive work, a much longer period in advance is advisable.

A consideration of the foregoing uncertainties will show that a definite mathematical solution is seldom possible. It would appear as if the question must be finally determined by "judgment," although the judgment should be guided by a careful consideration of all the modifying elements, and each change should be considered by itself even on the same road.

The Nevada Railroad Law.

The legislature of Nevada has passed a comprehensive act to regulate railroad, telegraph and telephone companies and to fix maximum freight charges. There is to be a railroad commission of three members, one of whom, receiving $5,000 a year, must give his whole time to the office. The other two are to receive $2,500 yearly. The commissioners are appointed by a board consisting of the Governor, the Lieutenant-Governor and the Attorney-General, and their terms will be three years. The commissioners must have a general understanding of matters relating to railroad transportation. The appointing board may remove a commissioner, but not until after a public hearing, if the commissioner shall desire one. A complaint made to the commission must be considered within four months and be determined within six months; and a failure to comply with this provision will render the office of each of the commissioners vacant.

The Secretary, who must be a stenographer, is to receive not over $1,800 a year. The commissioners may attend conventions of railroad commissioners, etc., but when outside the state shall not be allowed their expenses.

The term railroad is to include express, telegraph and telephone companies, but the act does not apply to street and electric railroads carrying passengers only within the limits of cities, nor to private railroads not doing business as common carriers; nor to any railroad less than 20 miles long. The foregoing is the substance of the first two sections. Following this are requirements of reasonable service and charges, etc., similar to the requirements of the Federal law. The western freight classification, already in use by the principal roads, shall be adopted by the commission for all the railroads of the state. The commission must see that the following rates for freight are not exceeded: Class one, 8 cents; class two, 7.4 cents; class three, 6.4 cents; class four, 5.2 cents; class five, 4.6 cents; class A, 4.6 cents; class B, 3.6 cents; class C, 3.1 cents; class D, 2.7 cents; class E, 2.7 cents. For carrying ore the commission must keep the rates within the following figures: Rough stone, iron ore, limestone, etc., ½ cent a ton a mile; ores worth $20 a ton, 1 cent a ton a mile. Following this are seven different rates for ores of different values, those worth $1,000 a ton being 2 cents a ton a mile. The commission may make rates lower than those named in the law, but it may permit narrow gage railroads to charge rates 150 per cent. higher than those specified. None of the maximum rates shall apply on any road until it has been in operation two years. Hauls of less than 50 miles may be charged for 50 miles, but for 15 miles or less the rate is to be fixed by the commission. Free transportation is prohibited, with the usual exceptions, including one allowing free transportation or reduced rates to be given to teachers and students. Persons in charge of live stock may be carried free, but there must be no discrimination. Every railroad must furnish suitable cars and when there are not enough cars must distribute them fairly according to the immediate requirements of the applicants. Railroads, as between themselves, and interurban roads, as between themselves,

must make proper arrangements for interchange. The commission shall have control over private tracks used by common carriers.

The sections concerning complaints and the treatment thereof are similar to those of the Federal law. Orders of the commission fixing rates are to take effect 30 days after the date of service and rates made by the commission are to be prima facie lawful for one year and until changed by the commission. The provisions of the commission's orders shall be prima facie reasonable unless suspended in the way prescribed. If rates fixed by the commission are complained of they shall remain in force until final determination by the courts. In all actions against the commission's rates, the burden of proof shall be upon the plaintiff. The commission shall have authority to inquire into the management of all the roads, shall prescribe blanks for reports and may require the production of papers kept by a railroad outside the state, under penalty of $1,000 a day. Every year in January each railroad must report a verified list of all passes issued, but this does not apply to transportation issued to persons not residents of Nevada. Annual reports must be sent in by the railroads by September 15. Illegal rates, rebates, etc., are prohibited as in the Federal law, and the penalty lies against both the carrier and the shipper. The giving of passes to state, county or municipal officers is forbidden, and either the giving or the acceptance of such transportation involves a penalty of $500 fine or six months in jail.

Accidents attendant with loss of human life must be reported at once to the commission and the commission may investigate where the public interest requires an investigation. Claims for overcharge, loss or damage not acted upon within 90 days may be investigated by the commission, which shall make a public report of the results.

Government Report on the Block System.

(*Concluded from page 510.*)

AUTOMATIC BLOCK SIGNALS.

In the early development of automatic signals, track instruments, that is, circuit-closing or circuit-breaking devices having levers placed at the side of the rail as to be moved by the wheels or actuate by the depression of the rails under passing trains—were used to a considerable extent for the operation of the signals. An instrument at the entrance of the block would, as a train passed it, break a circuit and thereby set the signal at that point in the stop position; the instrument at the end of the block, while setting the next signal at "stop" in the same manner as the first, would also close the circuit for the first signal, which would then return to the clear position. Signals operated by track instruments proved, however, to be wrong in principle.

In practical operation it is frequently necessary for a train to pass an automatic signal indicating "stop." This is especially for the reason that, if the signal is out of order and will not clear for an indefinite time even though the block is clear, it is impracticable to detain a train until a repair man can reach the spot and put the signal in order. Since any signal at "stop" may be out of order, it is generally found to be necessary to operate under a uniform rule that a train, after stopping at an automatic signal, may proceed carefully to the point of obstruction or through the block if no cause for the stop-signal indication is found. But if it happens that there is a preceding train in the block, this train, in passing out, where the track instrument is used, is likely to clear the signal in the rear of the second train, which has passed the stop signal and entered the same block with the first. In the same way, if a train parts and the forward portion passes on while the rear portion remains in the block, the signal that should protect the rear will be cleared.

Track-circuit control.—The track circuit is free from the imperfections of the track instrument; it holds the signal at "stop" so long as a car or even a pair of wheels remains on the rails of the circuit, and also, without any added complication, provides for the automatic clearing of the signal when the main track is cleared by a train taking a siding in the block (and after the switch has been set for the main track) and for setting the signal at "stop" and maintaining that indication when a switch is opened when a train enters the main track from a siding, and even when a train backs into the block at the outgoing end. As a result the track circuit is now universally used for the control of automatic signals on steam roads.

Arrangement of signals.—In the typical installation of automatic block signals, each block is of the length of one track circuit —from half a mile to 1 mile. At the entrance to the block a home signal is placed and, lower down on the same post, the distant signal for the home signal at the entrance to the next block. The separate distant arm may, however, be dispensed with and the home signal made three-position; the home arm horizontal then indicates stop, at 45 deg. it indicates that the block at the entrance of which it is placed is clear, but the next home signal is in stop position, and the vertical position indicates that the block is clear and the next signal in a position (45 deg. or vertical) indicating that its block is also clear. Longer blocks, with the signals controlled by two or more consecutive track circuits, are used to some extent. As distant signals more than 1 mile from their home signals would be farther than is necessary to insure safe stopping of trains and would impose an extra burden on the enginemen's memory, it is usual, where the blocks are much more than 1 mile long, to have separate distant signals within the blocks. Fig. 6 shows diagrammatically both short and long automatic blocks.

Switches.—Switches in the blocks control the track or signal circuits by means of simple circuit controlling devices; so long as a switch is not set for the main track the signal for the block in which it is located indicates stop. In addition the side-track rails extending to the point of safe clearance from the main track, are connected with the track circuit so that if cars are left dangerously near the main track the signal is held in the stop position (see Fig. 4).

While the automatic signals give the proper indication if a switch is left open and afford protection to a train that enters the main track from a siding, there is still the possibility that a switch may be set for the siding and a train may start to enter the main track after another train has passed the signal controlled by that

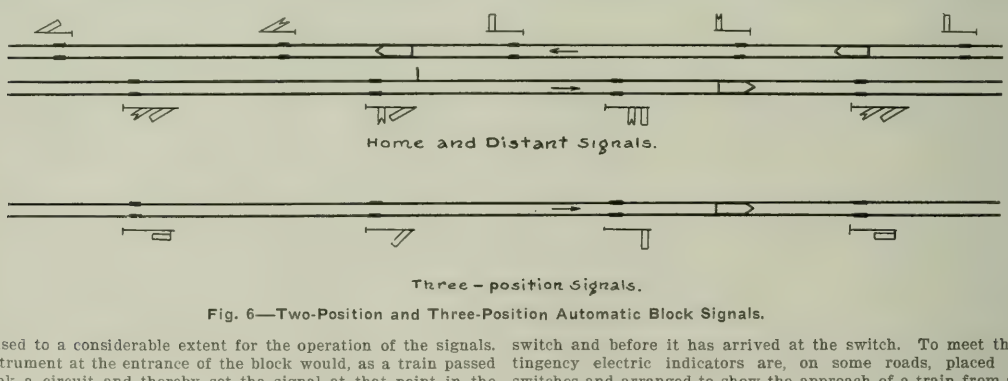


Fig. 6—Two-Position and Three-Position Automatic Block Signals.

switch and before it has arrived at the switch. To meet this contingency electric indicators are, on some roads, placed at the switches and arranged to show the approach of a train from a point some distance in the rear of the nearest signal. It is also provided by rule that a switch must not be moved when a train is approaching, and that, after a switch has been set for the siding (and the signal thereby set at "stop"), the train shall not move from the siding to the main track until a certain time has elapsed, so that any train that may be approaching without the knowledge of the trainmen at the switch, may have time to arrive if it has already passed the signal. The dependence of these provisions upon observance of rules and the difficulty of insuring that such rules shall always be strictly observed, emphasize the importance of interlocking, which will be touched upon later.

Automatic signals on single track.—Automatic signals have been used on single-track roads much less extensively than on double track. Two difficulties are met with in applying automatic signals on single track, which have doubtless prevented their more extended use on such lines. To make the signals efficient in preventing collisions between trains running in opposite directions—in cases of forgetfulness on the part of trainmen, or mistakes in or misunderstanding of orders, the controlling circuits must be more extended and complicated than are those on double track; that is, each of two trains approaching each other must set signals at "stop" against the opposing train, so far in advance of itself as to insure that both trains will receive stop indications in time to stop before meeting. And, in addition, when a train finds a signal at "stop" it must not proceed as it would on double track, merely looking out

for a train standing or moving in the same direction as itself, but must suffer considerable delay by sending a man ahead with a red flag or light, because there is always the possibility that a train may be approaching in the opposite direction. In spite of these difficulties, however, automatic signals are being installed in large numbers on single track by certain roads.

Signals.—Clockwork and inclosed disk signals, as still used on a few roads for automatic block signals, have already been described. Automatic semaphores are worked by compressed air controlled by electro-magnetically operated valves and supplied by a pipe line laid along the track from compressors usually located at water-supply stations; by compressed carbonic-acid gas supplied from portable cylinders delivered and connected to the various signals from time to time, and, like the compressed air, controlled by electro-magnetic valves; and by small electric motors connected by gearing to the operating mechanism and supplied with current from primary batteries or from storage cells. The storage cells may be charged on line circuits from generator stations located at suitable intervals or by primary batteries, or may be handled as portable batteries, taken to the generator stations for charging and returned, charged, to the signals. Storage batteries are also used on some lines to furnish current for the operation of electro-pneumatic signals and for the track circuits.

Automatic signals on electric railroads.—Automatic signals controlled by track circuits are used on a few electric railroads equipped for heavy service. Alternating current is used in the track circuits to render the relays unresponsive to the traction current flowing through the rails. The resulting increase of cost and complexity is considerable, but the signals and mechanism, other than appliances connected with the track circuits, are not materially different from those used on steam roads.

Automatic signals with automatic stops.—In the New York subway and on the Boston elevated railroad automatic train-stopping devices are used. As applied in the subway each trip for the automatic stop remains "set" until the train that operated it has passed far enough in advance, so that any following train that might overrun the trip would certainly be brought to a stop before colliding with the train protected by that trip. This is accomplished by making the length of block a little greater than the distance in which a train can be stopped, and so arranging the circuits that each signal remains in stop position, and the corresponding trip "set" until a train protected by it passes out of the next block ahead; that is, a train always has at "stop" in its rear not only the signal at the entrance to the block in which it is at the moment, but also the next signal back of that, and has never less than one block of clear track behind it in which a following train will be automatically stopped if it is not sooner stopped by its motorman.

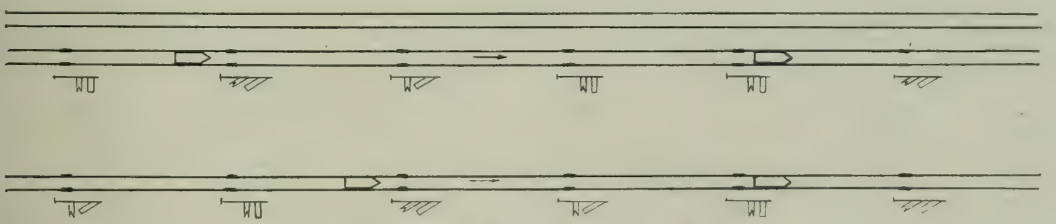


Fig. 7—Automatic Signals in New York Subway.

The effect of this on the train movement is shown by the upper diagram, Fig. 7, where it is seen that, of two trains in motion, the second must be a little more than three blocks in the rear of the first if it is to find each distant signal clear, as it should if it is to continue running at full speed. With the ordinary arrangement of signals, as shown by the lower diagram, the second train could be one block farther advanced; or, the spacing of trains must be nearly one-half greater when the extra interval of one block is used, and the capacity of the road is proportionately reduced. Of course, it is hardly necessary to say that the almost absolute safety secured justifies the use of the automatic stops and increased train interval in view of the density and character of the traffic and the peculiar conditions in the subway.

False clear signals.—While it is possible for an automatic signal or its controlling devices to become deranged in such a way as to indicate a clear block when the block is occupied by a train, the records show that, with proper construction and maintenance, such failures are very rare. Since they do occur, however, some railroad officers feel that the signals should be subject to constant inspection—that some one on each train should see that every signal passed indicates stop. On a few roads, especially some of the first to install automatic signals, each signal is placed 150 ft. or more beyond the beginning of the track circuit that controls it, as at X, Fig. 4, so that, if it is working properly, it will move to the stop position in the sight of the engineman, and if it fails to move the engineman will at once detect the failure. On many other roads, however, this arrangement has not been viewed with favor, as it is felt that the signals should continue to give the true indication of the condition of the block ahead until passed by the enginemen, and it is believed that most of the few dangerous failures and the conditions that might cause them will be discovered by systematic inspection on the part of the maintenance force.

Reliability of automatic signals.—A vital element of the automatic signal system is reliability. If the signals should fail very frequently, even though the failures were on the safe side, the detentions to trains would become a serious inconvenience and, still worse, the trainmen, after repeatedly finding signals at "stop" when the blocks were clear, would cease to give much weight to the stop indications of the signals. If false clear indications should become frequent the system would evidently be worse than useless. Careful inspection and intelligent maintenance work are essential; for no matter how well constructed the appliances may be as installed, they must deteriorate, and continued efficient service can only be secured by finding and removing faulty conditions before they become the causes of failures.

The records of failures vary among the different roads, and it is probable that different methods of classifying failures and differences in the strictness with which reports of all failures are demanded account for some of the differences in relative numbers of failures given. Aside from this the results will of course depend upon the character of the appliances, the length of time they have been in service, and the quality of the maintenance work. However, the results obtained on several thousand miles of road equipped with automatic signals show very satisfactory working. False clear signals are generally rare; and, since absolute perfection and infallibility in that direction must, in the nature of things, be unattainable, it seems fair to consider that the small number recorded should not weigh against the safety and reliability of the automatic system.

Cost.—While the cost of installation and maintenance of automatic signals are, of course, much greater than for the telegraph block system, the cost of operation is generally much less; for if the average length of block under the manual system were even two or three times that of the automatic blocks the number of telegraph operators required would be much greater than the number needed at junctions and passing places only when the block signals are automatic. The cost of automatic signals is therefore offset, at least in part, by saving in cost of operation, and the advantage of the short blocks in facilitating train movement is so great and the working of the signals so satisfactory that they are favored by a large number of American railroad officers.

THE CONTROLLED MANUAL BLOCK SYSTEM.

In the controlled manual block system the signalman is physically prevented from clearing his signal unless the signalman at the other end of the block manipulates his apparatus so as to close an electric circuit and electrically release the signal. Thus each signalman is forced to consult or ask permission of the signalman in advance before clearing his signal.

To guard against possible mistakes of both signalmen at the same time an automatic locking and releasing device, actuated by the passage of trains, is added to the apparatus by which the signalman releases the signal at the entrance to the block in his rear. This is so arranged that each time the apparatus is operated to give a release it automatically becomes locked against a repetition of the operation until a train, having come through the block, passes that block station and by acting upon a device depressed by the wheels or by passing onto and off a track circuit releases the lock. The result is that, even though the signalman should make a mistake and attempt to release while a train was in the block, he would be unable to do so until the train had passed his station.

Appliances.—The appliances required in addition to the signals and means of communication are an electrical block instrument by which the signalman at B, for example, closes the circuit to unlock the lever at A; a lock on the signal lever, sometimes combined with the block instrument; line wires from station to station, and either a track instrument operated by the wheels of passing trains or a track circuit, by which the trains effect the releasing of the

block instrument as they pass out of the block. Additional appliances sometimes used are electric "slots" or tripping devices on the signals by which the signals are automatically returned to the stop position when trains pass, and "continuous track-circuiting"—that is, the connection of the track throughout the entire length of the block into one or more track circuits arranged to keep one of the releasing circuits open, or inoperative, and so prevent the clearing of the signal; so long as a single car or engine is on the rails included in such track circuits.

Operation.—In the most common form of block instrument B unlocks A's lever by pulling the lower knob outward and immediately letting it return to its original position, in which it then becomes locked against a repetition of the operation. At the same time the word "Free," previously visible, disappears from the rectangular opening in the case and the word "Locked," indicating that the operating knob is locked, as just stated, takes its place. The unlocking of the lever at A is shown by the inclined position of the indicator arm in A's instrument. The signal at A is then cleared.

When the train enters the block at A, the words "Train in block" automatically appear at the rectangular opening in B's instrument. B then gets his own lever for the next block unlocked by C and clears his signal for Block B C. While B's instrument continues in the condition in which the words "Train in block" are displayed, the unlocking circuit is open and the operating knob remains locked so that, after A's signal has been returned to, and become locked in, the stop position, in the rear of the train, it is impossible for B to repeat the unlocking and allow that signal to be cleared again until the train has passed out of the block.

When the train passes B, its wheels actuate the automatic release; to insure, however, that the signal at B shall be returned to the stop position for the protection of the train between B and C, before a following train is admitted to the block A B, the circuits are so arranged that the releasing is not completed until B's signal has been so placed. When this has been done and the train, by passing onto and off the releasing track circuit, has caused the track relay to open and close again (so that the releasing is delayed until the last car has passed), the word "Free" reappears and it is again possible to draw out the operating knob for the purpose of unlocking A's lever.

The procedure in operating the controlled manual system is nearly the same as it is for the telegraph block system. A signalman, however, cannot clear his signal in accordance with Rule 318, but must ask for "an unlock;" when an unlock is asked for, if the block is clear, it must be given by the proper manipulation of the block instrument. It is common practice to use electric bells for the ordinary communications in the working of the system.

Imperfection.—Although this is an accepted form of controlled manual apparatus and is the one most largely used in America, the fact should not be overlooked that it has one weakness. That is, if a train parts in the block and the forward portion passes out while the rear stops in the block, or if a train is admitted to a block occupied by a preceding train (and this is sometimes necessary in the case of a train stalled or otherwise detained for an unusual time), the one train or portion of a parted train, in passing out of the block, will release the instrument while the block is still occupied; and precisely to the degree in which the signalmen may have fallen into the habit of depending upon the controlling devices, will there be danger of their giving a clear signal in such a case. Obviously, this condition would be common if permissive blocking were carried on. Of course, this weakness can be removed by the addition of track circuits taking in the whole length of each block so that, as in the case of automatic signals, a clear signal cannot be given so long as there is a single car in the block. But, on account of the considerable addition to the cost and the increased difficulty of maintenance, continuous track circuits have generally not been installed.

Merits of the system.—With continuous track circuits and all signals arranged to be automatically returned to the stop position the controlled manual should unquestionably be characterized as the ideal block system. It would be a combination of the telegraph and automatic systems, and each should check the faults of the other; a dangerous condition could hardly arise except through the coincidence of a failure of the controlling devices to prevent the clearing of a signal and, at the same time, an attempt on the part of one or both signalmen, through forgetfulness, to clear the signal improperly. Such a coincidence should be a very remote contingency.

The ideal condition is not usually attained, as one or both of the safeguards mentioned are commonly omitted. Even so, installation and maintenance are both costly. At the same time there is, in comparison with the telegraph block system, no such saving in cost of operation as an installation of automatic signals may effect. On the contrary, since the blocking should be absolute if the full advantage is to be derived from the controlled manual system, there must, in general, be a tendency to shorten the blocks and so increase the operating cost. While the controlled manual system is preferred by some railroad officers and the actual installations without all the possible safeguards, seem to have made excellent records, it appears that a much greater number of officials are fully satisfied with automatic signals.

THE ELECTRIC TRAIN STAFF.

A form of the controlled manual block system for controlling train movements on single track, known as the electric train staff system, is in use to some extent. Under this system each train passing through a block is required to carry from one end of the block to the other a small iron rod, called a train staff, as a visible evidence of its right to occupy that block; and no train is allowed to be in a block without having in its possession a staff for that block. Originally there was but one staff for each block, which bore the names of the stations at the ends of the block as the means of distinguishing it from the staffs belonging to the adjoining blocks. Evidently if, after one train had moved from A to B and left the staff at B, a second train moving in the same direction should arrive at A, the staff would be at the wrong end of the block, and the train could not proceed until a train in the opposite direction had returned the staff to A.

Operation.—The electric staff system meets the requirements of practical working by providing several staffs for each block, which are normally secured, part at one end of the block and part at the other, in electric staff instruments so arranged that it is impossible to have more than one staff out at a time. When all the staffs are in, A, with the co-operation of B to unlock his instrument, can remove one staff, and vice versa; but the removal of one staff so affects the electric circuit that neither instrument can again be unlocked until that staff has been placed in the instrument at the other end of the block or returned to the instrument from which it was removed. Thus the staff is the key to the block, the possession of which by a train prevents the admission of any other train at either end of the block.

To provide for permissive blocking, which is likely to be necessary where the blocks are long, a special staff is supplied. One of several removable portions of this staff can be delivered to each of several trains that have to pass through the block permissively; the last train of the series takes the staff with the unused parts, and this, when combined with the parts delivered by the preceding trains (and only when thus complete), can be inserted in the staff machine to make possible the removal of a staff for the movement of a train in the opposite direction.

The signal levers are usually provided with locks which can be released only by the use of the staff as a key. The signals may also have electric "slots" by which they are automatically returned to the stop position as trains pass.

INTERLOCKING.

The plan, Fig. 8, shows the arrangement of tracks at the junction of a double-track branch with a double-track main line, including a crossover to provide for movements from any track to any other and the signals required for complete signaling and interlocking at such a junction. Each switch is provided with a lock to secure it in its safe positions and detect, by failing to lock, any failure of the switch to move to a safe position.

To prevent the unlocking of a switch while a train is passing over it, each lock has connected to it a bar of flat iron supported along the side of the rail in such a way that it is raised above the top of the rail at each movement of the lock and checks the complete movement of the lock if such raising is prevented by contact with the wheels of a train.

The interlocking machine.—Each switch (or two switches forming a crossover), each lock (or two locks on adjacent switches), and each signal is operated by one of a group of levers assembled in the interlocking cabin or "tower." Nineteen levers are required for the plant illustrated and, allowing, as is customary, several unused spaces in the machine for additional levers that may be needed for fuutre extension of the plant, a machine of twenty-four levers is used. The levers are so mechanically interconnected that they can be moved only in a certain order and the movement of one lever will prevent the movement of certain others. Thus, distant signal lever No. 1 can be moved to clear its signal only when levers Nos. 2 and 5 have been moved to clear those signals, for which No. 1 is the distant signal; No. 3 can be moved only after the movement of Nos. 4 and 5. Signal No. 2 can be cleared only when switches Nos. 11 and 14 are set for the main track east and locked by No. 12, and while No. 2 is clear No. 12 cannot be moved to unlock the switches which, in turn, are thus prevented from being disturbed; switch lever No. 13 must also be in the position for the main track, so that no train moving in the opposite direction on the westward main track can be sent onto the branch track across the path of the train for which signal No. 2 has been cleared. Signal No. 4 cannot be cleared at the same time as No. 2, so as to allow a branch train to run into the side of the train on the main track, because No. 4 requires No. 11 in the reverse position—for the branch. The mechanism by which this interconnection of the levers is effected is called interlocking, because the movement of one lever locks certain others so that they cannot be moved.

Interlocking signals.—Signal No. 23 is the home signal for the main track westward, and distant signal No. 24 works in connection with it and signal No. 22. Signal arm No. 20, below No. 23, on the same post is the signal for a train passing from the westward main track to the branch and indicates by its position below No. 23 that the train is to diverge from the straight track and must reduce speed; distant signal-arm No. 21 gives the same information and works in connection with Nos. 20 and 19. The small signals, Nos. 6 and 7, govern movements eastward to any possible points from the westward main and branch tracks, respectively; No. 18 similarly governs westward movements from the eastward main track.

Signals Nos. 5, 19 and 22, called advance or advance block signals because, with reference to the movements of the trains governed by them, they are beyond or in advance of the interlocked switches and home signals, are the block signals at the entrances of the blocks extending from the junction to the next block stations in the three directions. Where automatic block signals are installed the advance signals are usually automatic and the distant signals are placed on the same posts with the automatic block signals next in the rear of the interlocking home signals (see Fig. 2). The interlocking home signals, Nos. 2, 4, 20 and 23, in addition to being operated by their levers, are controlled by track circuits extending from them to the next ("advance") automatic block signals, so that they return to the stop position when trains pass them and cannot be cleared while the controlling track circuits are occupied. Thus the automatic signal system is carried through the interlocking plants and trains are insured block-signal protection at every point.

Importance of interlocking.—It will be apparent that for the mere control of movements through the blocks from this point three signals would be sufficient; but it would be impossible to locate those three signals so as to govern and safeguard properly the movements at the junction itself. This can only be accomplished by the installation of a complete complement of signals and interlocking,

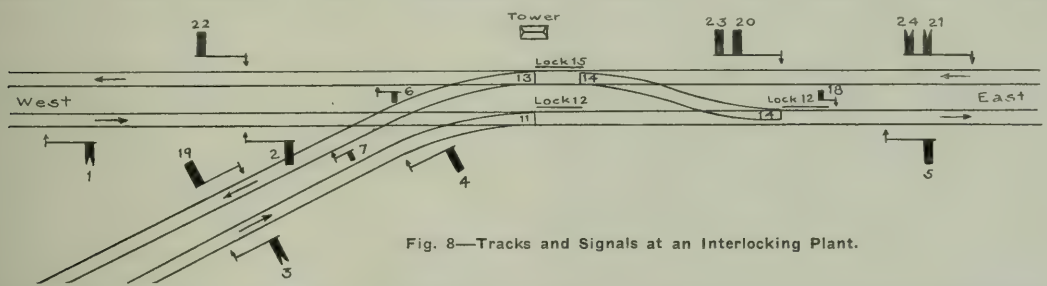


Fig. 8—Tracks and Signals at an Interlocking Plant.

which, as previously pointed out, is desirable at every railroad crossing, drawbridge, or important group of switches, and is hardly less important than the block signal protection between stations.

From here the report goes on to describe the block signaling practice on the Chesapeake & Ohio. That road is selected as a road that has maintained block working on lines of both heavy and light traffic, double and single track, for many years with very satisfactory results, yet has not found it necessary to use elaborate or expensive appliances on the greater part of the line or to provide a much greater operating force than would be required for the station and train-order work if the block system were not in service. This road affords a good illustration of the possibility of securing satisfactory results from the use of the block system with a small expenditure of money. Signals having arms for movements in both directions on the same post are used to a great extent at simple block stations. On the busier double-track lines, however, there are interlocking plants at many of the passing sidings and other important points. Certain block sections on one of the single-track divisions, in which there are tunnels, are provided with a simple form of controlled manual block apparatus. On some of the double-track lines there are single-track tunnels. At these points there are interlockings for the switches at the double-track endings, and the short sections of single track are worked by the electric train staff system which is absolute; no provision is made for permissive movement of trains going in the same direction. * * *

The form of block register used at each station on the Chesapeake & Ohio has spaces for a very complete record of each operation connected with the movement of a train through the blocks on either side of that station. The several entries forming the record of one train are made in one column in the order of the train's movement. By noting, in the case of either block, whether or not all the spaces are filled in the last column containing entries, it can be seen at a glance whether the block is clear or occupied. If one train is passed at a station by another going in the same direction, its record for the block in advance is made in the next column beyond that for the train that passed it, so that the last column used correctly shows the condition of the block. In addition, a transfer book is provided in which the signalmen enter, with the signatures of both, the positions of the signals and the train orders on hand when one man is relieved by the other at the end of his time on duty.

Absolute blocking is maintained as far as possible, but on the busiest portions of the road, at some of the block stations, provision has been made for giving permissive signal indications; this is done chiefly in the case of freight trains ascending heavy grades. But on the lines of lighter traffic the exceptions to the absolute rule are said to be very few; and this is the case where the blocks are 8 to 10 miles long, and they are even longer on some branches having the lightest traffic. In some cases on single track there are passing sidings in these long blocks, and it is occasionally necessary to let two freight trains moving in opposite directions enter the block to meet and pass at such a siding. The trains are then, however, given telegraphic train orders providing for their meeting at that siding and, in addition, caution cards for their entrance into the block; so that the chances of the men on either train forgetting the meeting point are reduced to a minimum.

CERTAIN IMPROVEMENTS IN SIGNALING.

Among the improvements in signaling now in contemplation or in course of adoption special mention may be made, in conclusion, of the use of green lights instead of white for the proceed or "all clear" indication and semaphores giving their indications by positions of the arms above instead of below the horizontal.

The use of green lights for clear is now the practice on a number of important roads and is approved by many railroad officers and by the great majority of signal experts. The purpose of the improvement is, by taking a distinctive color for the clear indication, to eliminate the possibility that a stop or caution indication may be converted into "all clear" by the mere breaking of a colored glass, and at the same time to remove the recognized danger that one of the many lights in the streets and houses of cities and towns may be mistaken for the clear indication of a signal on which the light is out and which may at the time be giving a contrary indication.

The belief that the dangers are very remote, the expense of making the change and the difficulty of obtaining a good third color for the night caution indication have delayed this improvement. A glass giving a distinctive yellow-colored light has, however, been produced and one or two roads are using a green and a red light side by side. There can be little doubt that the other obstacles will give way before the growing conviction that the danger must be recognized and that the change ought to be made.

The semaphore arm working below the horizontal requires a counter-weight to bring it back to the horizontal position when the operating force is removed, and this must be sufficient to overbalance the weight of any possible accumulation of snow or ice on the arm. The desirability of having the arms work above the horizontal, so that their own weight and that of snow and ice would tend to bring them to the stop position, has been recognized for many years. Unfortunately, before attention was given to these considerations, semaphores were made with arms working below the horizontal, and the first examples were copied as the semaphore type of signal grew in favor, until, when serious thought was given to the advantage of using the upper quadrant, the difficulty of making the change seemed too great.

To Messrs. Rudd and Rhea, of the Pennsylvania system east and west of Pittsburg, who have reported certain recommendations for uniform standard signaling on those lines, is perhaps due the credit of first seriously undertaking to bring about a change of practice in this respect. Signals exemplifying their recommendations are in trial service on one division of the Pennsylvania road; the arms are three-position; the arm 45 deg. above the horizontal indicates that the block immediately in advance of it is clear, but the next signal is in stop position; the vertical arm indicates that the block is clear and that the next signal also indicates block clear; that is, the next signal is either at 45 deg. or 90 deg. above the horizontal. Signals of this type are also on trial on one or two other lines and are authorized for a few joint terminal districts where the standard signaling of neither road concerned would be satisfactory to the other. Although they are warmly favored by many signal experts,

it is impossible to predict as yet whether these signals will ultimately displace those now in service.

British Practice in Railroad Accident Inquiries and Railroad Inspection.

BY LIEUT.-COL. H. A. YORKE, CHIEF INSPECTOR.

The Regulation of Railroads Act, 1842,* renders it obligatory upon every railroad company to give notice to the Board of Trade of its intention to open for passenger traffic any railroad or section of a railroad. This provision has no reference to lines used wholly for goods traffic. On receipt of such notice the Board of Trade is required to cause the line to be inspected before the opening takes place. If the officer appointed by the Board should after inspection report to the department that in his opinion "the opening of the line would be attended with danger to the public using the same, by reason of the incompleteness of the works or permanent way, or of the insufficiency of the establishment for working such railroad," the department may direct the company to postpone the opening of the line for one month at a time, the process being repeated from month to month as often as may be necessary. The company is liable to a fine of £20 a day if it should open a railroad in contravention of such order. The inspections made by the officers of the Board of Trade are very complete, the permanent way, bridges, viaducts, tunnels, stations and other works are carefully examined, iron and steel girders are tested, and the signalling and interlocking are thoroughly tried, and every means are employed to ascertain that the railroad has been constructed and completed in the most satisfactory manner. A simple code of requirements has been prepared by the department for the guidance of railroad companies, and as the special circumstances of each line are considered on their merits it does not often happen that it becomes necessary to postpone the opening of a new line. The Act does not authorize the department to inspect any railroad, or part of a railroad, after it has been opened, unless some alteration or addition is made to it, such as the construction of an additional line, deviation line, station, junction, or crossing on the level, in which case the new works are required to be inspected. It is the duty of the company to maintain the line in accordance with the standard of efficiency which it originally possessed, but whether it does so or not the Board of Trade has no power to interfere. It may be of interest to state here that all tramways or street railroads, or any extension of them, whether worked by horses, steam, cable, or electricity, have also to be inspected for the Board of Trade and "certified as fit for traffic" before they may be opened for public use.

The Regulation of Railroads Act of 1871 renders it obligatory on all railroad companies to give notice to the department of any accident which may occur in or about the railroad, or any works or buildings connected therewith, that is to say, any accident attended with loss of life or personal injury to any person whatsoever, any collision in which one of the trains is a passenger train, any passenger train or part of such train leaving the rails, or any other accident likely to have caused loss of life or personal injury, specified on that behalf by any order made from time to time by the Board of Trade. On receipt of such report the department is authorized to cause an inquiry to be made into the cause of any accident so reported, and the officer appointed to hold the inquiry has power to enter upon any railroad premises for the purpose of his inquiry, to summon any person engaged upon the railroad to attend the inquiry as a witness, and to require the production of all books and documents which he considers necessary for the purpose. There is no statutory procedure laid down for such inquiries, which are conducted in the manner that seems to the officer best suited to the circumstances of the case, but a fairly well recognized procedure has grown up. The site of the accident is first visited, and a careful investigation made of all the circumstances attending the disaster. An adjournment is then made to a room, and the evidence of the various witnesses is taken down verbatim. The court is not a court of law, and witnesses are not examined on oath, nor is the officer bound by the strict law of evidence; it is simply a court of inquiry. The admission of the general public and of the press rests within the discretion of the officer; the usual practice being to admit the press and public in cases of general interest, unless there has been loss of life, and there is any chance of any servant of the company, or of any other person, being put upon his trial for manslaughter or other grave offence, such as criminal negligence, in which case it is not as a rule considered advisable to admit the press, etc., lest the person implicated might be prejudiced by anything that transpired during the inquiry. It must be clearly borne in mind that the inquiry by the Board of Trade is for the purpose of ascertaining the cause of the accident with the view of preventing a recurrence of the same, and not for the purpose of penalizing anyone; the latter is left to be dealt with by the usual process of law. A Board of Trade inquiry, therefore, is in addition to, and independent of, any proceedings before the coroner or magistrate. The Act of 1871 confers upon the coroner, when holding an inquest on the death of a person occasioned by a railroad accident, the right to request the Board of Trade to appoint an inspector, or some person possessing special knowledge, to act as assessor to the coroner, and this is sometimes done. But such a course does not prevent the department from holding an independent inquiry. The same Act empowers the Board of Trade to hold what is called a "formal investigation" into the cause of any accident in lieu of, or in addition to, the less formal inquiry to which reference has been made. In the event of such "formal investigation" being held, the Board may appoint "any person or persons possessing special or legal knowledge to assist an inspector holding the inquiry, or may "direct the county court judge, stipendiary magistrate, metropolitan police magistrate, or other person" to hold the inquiry with the assistance of an inspector or any other assessor. Such an investigation has to be held in open court, and the witnesses may be examined on oath, and the court has all the powers of a court of summary jurisdiction, besides all the powers of an inspector under the Act. But the necessity for holding such a formal investigation has very rarely arisen. The inspector after making his inquiry is required to make to the Board of Trade a report as to the causes of the accident and the circumstances attending the same, with any observations on the subject which he deems right, and the Board "shall cause every such report to be made public in such manner as they think expedient." The usual manner of publishing such reports is to forward them to the railroad companies concerned, and to the press, and to anyone else who is interested. The reports are subsequently included in a "blue book" and presented to Parliament. It should be noted that although the officer may in his report make recommendations with a view to guarding against any similar accident occurring in the future, no power is given to the Board of Trade, or any other authority, to compel any railroad company to adopt such recommendations. This omission is sometimes criticized as a defect in the Act, but it is not really so. The moral effect of the publication of the report with the criticisms of the company's methods is great, and it seldom happens that a company refuses to adopt, or at least to test the recommendations made by the officer who held the inquiry. If, however, the company is of opinion that the suggestions of the officer are not likely to be useful, or are for any reason inexpedient, the company is at liberty to reject them, the responsibility of so doing resting on it. The effect of this latitude is to give the company discretion in the matter, and to enable the Act of Parliament to be administered without undue interference.

An important Act was passed in 1889, putting on the Board of Trade the duty of calling upon all railroad companies throughout the United Kingdom to adopt upon all lines carrying passengers the system of block working; to interlock points and signals, and to fit all trains carrying passengers with "continuous brakes." A reasonable time was allowed to the companies in which to comply, and the work is now practically complete. In respect of block working and interlocking, therefore, the lines of the United Kingdom are far ahead of those of any other country, and a marked diminution of accidents, particularly of collisions, has resulted from this cause. The use of the electric staff or electric tablet for single line working, which practically combines the principle of block working with the use of the ordinary train staff, is held to be a compliance with the Act. If, however, the ordinary train staff is used in conjunction with train "tickets," then block instruments have to be provided in addition. When the line is of such small importance that the traffic can be handled by one engine in steam, block instruments are, of course, not required. The effect of the regulations is that single lines as well as double lines in Great Britain are worked with a remarkable immunity from accident, and head-on collisions are almost unknown.

In addition to the Acts of Parliament safeguarding the interests of passengers, recent legislation has been directed to the protection of the servants of railroad companies, and investigations are held into numerous cases of injury, fatal or otherwise, which befall railroad men. A code of rules has been drawn up by direction of Parliament for the safety of the men, and further rules are at present under consideration.

There are four inspecting officers, whose duties are chiefly, though not entirely, confined to the inspection of new railroads and tramways, or new works on railroads, *e. g.*, signal boxes, stations, sidings, junctions, etc., and to the investigation of accidents to trains. There are also two assistant inspecting officers and three sub-inspectors, whose duties are chiefly directed to the investigation of accidents to railway servants. The above staff deals with all the railroads and tramways in the United Kingdom, including Scotland and Ireland. The duties are sufficiently onerous and responsible. The relations between the officers of the Board of Trade and the officers of the railroad companies are of a friendly nature, and the latter do all they can to assist the former in the performance of their duties.

* An earlier Act of 1840 contained similar, but less complete, provisions, and inspections of railroads prior to 1842, and inquiries into accidents prior to 1871, were held under the Act of 1840. The earliest recorded inspection took place in November, 1840, and the earliest recorded inquiry into a railroad accident was made in August, 1840.

Increasing the Earning Capacity of Freight Cars.*

The only restrictions to further enlargement in the number and capacity of locomotives and cars are the track and bridge gage, clearance and weight limitations, and the ability of industrial tracks and terminal facilities to receive the equipment. Ten years ago industrial works received their ore, pig iron, billets and similar materials in carload lots of 66,000 lbs., whereas with modern equipment this limit has been raised to 125,000 lbs.; the limit for coal has been increased from 60,000 lbs. to 110,000 lbs.; for coke from 40,000 lbs. to 70,000 lbs.; for cotton, grain and merchandise from 66,000 lbs. to 88,000 lbs., and for other items of carload freight the limits have been relatively increased. The bulk capacity of open cars has been enlarged from 800 to 2,000 cu. ft., and of box cars from 1,700 to 2,400 cu. ft. The length, width and height of cars have been extended in proportion, and the benefit to shippers and dealers in the way of increased tonnage per lineal foot of track space, reduced number of cars to handle and consequent decrease in switching charges and expense for loading and unloading freight is therefore quite apparent.

The general tendency has been to increase the weight of cars in somewhat greater proportion than the capacity, for the purpose of insuring sufficient strength in the equipment to favor the shipper by reducing the cost for loading and unloading freight and to enable the manufacturer or wholesaler to assemble a greater proportion of his output in one unit at the mill, factory or warehouse, thereby lessening the expense of handling and assembling this material at its destination.

In addition to the large number of freight cars placed in service, due consideration must be given to this increase in the comparative strength and carrying capacity. For instance: Assuming that there are 10,000 tons of coal to move from the mine region to a lake port for the lading of one boat, and likewise a quantity of ore to move from the same port to the furnaces, with a given number of cars assigned to such transportation service; ten years ago to have moved this coal would have required the use of 333 cars which could have returned with 11,000 tons of ore. To-day 182, or about 55 per cent. less, cars of modern design can transport the same amount of coal and return with 11,375 tons, or 3½ per cent. more ore, all of which has reduced the dock and mill yard, switching, loading and unloading facilities required by shippers and dealers. On the other hand, the railroads, in order to handle these larger capacity cars, have found it necessary to increase the strength of roadways and bridges, enlarge tunnels, elevate overhead structures and make relatively greater and more costly expenditures for track and equipment and for maintenance and operation.

Business has outgrown the storage, loading and unloading facilities for carload freight, and the railroads are expected to carry the burden of traffic congestion and of the extravagant use of cars for warehousing instead of for transportation purposes, whereas this expense should properly be borne by the producers, shippers, receivers and exporters. The matter of terminal facilities is the limitation of handling business during times of heavy traffic.

Design and Construction.

Compact train loads increase and accelerate movement by reducing the cost for switching and transporting traffic. Therefore, in the design of freight cars it is advisable to arrange for the maximum volume and weight of lading per lineal foot of track space and for the quick loading and unloading of the greatest variety of commodities.

While convertible features should not be embodied in equipment to an extent that would result in extraordinary first or maintenance cost, a limited number of practical arrangements, such as movable floors, ends and sides may be combined to provide a car suitable to carry and dump lading such as coal, ore, dolomite, sand and similar material into manufacturing plants, and to be loaded with billets, pig iron, pipe, plate, structural steel and other commodities, thereby enabling it to carry freight both coming and going, thus reducing the light car mileage to a minimum.

Wood should be used in freight car construction only where it is required to provide for the cleating and otherwise bracing and building up of certain classes of lading and where metal would not insure the proper insulation against heat or cold.

Of the various items contributing to freight car delays and failures, the couplers, coupler yokes, draft gear and their attachments to the underframes, body and truck bolsters and the wheels and brake equipment contribute either directly or indirectly to the greatest extent. A combination of coupler, coupler yoke and draft gear of sufficient strength and elasticity to withstand the locomotive maximum drawbar pull and the punishment due to buffing shocks will, when securely attached along the center line of draft to the center sills in such a manner as to distribute the stresses at the greatest number of points and over the largest area, materially reduce the coupling difficulties.

The use of substantial body and truck bolsters that will carry the ultimate load at the center plate; of anti-friction center plates and side bearings, and of ample lateral movement for couplers at the end sills will do much to reduce train resistance, wheel flange wear and liability for derailment. However, so long as the rail section now generally in use is continued it will be difficult to prevent rapid wheel flange wear and possibility for breakage.

Interchangeability of Parts.

While the Master Car Builders' Association has made much progress in promulgating general practices and adopting standards of minor parts of cars, the changed conditions now make it essential that car bodies and trucks as a whole, of similar kinds and classes, shall be simplified by standard practice and made interchangeable, and it is anticipated that some final action along these lines will result from the coming meeting.

Maintenance.

The number of loaded and empty system and foreign revenue freight cars (exclusive of cars in bad order condition under load at destination), held over each day (except after Sundays and legal holidays), for all classes of accident and ordinary repairs, should not exceed 3 per cent. of the total system and foreign revenue cars on the line and the repair force and material should be so regulated that no more bad order cars will be detained each day than the number repaired, every preference being given to loaded and empty cars that are in the greatest demand for the movement of the business offered. When the earning capacity averages from $2.50 to $3.00 per day for each freight car available for service, the interest on an investment for shop facilities to adequately economize and increase the output can be readily justified.

Indifferent foreign cars should be put in proper repair for loading and not returned to the owners light except when generally worn out by age and decay, or unless lading is not available and a home station is close by. This practice will avoid loss due to light mileage and additional damage to the car through its movement in a defective condition.

Terminal and Interchange Inspection.

The object of the Master Car Builders' Rules is to facilitate the movement of cars in interchange service and to place the responsibility for defects which may or may not make a loaded or empty car unfit for service. However, the intent of the rules is frequently nullified through a lack of good judgment owing to the somewhat general impression that the ability of a car inspector is decided by his record as a "car stopper" rather than as a "car mover," and the holding of cars by unintelligent inspection or on technicalities at joint and interchange points, is responsible for much delay to traffic, expense for transferring lading and loss of use of equipment.

Cars set off on the line of road due to bad order condition of couplers, draft attachments, wheels or brakes; heated bearings; shifted lading and other similar causes are usually the outcome of improper inspection, repairs, adjustment or testing of brakes, lubrication and loading at originating terminals, and result in accidents, destroyed lading and cars, reduced train rating, delays to traffic, blocking of passing sidings, engine and train crew overtime and extraordinary expense for sending men and material out on the line to make repairs. The elimination of rules and inspection points which are unnecessary to maintain cars en route in a serviceable condition for operation and safe for trainmen and lading; fewer and more thoroughly trained car inspectors; agreements between connecting lines that will keep cars moving on such interchange records as will insure proper accounting for repair charges; a greater number of more competent car repairmen and more thorough attention given to equipment at the unloading and loading points will, without a doubt, reduce some of the present line delays.

Loading and Unloading.

In general, shippers and dealers have been greatly benefited by cars of increased cubical and weight capacity per lineal foot of track space; by improved designs requiring the least expense for loading, building up of lading and unloading; by greater tonnage per car requiring less cars to be switched and by reduced terminal car mileage, while the railroads have not derived a proportionate increase in revenue to make up for the increased initial and operating cost, due to the sluggist movement of tonnage at terminals; reduced proportion of paying to dead load and an increased expense on account of rougher handling, and greater depreciation due to wear and tear.

During the transition from the light to the heavy capacity cars, the minimum weight limits for carload rate lading, which should be such as will insure full loading of the car, have remained stationary and this has made it difficult for railroads to demonstrate the advantages of the more modern service provided. The longer time taken for loading and unloading has also contributed materially to the inability of railroads to derive from their enlarged and improved trackage, terminal yard, motive power and operating facilities the movement of revenue freight that their investment has provided.

While cars are intended for the legitimate purpose of transportation, they do everything but spend the majority of their time in moving freight, and the existing situation should be remedied by restricting the free time allowance for loading and unloading carload freight to the real necessity of shippers and receivers who have pro-

*Extracts from a paper by J. E. Muhlfeld, Gen. Supt. Motive Power, B. & O., read at the March meeting of the Railway Club of Pittsburg.

vided adequate track and storage facilities to handle their business, and who do not require that the railroad terminal yards and equipment shall be incapacitated through their failure to handle lading on and off cars promptly.

Railroads should not be required to provide equipment to meet extraordinary transportation demands, when sluggish handling, for which they are not responsible, exists at terminals, but it is proper that they should apportion the car supply on the basis of the time required to load and unload, and to refuse to furnish cars at regular rates to those who have no handling or storage facilities and who make extravagant use of railroad company's equipment and tracks from which to handle business purchased by them in carload lots.

With the present earning capacity of freight cars the collection of the demurrage or rental charge in excess of the free time allowed, reimburses railroads to only a slight extent for the revenue that could be derived if the equipment was available for its legitimate purpose instead of serving time and increasing the expenses by a greater physical depreciation and interest on the investment than would be the case if it was employed in transportation.

The railroad demurrage rules and rates should be brought more nearly to a basis commensurate with warehouse storage charges, so that the value of their equipment, tracks and terminal space will have similar earning capacity. While legislation exists permitting railroads to impose demurrage charges for delays in unloading, there is none to compel the consignees to unload cars, although a decided reduction in the free time and other concessions allowed shippers whose business has outgrown their warehouses, elevator and other storage facilities would not be unreasonable.

A commercial or industrial organization would not think of allowing the equipment upon which it is dependent for its output to lie dormant for 21 hours during each 24-hour period, but this is the freight car situation of railroads which are to-day being criticised for the non-movement of important traffic. Under these conditions the consignors and consignees directly concerned are the only persons benefited, and instead of a shortage of car supply there exists a shortage of car movement.

To insure the prompt handling of the traffic of those consignors and consignees who have provided suitable and adequate facilities for forwarding, receiving and storing freight, it is but proper that such rules should be promulgated as will give them the same proportionate benefit of the improved railroad facilities that their own progress and investment justifies. This might be satisfactorily accomplished by increasing the present extremely low tariff rates and allowing a commutation on the total freight charges in lieu of a proportionate reduction in the maximum free time allowance for loading and unloading equipment after consignors or consignees have been notified that the cars are subject to their disposition. By this means a premium in addition to the established demurrage charges would be exacted from those dilatory shippers and dealers who do not co-operate with each other or with the railroads to reduce the idle time of cars, and the public would be materialiy benefited.

Distribution and Movement.

To accomplish better results in the distribution and movement of cars, a combination of greater lading and quicker handling is necessary, and some of the following rules may be worthy of consideration:

The distribution of the year's business and regulation of the movement of the general commodities required for living purposes to conform to the periods of greatest supply and demand and to the capacity of the railroads to handle the same, preferably during the season that gives the combined maximum speed and train load.

The distribution of cars as between shippers on the basis of their capacity for output and ability to promptly load and secure disposition of lading and release of equipment at destination.

A restricted supply of equipment to shippers and dealers who practice obsolete business methods and load and hold lading in cars subject to future market conditions.

The distribution of cars, as between railroads, on the basis of the number, cubical and carrying capacity of cars of the different classes owned; on the routing of the lading and on the mileage of the originating and non-originating traffic over the various lines.

Cars of such general condition that they cannot be depended upon to promptly pass inspection at interchange points should be restricted to owners' lines where company's material, local freight or other suitable lading can be hauled with the least liability of delay, transfer or repairs.

An increase in the carload minima commensurate to the enlargement in the equipment and the confining of classes and capacities of cars most suitable for local shipments to the territory where they will average the greatest amount of lading per carload lot.

The use of cars for such commodities as will permit of maximum lading, quick loading and unloading and non-interference with the use of the equipment for its designated purpose.

The non-use of railroad revenue service cars for the handling of mill refuse, garbage and like materials.

A public storage for bulk freight that cannot be promptly disposed of or trans-shipped at lake and tidewater ports; a reduced and uniform free time allowance for all commodities and an increased demurrage charge for cars placed on railroad and industrial tracks for loading and unloading.

The billing of lading in carload lots from origination to final destination and the discontinuance of costly stopover privileges for sampling, transferring or milling grain, dressing lumber, compressing cotton and like manipulation involving rebilling at intermediate points.

A curtailment of the reconsigning and readjusting privilege and an increase in the charge.

To stimulate the making of quick repairs, bad order cars to be no exception to per diem rules covering serviceable cars, except where unsafe to load on account of general worn out condition due to age or decay.

System cars consigned to company's use to be placed under car service charges.

A system of tracing for the location of delayed shipments in cars standing on siding, yard, repair and storage tracks, for the purpose of facilitating the movement.

The classification of trains to increase the main line movement of cars through or around the greatest possible number of intermediate terminals and to reduce the switching movement.

The non-holding of motive power for maximum train loads to be moved against the flow of traffic.

The prompt and regular movement of freight from loading to unloading points and advance information as to movement and arrival to be given the consignee.

The running of trains at regular intervals and with respect to the destination of cars rather than from one division terminal to another.

Reduced delays to trains at origination and destination terminals and en route, and the maintenance of a uniform schedule speed equivalent to at least 75 per cent. of the average running speed.

Locomotives suitable for the handling of trains of the greatest permissible tonnage at the maximum allowable speed over the different operating divisions should be used and loaded with a reasonable remaining surplus of power to prevent liability of trains failing to make schedule time.

Track Deformations and Their Prevention.*†

BY G. CUENOT,
Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway.

VI.

EXPERIMENTS WITH THE DECLIMETRE.

The object of the experiments with the *déclimètre* was to measure the bending of the tie and to bring about the overturning of the fastenings under increasing forces, having as an effect the spreading of the track to the limit (.98 in.), where it is considered as out of service.

This apparatus is essentially composed of a screw and nut, and rests on the heads of the two rails, under conditions similar to those of the wheel tires. The screw acts, through the intermediary of a ball and piston, on glycerine, which is contained in a reservoir, the pressure of which is registered by a pressure gage; it tends to spread the two rails, and the force causes the tie to assume a convex curvature. (See Fig. 14.) The displacement of the rail is registered and amplified by an independent instrument.

This apparatus serves also to measure the resistance of the track to lateral displacement, by supporting it against an abutment pier, and by acting on a single rail.

The experiments were made on composite and wood ties, at first in separate units, then by groups of two, each distant from the other (13.78 in.). The ties were placed on two supports, nearly of the length corresponding to that of the tamped bed. Steel ties in use on the state system were also experimented with, under similar conditions.

The apparatus was fixed, in the first case, in the axis of the tie to be tried, and in the second case, in the center of the two ties. In order to measure the curvature of the pieces, which it tended to produce, and which made known, so to speak, the degree of their rigidity, there was opportunity for estimating the importance of the flexures from their initial position which these pieces underwent. To this effect a right line was traced on the ties, whose two extreme points were placed near the ends of each of the pieces, and, at a given moment, the flexure in comparison with this line, now become curved, was measured, by describing with the same points a new right line, and by observing the departure of these two lines at the middle of their length.

This apparatus, which tended to spread the two sections of rail, acted at first on the tie, to induce its flexure; then, when this had attained a certain degree, which corresponded to the bending

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†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.

of the head of the screw spike on the plate, apart from its shoulder, the fastenings, principally those placed in the interior, commenced to be overturned, up to the moment when the base of rail escaped from the head of either of the interior screw spikes. (Fig. 15.) This effect was obtained without increase of force.

These experiments have shown that there was reason for consolidating the interior fastenings, and for increasing the number in comparison with the exterior fastenings. The good effect of the reinforcement of the plates in use on the P. L. M. system was also proved. In the type employed, the head of the screw is only partially sustained by the shoulder; it has then a tendency to overturn in the empty space until it meets the exterior part lying below the shoulder. There results a weakening of the fastening and a bedding of the screw spike which diminishes the resistance to this one in the interior, in the second, two in the interior and one on the exterior. The *déclimètre* was placed, as in the preceding experiments, in the axis of the tie. The forces were successively exercised, and were noted for each spread of the rails of .2 in. up to .98 in., where the track is considered out of service. The deformations of the beam, placed on two supports right at the rails, were read in comparison with the lower and horizontal edge of a steel rule, resting on invariable supports parallel with the tie. The latter was raised at the center in comparison with its original position, and lowered at its extremities; the curve of deformation was thus convex upward.

It would take too long and be without great interest to give the detail of all these experiments. They are summarized in the table hereafter:

"Summary of Maximum Results Obtained.

Experiments made.	Plates employed.	Composite ties. Forces.	Spreading.	Flexures.	Oak ties. Forces.	Spreading.	Flexures.	Steel ties of the State. Forces.	Spreading.	Flexures.
		One screw spike in the interior						A bolt in the interior		
Single ties.	Ordinary	7,899 lbs	0.75 in	0.18 in.	7,877 lbs.	0.95 in	0.41 in	8,267 lbs	0.87 in	0.47 in
		Two screw spikes in the interior.						Two bolts in the Interior.		
		16,311 "	0.18 in.	0.28 in.	16,259 lbs.	1.08 "	0.82 "	18,298 lbs	0.98 in	0.91 in
	Reinforced	One screw spike in the interior								
		8,303 "	0.77 in.	0.17 in.	9,294 lbs.	1.02 "	0.51 "			
		Two screw spikes in the interior								
		16,755 "	1.17 in.	0.43 in.	18,930 lbs.	1.31 "	0.81 "			
Twin ties.	Ordinary	One screw spike in the interior								
		*18,960 "	0.98 in.	0.28 in.	17,086 lbs.	0.98 "	0.36 "			
		Two screw spikes in the interior.								
		*33,620 "	1.18 in.	0.46 in.	32,518 lbs.	1.18 "	1.01 "			
	Reinforced	One screw spike in the interior.								
		17,968 "	0.89 in.	0.32 in.	19,841 lbs.	0.98 "	0.46 "			
		Two screw spikes in the interior.								
		35,677 "	1.30 in.	0.51 in.	39,683 lbs.	1.38 "	0.89 "			

*This experiment was not continued since the maximum force was not reached.

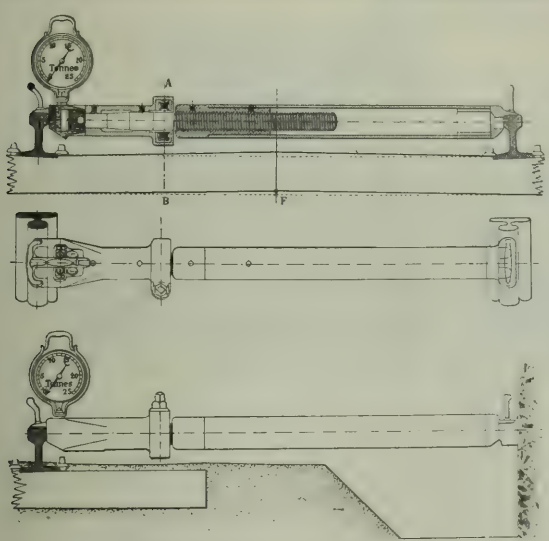
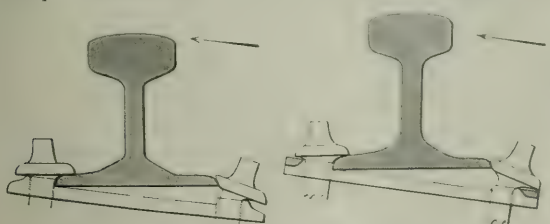


Fig. 14—Declimetre; Longitudinal Section, Plan and Elevation.

kind of force. The rail is no longer maintained by the screw spike, and generally escapes from the fastening. In order to remedy this disadvantage, it is sufficient to prolong the shoulder of the plate on the exterior. In the trials which followed, the interior screw spike took the position indicated in Fig. 15, and the resistance to overturning was increased by 20 per cent.

The experiments with the *déclimètre* were carried on in like manner with the steel ties of the State System. The rails were fixed on the ties through the intermediary of steel plates, with an inclination of 1 in 20, and bolted on their upper surface. Three bolts per rail were used in the first test, two on the exterior and



Not reinforced. *Reinforced at ends.*

Fig. 15—Ordinary P. M. Tie Plate.

This table shows: (1) that the forces were proportional to the number of interior fastenings; (2) that the forces sustained by the composite ties, provided with ordinary plates, were a little superior to those undergone by the wood ties, but that the inverse result was obtained in the experiments with reinforced plates. This fact can only be explained by the more complete reinforcement of the shoulder of the plates employed on the wood ties. In fact, for these latter pieces, the shoulder was prolonged in an inclined plane, C D, by adding a piece A B C D (Fig. 16), while we were satisfied, for the plates intended for composite ties, with a plane G H (Fig. 16), much less inclined; thus the heads of the screw spikes were found to be more supported on the first plates (Fig. 18), than on the second (Fig. 16), which explains the difference in the increase of the forces.

It may therefore be concluded that with plates absolutely identical, the forces would have increased in the two cases in the same proportion. Whatever it may be, no track is submitted in practice to the forces which were obtained, and these latter can always be considered as maxima, which will never be reached.

DEFORMATION OF TIES.

The curves of deformation of these different ties, a deformation which was obtained by spreading the track, acting horizontally on the rails, are those which give the application of the theory, and the theoretical flexures are very close to those which were observed.

The moment of the flexure to which the wood and steel cross

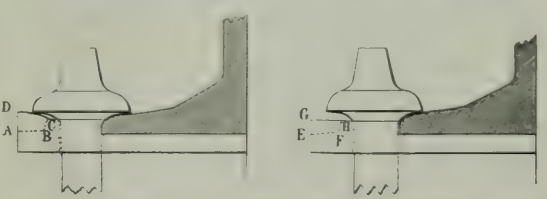


Fig. 16—Tie Plates Used on Wood (Left) and Composite (Right) Ties.

ties are submitted is constant for all sections; the curve of deformation, determined by the condition that the beam, resting on two supports right at the rails, is horizontal at the middle of the span, is then represented by the equation:

$$E\,I\,y = \frac{K\,x^2}{2} - \frac{K\,l\,a\,x}{2}.$$

in which K represents the moment of constant flexure, l the half span of the beam, a the length between the extremity of the beam and the rails, by taking as the origin of co-ordinates the middle of the beam, and as axes the neutral line and the perpendicular erected at its middle.

It has been deduced from it that the total bending of the beam, which is equal to the sum of the flexures, at the middle and at its extremities, is given by the expression:

$$\frac{K\,l^2}{2\,E\,I}$$

The table following permits a comparison of the observed and

theoretical flexures, calculated as has just been described; the flexures obtained have been taken by attaching the rails to the cross ties with the screw spikes in the interior, which assures the greatest solidity to the fastening, and an integral transmission of the force to the beam:

Value of the force.	Bending moment of the Wooden.	Steel.	Flexures — Wooden ties — Observed	Theoretical.	Steel ties — Observed.	Theoretical
2,205 lbs.	180					
4,409 "	360		0.40 in.	0.24 in.		
5,291 "	432	323			0.26 in.	0.29 in.
8,818 "	720		0.64 in	0.47 in.		
9,920 "	810	605			0.44 in.	0.55 in.
11,023 "	900		0.80 in.	0.59 in.		
13,228 "	1.080		0.78 in	0.71 in.		
13,669 "	1.116	834			0.59 in.	0.76 in.
15,432 "	1.260		0.75 in.	0.83 in.		
16,259 "	1.328		0.82 in	0.88 in.		
16,314 "	1.332	995			0.69 in.	0.91 in.
18,298 "	1.494	1.116			0.91 in.	1.07 in.

Two observations may be made on the results set down in this table:

1. The theoretical flexures of the wood tie are sensibly equal to the flexures observed within the limits of elasticity of the wood, that is to say, in the case in question, up to a force of 11,023 lbs., corresponding to a bending of .79 in. When this bending is reached, it is remarked that, under increasing forces, the bending diminishes, which corresponds to a new state of the body, which takes a permanent deformation, and is extended while taking a less curvature. Besides, from this moment, the wood becomes brittle, and several ties were broken under the plate, where the weakest section is found by reason of the adzing for the plate.

2. The theoretical flexures of the steel tie are a little superior to those which were observed. The reason for it is the following: The plates of support for the rail were riveted to the upper surface of the cross tie and became a part of it. An increase of section results, for a notable length of the beam (about 23.62 in.), and, consequently, of the moment of inertia; the latter, which in the normal section is only 168, is increased by the moment of the plate, that is to say 256, a value which reaches nearly double the inertia of the section of the ties.

The latter has, then, from this fact, an exceptional rigidity, which explains the difference observed between the theoretical and recorded flexures.

STRESS OF METAL AND OF WOOD.

It is possible, after having studied the deformation of cross ties; to investigate the stress of metal and wood resulting from this deformation. It is given by the formula:

$$R = \frac{x\ z}{I}$$

in which R is the stress per unit of surface, x the bending moment, $\frac{I}{Z}$ the resisting moment of the beam.

The table which follows gives for each force the maximum stress to which the extreme fiber of the sections is submitted.

Value of force.	Moment — Bending — Wood tie.	Steel tie.	Resisting — Wood tie.	Steel tie.	Value of force, in lbs. per sq.in. — Wood tie.	Steel tie.
2,205 lbs.	180	135	18	30	355	6,400
4,409 "	360	270			711	12,800
5,291 "	432	323			853	15,645
8,818 "	720	540			1.422	.....
9,920 "	820	605			.....	28,589
11,023 "	900	675			1.778	.....
13,228 "	1.080	810			2,133	.....
13,669 "	1.116	838			.....	39,498
15,432 "	1.260	945			2.489	.....
16,259 "	1.328	992			2.617	.....
16,314 "	1.332	995			.....	47,164
18,298 "	1.494	1.116			.....	52,910

It is observed: 1. That the wood tie was stressed, in the experiments accomplished, very near to the limit of elasticity of the material which composes it, since the latter is nearly 2,133 lbs. per sq. in., as was established in the study of the deformation. The result to be drawn is that a wood cross tie ought never to take a flexure greater than 0.40 in. under penalty of being exposed to rupture.

2. That the steel tie was stressed to a limit near that of rupture, 52,626 lbs., in place of 64,004 lbs. per sq. in., and that it has a resisting moment little higher, since, under a feeble force its stress reaches the limit generally admitted, 6,400 lbs. per sq. in.; it is true that the plate or the chair can reduce in a large measure the calculated stress.

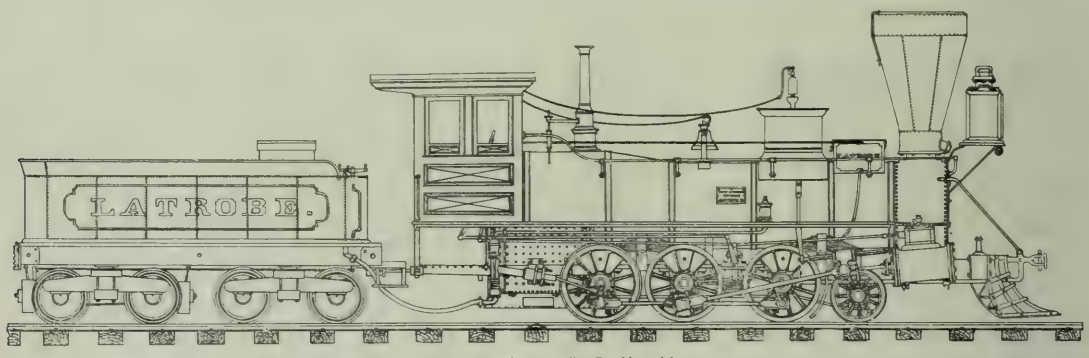
(To be continued.)

Smith & Perkins, and Their Locomotives.

BY C. H. CARUTHERS.

Few of the ycunger railroad men of to-day are probably aware that locomotives were once built in Alexandria, Va., but those who were actively engaged on railroads in the years immediately preceding, and during the ten or twelve following the Civil War, and who are still living, know that from 1851 until 1858 the Virginia Locomotive Works, conducted by Smith & Perkins, was located at that place and turned out during that time a number of locomotives which proved very satisfactory to the companies for which they were built. Perhaps the greater proportion of the output was sold to roads centering in or near Alexandria, although two were built of the Hayes 10-wheel Camel type for the Baltimore & Ohio, two for the Allegheny Portage Railroad, of the state system of Pennsylvania, and fifteen for the Pennsylvania Railroad. One of those first referred to was of 4-4-0 type named "Virginia," and is said to have had a good reputation for speed.

Nearly all differed in many respects from other locomotives



The Latrobe, P. R. R. No. 41.
Built by Smith & Perkins, Alexandria, Va., 1852.

then in service, and although some of these differences in construction were not found to be altogether desirable, the engines had many points of merit, and were built of good material and of excellent workmanship. All were fine steamers and very quick. The quality of materials used in their construction was fully shown when an attempt was made to explode the boiler of one after it had been put out of service at the end of fifteen years from the date of its construction. This trial was made at a point near the Horseshoe Bend, used by the Pennsylvania railroad company for such experiments, and although every conceivable condition was tried under which a locomotive boiler was likely to explode, all were unsuccessful.

The line-drawing of engine "Latrobe" (later No. 41) shows the exact appearance of the first two Smith & Perkins' locomotives built for the Pennsylvania Railroad, and the two built for the Allegheny Portage Railroad, at the time of coming on their respective roads in 1852. The design was exactly alike in all four, although the two Portage engines were considerably heavier than the other two. It will be noticed that the boilers were of wagon-top type with a column containing the safety-valves located near the front of the roof-sheet. This column was surmounted by a neat escape pipe of polished brass. The dome was well forward on the barrel of the boiler, and the whistle was on the center of its cover.

The cylinders were slightly inclined, without castings of any kind, and were bolted to the frames and sides of the smokebox. Single guides of diamond-bar pattern were used, and but one valve was in each steam-chest. This valve, however, like those on the Winans Camels, could be worked either at full or half stroke by the type of drop-hook gear used, which was illustrated in the *Railroad Gazette* of Aug. 17, 1906, page 142. Each engine was carried on three pairs of driving wheels and one pair of leading wheels, all placed between the cylinders and firebox, and with the axle-boxes of the leading wheels held in rigid pedestals on the main frames,



"Buckhorns."

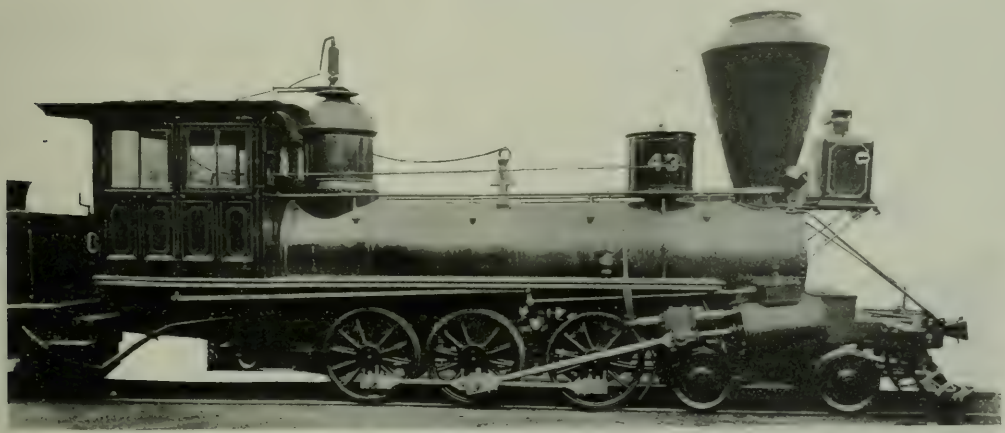


Odd Dome Casing.

exactly like those of the drivers. It has never been clear to the writer what the builders expected to gain by using this smaller pair of wheels arranged rigidly, instead of another pair of drivers, which would have given the advantage of 12,400 lbs. additional weight for adhesion, and the engines would doubtless have rounded curves as well. With the arrangement used, no flanges were on either the first or second pairs of drivers. Two pumps were used on each engine and were placed, one on each side, behind the rear pair of drivers, from the pins of which they were driven by return cranks. The smoke-arches were square at the bottom and quite deep. The cabs were well lighted, and had two panels on each side sloping

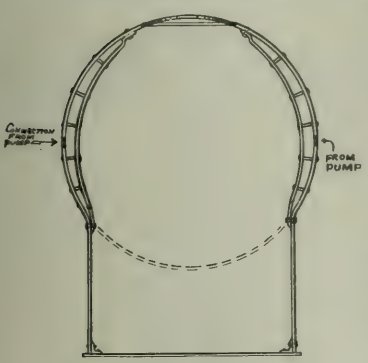
the Pennsylvania when that company bought the state improvements in 1857.

From the half-tone of No. 43, reproduced from a photograph taken of that engine, which was another of the four, soon after it had received a new firebox and other repairs at the Pittsburg shops in 1863, it will be seen that the dome has been taken off the forward part of the boiler barrel and placed on the roof-sheet, with the safety-valves on the cover, and a large cylindrical sandbox of a type used extensively by the Pennsylvania for a time on freight engines, has been substituted for a square one like that shown on "Latrobe." A four-wheel vibrating truck has also replaced the single pair of leading wheels, and one non-lifting injector replaced the two pumps. The drop-hook valve motion is retained, but without the cut-off hooks and straps, although the cut-off eccentrics, which were cast solid, were not removed from the axle, nor the "half-moons" for its control from the auxiliary reversing shaft. This engine had been originally built with an excess of overhang at the rear, and showed a dangerous tendency to lift the front end from the rails when running. It was, therefore, relegated to yard service at Pittsburg, and even then ran with a considerable weight of scrap iron piled in a box on the short space between the smokebox and the bumper. It was thought that the introduction of the four-wheel truck in 1863 would remedy this trouble, but one or two trips over the division soon dispelled this illusion and the engine spent the next twelve years in further yard service, and was then cut up. The stack shown on it was an adapta-



P. R. R. No. 43 (Altoona).

Built in 1852 at Alexandria, Va., by Smith & Perkins. The only changes from the original form are cab, smokestack, pony wheel truck, sandbox, dome case and removal of dome from waist to roof-sheet. A column containing the safety valves at first occupied the roofsheet. These valves are now shown on the dome cover. The four-wheel truck replaces the original single pair of 30-in. leading wheels carried in rigid pedestals. The injector shown replaces a pump which stood in about the same place and was driven by a return crank on the pin of the rear drivers. Such an arrangement also existed on the left side. No 43 was scrapped in 1876.



Water Spaces in Smokebox.
Smith & Perkins, 1853.

uniformly at the ends and sides from a raised point in the center of each. The sandboxes were square with polished brass trimmings around the edges, and the name of the engine was in letters of the same material placed in the center of each side of the boxes. Bands of polished brass also encircled the Russia iron jackets of the boilers. The dome-casings were of plain sheet iron painted, with mouldings at top and bottom of cast iron. The painting consisted of vermilion on the wheels and the mouldings of the dome-casings, and green on the plain parts of the sandboxes and dome-casings, and the cabs.

After several years' service, "buckhorn" stands for the safety-valves with the whistle between the branches, were placed on the columns on the roof-sheets of three.

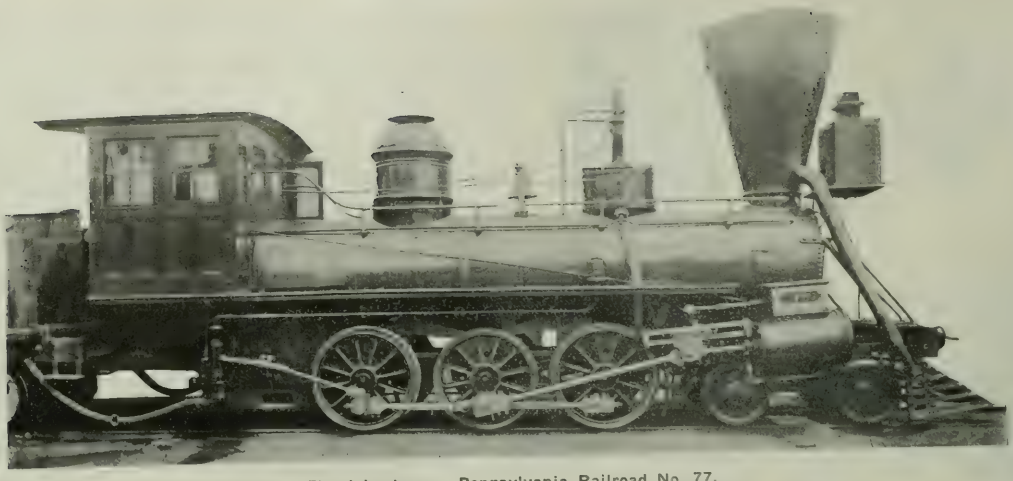
The two Portage engines, of course, came into possession of

tion of John P. Laird's patent to the ordinary freight stack of the period.

The next ten built for the Pennsylvania came on the road at various times in 1853-4. They were somewhat heavier than the "Latrobe" and differed from it somewhat in design.

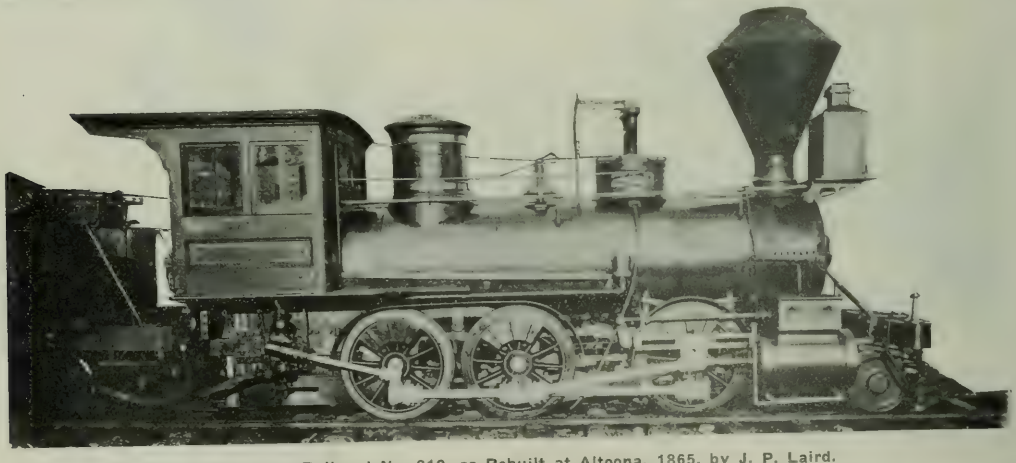
These engines had straight-top boilers with copper fireboxes, domes well forward on the roof-sheets and fitted with close covers. The safety-valves were on the tips of a "buckhorn" casting with the whistle placed between, and this casting was attached to the top of a column about twelve inches in height which was fastened to the top of the first wing of the boiler-barrel. The sandboxes were circular with flat tops and bottoms, and the safety-valve columns mentioned passed up through their centers. Pumps, valve-gear, cylinders, guides, hand-rails, bells, wheels, rods, stacks and cowcatchers were identical with similar parts on "Latrobe," but one striking difference was in the smoke-arches which were made with water-spaces on each side opening into the boilers and connected to the check-chambers by branch pipes, as shown on half-tone of engine "Goliah." The sheets forming these water-spaces were strengthened by staybolts as in the water legs of a firebox. The arrangement proved troublesome, and the inner plates with the connecting branch pipes were taken out, and the tube sheets closed in the usual manner. Circular plates covered the feed openings in the outer sheets, and the heads of the staybolts remained as a reminder of the device.

The boiler casings were of Russia iron with bands of the same material. The dome casings were also of Russia iron, with moulded bases and cornices of cast iron. Two narrow bands of brass encircled the Russia iron at top and bottom, and the name of the engine was on the base formed of polished brass letters, except in the case of the first one of the lot. Here the casing was entirely



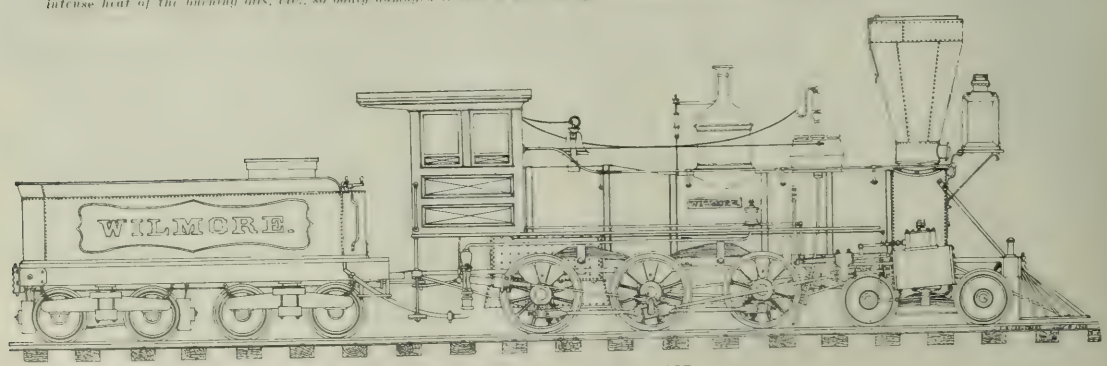
The Johnstown. Pennsylvania Railroad No. 77.

Built in 1853, at Alexandria, Va., by Smith & Perkins. The only parts not of original engine are cab, dome casing, rear wheel truck and link motion. The last two parts were substituted for original drop hooks, and single pair of 50-in. leading wheels set on rigid pedestals at Altoona shops in 1865. Heads of stayholts for water space which at first surrounded sides of smoke arch, and also the plate covering opening where auxiliary feed-water entered while the water space was used, show plainly on the photograph. A pump similar to the one shown is on the other side of the engine. No. 77 was cut up in 1875.



Pennsylvania Railroad No. 210, as Rebuilt at Altoona, 1865, by J. P. Laird.

Built by Smith & Perkins at Alexandria, Va., in 1853. It is probably Philadelphia, No. 63, although a similar engine named Wilkinsburg, No. 93, had been sent with the 63 to the P. & E. Division in 1864, and their numbers changed. One was later changed to the main line and numbered 210, and rebuilt as shown. It is somewhat difficult to discover accurately which of the two this was, but indications point to 63 rather than 93. The boiler, dome, sandbox, backhead, safety valves, bell, are original. Everything else is new. If it was No. 63, even the dome casting is not quite like the original, as that engine came out with one different from all the other Perkins engines. This engine subsequently had the safety valves placed on the dome cover, and received a standard sandbox. It fell into the cellar of the paint shop when the shops were burned during the riots at Pittsburg in 1877, and the intense heat of the burning oils, etc., so badly damaged it that it was cut up.



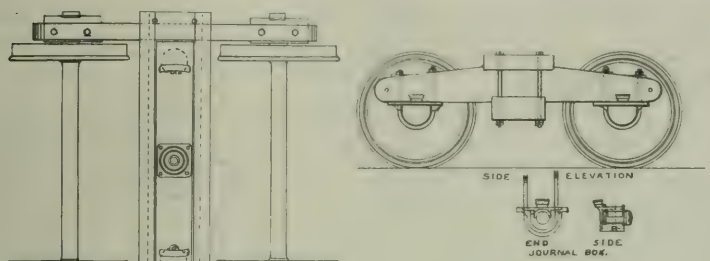
The Wilmore, P. R. R. No. 127.

1856. Cylinders, 17x22 in.; drivers, 44 in.; Gooch valve motion, suspended link. Weight on drivers, 44,000 lbs. Total weight, 60,000 lbs. Boiler, 42-in. diameter. Firebox, 60 in. long, inside. Fuel, coal.

of Russia iron without mouldings, and the letters forming the name were placed midway between the top and bottom. This casing was afterward replaced by one of same design as on the other engines.

The edges of the top and bottom of each sandbox were polished, as also were the cylinder heads, rods, the greater part of the valve gear and connections and the steam chest covers. The steam chests were polished at the top and bottom, with a rough strip left at the center about one-third of the height of the chest. This strip was painted black. The wheels, cabs, sandboxes and mouldings of the dome-casings were painted vermilion.

Although the photograph from which the half-tone of No. 77 (Johnstown) was taken, shows that engine after it had received some changes at Altoona shops in 1867, it will convey a good idea



Smith & Perkins Tender Truck, 1852-1859.

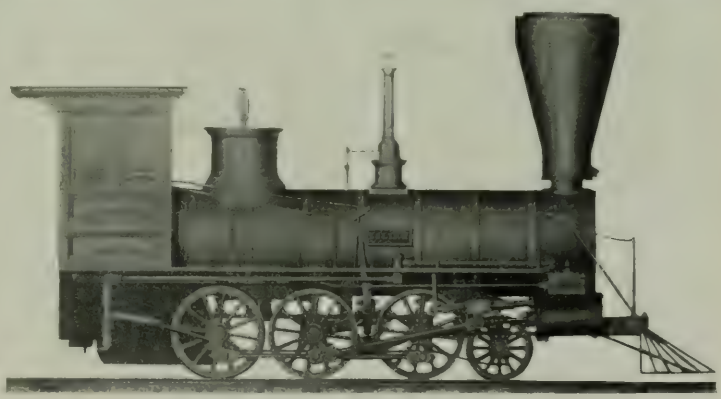
of the general appearance of the lot of ten engines of which it formed one; as the original sandbox, "buckhorn" stand with whistle and safety valves, bell and fixtures, hand rails, driving-wheels, main and parallel rods, pumps and connections, frames, boiler and smoke-box still remain. The heads of the staybolts used in connection with the water-space in the smokebox and the circular plate covering the former opening for the auxiliary branch pipe, can be seen plainly. The changes referred to are, the substitution of link-motion for drop-hooks, the four-wheel truck for the single pair of leading wheels, Laird guides and crossheads for the single diamond-bar guide, a dome-casing adapted to the new condition of a pop-valve in the cover, and casings over the cylinder and steam-chest. The stack and cab are of types applied to all of the Perkins engines on the Pennsylvania within two or three years after they came on the road. It is unfortunate that the artist did not include more of the tender and thus show at least one of the original trucks which remained under it. Just the end of one of the outside wooden stringers appears. The forward engine spring has also been moved back, and rests with one end beside the front end of the rear spring on the central driving-box, the buckle on both having been moved sufficiently to equalize the weight.

Engine No. 210 shows a Smith & Perkins boiler used with entirely new cylinders, frames and running gears, the latter of Mogul type. This combination was made at Altoona in 1865 after one or two of these engines had been transferred to the Philadelphia & Erie, numbered in conformity to the numbers used on that road at the time, but had been returned to the Main Line after about one year's service. It was then renumbered 210, as shown. The boiler, sandbox, "buckhorn" stand with safety-valves and whistle, bell and fixtures, dome and casing, and handrails from the dome forward are the original. The records of the company show that 63 and 93 were the two sent to the Philadelphia & Erie, but do not state which was afterward changed to 210. About 1873 the safety-valves were placed on the dome cover and the sandbox was replaced by one of standard type, the "buckhorns" and their column passing to the scrap-heap. The engine was then used on Liberty street in Pittsburg until July, 1877, when it was cut up as the result of a terrific burning received after falling with a quantity of oil and varnish into the cellar of the paint shop at the time of its destruction by fire during the riots of that year.

One of the greatest objections to these engines was the amount of overhang at each end. This not only caused the engines to rock and "sidesaw" dangerously when run at anything exceeding a very ordinary speed, but if one became derailed even at moderate speed, it almost invariably turned nearly end for end, and often finished by upsetting. A number of the employees not only met with serious injuries from this cause, but in two or three instances were killed instantly. After a number of such accidents, the railroad company began late in 1862 to take out these leading wheels from some of the Perkins engines and adapt the frames at that point to the use of the standard four-wheel swinging trucks. In practice this change was found to somewhat prevent the "sidesawing," but did not altogether overcome the tendency to turn around when the engines were derailed, and as the larger engines which were rapidly coming into service on the road were relegating the Perkins engines to yard service, six were allowed to remain as first built. All showed records of service for periods ranging from eighteen to twenty-four years with the company, and an official of the Westinghouse Air-brake Co. informed me in 1897 that one, which had been sold by the Pennsylvania to a railroad in Oregon, was still running at that time.

In 1856 three Smith & Perkins engines were built for the Pennsylvania Railroad, which were believed to be a great improvement over their predecessors. The boilers were of wagon-top form with the domes on the center of the waist sheets. The safety-valves were on the dome covers, and both domes and covers were encased in neat jackets of polished brass. This material was also used for bands around the boiler casing and for covering the cylinders. The whistle stands passed up through the circular sandboxes, and the bells were on the roof-sheets, in front of the cabs. The driving-wheels were somewhat spread and the rear pairs were under the rather shallow fireboxes. The pumps were behind the drivers as on the other engines, but the return cranks from which they were driven, were on the main pins. The valve-gear on these three engines was of the suspended link, or Gooch, type. Wheels, cabs, sandboxes, dome-bases and cowcatchers were painted vermilion. These three engines were transferred in 1858 to Western lines which afterward became parts of the present Pittsburg, Cincinnati, Chicago & St. Louis, and I am credibly informed that one of them which had been renamed "Mingo Chief" at the time of the transfer, continued in service until 1881.

The handrails and bells, with the supporting posts of both, and the builders' badge-plates, were of polished brass and uniform design on all of the engines thus far described. The badge-plates were neatly engraved, and were mounted on blocks of polished hardwood



The Goliah.

on the sides of the boiler jackets, directly below the bells. The principal dimensions of the engines were as follows:

	Weight	
	On drivers.	Total
First 2 Penn. R.R.	41,800 lbs.	54,200 lbs.
2 Allegheny Portage	50,500 "	61,500 "
10 Penn. R.R.	44,600 "	55,800 "
Last 3 Penn. R.R.	44,400 "	60,600 "
Cylinders, of all	17 in. x 22 in.	
Diameter of drivers	44 in.	
Diameter of leading wheels	30 in.	

The tenders of all the foregoing engines were also alike and differed only from other tenders in use in the type of center-bearing trucks used under them. The frames of these trucks were of wood. Two sills on the outside of each two pairs of wheels had the journal boxes attached to their ends by stirrup bolts which passed around the semi-circular boxes and up through the sills. A spring-plank was placed transversely between the wheels and extended slightly beyond the outside of these sills which were notched into it on their

under sides. Two narrow sills united at their ends by wide distance-pieces, crossed transversely over the tops of the sills and were also notched into them, and the whole frame was held firmly together by four bolts, two at each end of the spring-plank, which passed through the latter and the top pieces on the outside of the longitudinal sills. The journal boxes were very simple, consisting of a half-round cellar upon which a flat cap was placed, and this cap was shaped on its underside to retain the brass in position. The whole was then attached to the sills of the frame, as already described. Two circular springs of solid india-rubber were placed on the spring plank, one at each end, and a loose transom containing the center plate and side-bearing plates rested on the springs between the top transverse pieces and the side sills. Only one truck of each tender was fitted with a brake. As late as 1892 the writer saw a truck of this type in use under the tender of a Winans Camel engine on the Baltimore & Ohio Railroad, at Cumberland, Md. The only difference was in the use of the standard B. & O. journal boxes.

The tenders of the first four engines described were painted green and those of the other thirteen were resplendent in vermilion. All had the letters forming the engines' names painted in white on their sides and surrounded by a neat stripe of the same color. The frames of the trucks were painted in terra-cotta, with black ironwork.

The writer was very familiar with these engines from the days of his early boyhood when he made rather crude water-color sketches of them soon after they came on the road and while the original details were yet unchanged, until the time in later years when they began to pass into other hands, or the scrap-heap.

The illustration of the "Goliah" is from a photograph of a lithograph in possession of the Baldwin Locomotive Works. Neither the writer nor a number of people whom he has consulted who were familiar with the Smith & Perkins engines, ever saw one of them having the attachment to the outer end of the valve rod, as shown, and it probably was never reproduced in practice. The frames are also shown as terminating at the front of the firebox, as in Ross Winans' practice on the Camel engines. This was not the case on any of the other engines considered in this article, but was doubtless used on some of the engines built by the firm, as Mr. Perkins is known to have favored that arrangement of the frames, and to have used it in his later practice to some extent on the Baltimore & Ohio.

The cab is a very accurate reproduction of those on the engines when first built, and the other parts are correct in individual detail, except that no handrails were afterward used on the outside of the running boards. The connection to the water-space at the side of the smokebox is also shown very clearly.

A peculiar feature of construction followed by Smith & Perkins on the first 14 locomotives described should not be passed without mention. The English type of throttle connections was used in which the stem is partly rotated by a handle attached to its outer end at right angles, and moved crosswise of the cab by the engineman; a guard on the top of the stuffing-box preventing it from going beyond the arc of a circle necessary to give full steam or closed positions. This type never became popular with the officials or the enginemen, and after one or two years' service was taken off and replaced by throttle-stems and levers of the standard type. It was the only instance which has come under the notice of the writer of the use of "regulators" on engines built by American builders for use in the United States.

Of the personnel of the firm, I am informed that Mr. Smith, whose initial letters I have been unable to find, was the financial member and Thatcher Perkins the mechanical. The venture did not prove successful from a financial standpoint and was closed down in 1858. On December 1, 1859, Mr. Perkins became the Master Mechanic of the Baltimore & Ohio. The position was practically that of a superintendent of motive power of to-day. Thenceforth many of his mechanical ideas entered into the locomotive construction of the road. Among these were the form of tender truck, already described; the Gooch link, of which he was a great admirer; the "buckhorn" stands for safety-valves which he applied to the Hayes 10-wheel Camels, and the use of a return cranks and their connections on the pins of the rear driving wheels to drive the pumps on the Winans Camels instead of the long rods from the crossheads with which they were originally equipped.

In 1865 Mr. Perkins resigned this position to become superintendent of the Pittsburg Locomotive Works, and it may be of interest to state that the salary accompanying the new position was five thousand dollars per year, not quite up to the present compensation for similar services. He subsequently resigned this position in Pittsburg to accept that of master mechanic of the Louisville & Nashville. He died in Baltimore, Md., in 1893. A portion of the buildings occupied by this firm is still standing and used in connection with other business.

It would be unfair to close this article without mentioning the obligation of the compiler and his readers to J. Snowden Bell, who was chief draftsman with Mr. Perkins at Mount Clare shops, and later at Pittsburg, Pa., and who has so willingly aided in securing the correctness of much of the data contained therein.

The Case of the Walschaert Valve Gear.

At a recent meeting of the New England Railroad Club the Walschaert valve gear was the subject of the evening, and while there was nothing absolutely new in what was presented, what was done may be taken as a general summing up of the present situation.

Everyone who spoke on the subject expressed a favorable opinion as to the working of the mechanism from the standpoint of maintenance and freedom from wear. It also appeared that the enginemen liked it, from the first, on account of its accessibility for oiling and inspection. This point was emphasized, as well as the great advantage resulting from the possibility of using the open space, left by discarding the eccentrics and rods, for frame bracing. The frames on the modern heavy locomotives need stiffening not only as individual members but in relation to each other. It is, therefore, safe to look for a reduction of the breakages of these parts. The modern Walschaert valve gear appeals forcibly to the mechanic, because it all lies in the same vertical plane. In looking down upon it there is little or no offset in any of the lines of motion, and this is an important matter. This does away with all tendency to twist and turn, and bending strains and deflections of one kind and another do not exist.

The criticism that the gear was all upon the outside and would, therefore, be easily knocked off when any slight brush with a car should occur, and the engine thus be put out of commission, does not hold; for, when the modern locomotive strikes anything, it is the other object that is pretty well done up; and after the wreckage is picked off from the front end, the engine continues on its journey.

With reference to the details of the gear, as it is now applied, the simplicity of every part of it is impressive. Not a rod nor a pin but is as simple and logical as it could be made, and there is nothing about it that need cause any apprehension as to its future development. If one part proves to be a little weak, an improvement can easily be made in it so that there will probably be no failures that time cannot remedy.

Although it appears that a saving of more than 1,000 lbs. can be made in this gear as compared with the Stephenson, it does not follow that the whole engine will be any lighter, because of the extra weight of the cylinder casting due to the moving out of the valve. Still there is an advantage in this saving of the weights of reciprocating or semi-reciprocating parts, so that the stresses due to momentum must be considerably reduced, and this accounts, in part, for the small pins that are used.

As far as steam distribution is concerned, the Walschaert gear possesses no particular advantage over the Stephenson when both are in good condition, and when the eccentric rods of the latter are long enough so that its maximum lead does not exceed $^{5}/_{16}$ in.; but, when the lead runs up to $^{7}/_{16}$ in. or more, there is an excessive pre-admission that is detrimental not only to the wearing of the parts but to the proper working of the engine.

In the case of the Walschaert gear, no instance could be cited where the pre-admission was more than one-half that amount, which was quite an item in its favor. Regarding the Joy valve motion, it has a constant lead, in common with the Walschaert; but it is more affected by the vertical movements of the boxes relative to the frame on an uneven track; and the cut-off at the moment the box is low in the pedestal is quite different from that occurring when it is higher, causing very irregular valve events at high speed. On a good, even roadbed, however, this is not objectionable, and the Joy gear is used to some extent in Europe but has not gained a predominating place. Its irregularities are more difficult to correct than are those of the Walschaert, and it must be very carefully worked out before being applied to an engine; while the difficulties of adjusting it in the roundhouse make it improbable that it will gain any footing in this country.

The general applicability of the Walschaert gear is shown by the types of engines on which it is used and the extent to which it has been introduced. It has been put upon all engines built for the Lake Shore during the last year or two. It is used extensively on the Pennsylvania, the 'Frisco, Big Four, Boston & Maine, Delaware & Hudson, Mexican Central, Delaware, Lackawanna & Western and others. It is used on nearly all types of modern engines; tenwheelers, moguls, Atlantic, Pacific and switchers with possibly a preponderance of consolidations over any other one type.

The Prussian authorities are calculating the cost of electrifying the line of railroad between Altona and Kiel, 65 miles, with a view, if the installation should not seem too costly, to test electrical working for a heavy traffic on a first class railroad. This line is exceptionally straight and level and has a heavy passenger traffic, and for this reason is chosen for the experiment; but whether it is tried or not will depend on the cost of transportation and equipment.

GENERAL NEWS SECTION

NOTES.

The Cincinnati, Hamilton & Dayton has increased the pay of its telegraph operators.

The Minnesota legislature has passed a law making a reduction of 10 per cent. in freight rates generally throughout the state.

The Wisconsin Central Railroad and two of its officials, Burton Johnson and C. T. Huey, have been found guilty at Minneapolis of giving rebates.

The Corporation Commission of Virginia has imposed a fine of $500 on the Southern Railway for violation of the demurrage rules of the commission.

The Mexican Central, having employed train auditors for some time, has decided to have them on all passenger trains. This will require 70 or 80 men.

In a suit against the Chicago, St. Paul, Minneapolis & Omaha and H. M. Pearce, Acting Freight Agent, charging illegal freight rates, a jury at Minneapolis April 11 returned a verdict of guilty.

The Long Island road has notified the men in its large shops that an employee who loses his season pass must thereafter pay his fare. It is said that the men in these shops have been losing 15 passes a month.

The state railroad commissioners of Massachusetts have written to the New York, New Haven & Hartford calling attention to the employment of passenger brakemen to do the work of conductors and baggage men, which, it is declared, is a kind of economy which amounts to a plain violation of the law.

It is announced in the newspapers that the trunk line railroads have decided not to make any increase in freight rates. The classification committee has held a number of meetings and it was expected that the rates on many commodities would be raised by changing the articles from a lower to a higher class, but it has been decided that the present is not a favorable time to make such an increase.

The State Railroad Commission of Texas has issued a notice requiring the railroads to show cause why they should not be made to increase by 25 per cent. their track and yard facilities at Dallas, Houston, San Antonio, Fort Worth, Sherman, Denison, Waco, Cleburne, Hillsboro and Austin. If the proposed order is issued it will necessitate the expenditure of at least $3,000,000 by the railroads in these improvements.

In a suit against the New York Central & Hudson River in the Federal Court at Syracuse, charging the payment of unlawful rebates by the road to the General Electric Company, the jury last week disagreed, after having been out 19 hours. On goods forwarded the railroad company made to the General Electric Company an allowance for switching, the G. E. having switching engines to handle cars within its yards.

According to a Chicago paper railroads in the West are complaining that the car inspectors of the Interstate Commerce Commission, who, it is declared, are always selected from the labor unions, are often unduly severe in their criticism of unimportant and non-dangerous defects in cars, and that this critical attitude is most manifest on roads against which the labor unions have for the time being an unfriendly feeling. It is claimed that these unreasonable criticisms delay much freight.

The Interstate Commerce Commission, in the suit of Van Camp against the Chicago, Indianapolis & Louisville, has decided that cement burial vaults, being heavier and less costly than iron burial vaults, should be carried cheaper; that is to say, at third class rates instead of second, which latter is the rate on the iron article; and it is ordered that beginning June 1 the classification must be thus changed. This being the Official Classification the order affects all of the other roads in that territory as well as the one more particularly complained of.

The United States Circuit Court of Appeals at Chicago has affirmed the conviction in the District Court of the Chicago & Alton Railroad, and John M. Faithorn and Fred A. Wann, ex-officials of the line, for granting rebates. The railroad was fined $20,000, and the officials $10,000 each. The rebates had been granted to the Schwarzschild & Sulzberger Company in the shipment of meats, a "refund of terminal charges," of $1 on each car for the use of the tracks of the packing company. In its opinion the Court of Appeals says: "The trouble in this case comes from the fact that the railroad did not take a lease of the tracks of the packing company for the purpose of discharging its undertakings as an interstate common carrier. The arrangement between the two corporations was, therefore, a device whereby the produce of the packing company was transported at a cost of $19 per car, while other shippers were paying $20. The court excludes from the case as not being within the issues, the question of the right of a railroad company to tender greater service or to furnish greater facilities to one shipper than to another at the same published charge."

The Interstate Commerce Commission's regulations for keeping accounts will be promulgated to the railroads on May 15, to become effective July 1. Monthly, quarterly, semi-annual and annual reports of earnings will be required. Prof. Henry C. Adams, statistician, thinks of proposing to make every head accountant of a railroad a sworn agent of the government. By the plan of accounting, every transaction involving the payment of money will come under the supervision of the accountant. Not a rebate, for instance, could be granted without his being involved in the transaction. By making him an agent of the government Mr. Adams believes that the government would be in the best position to enforce the law and to guarantee that the letter of published tariffs is enforced in making and collecting charges.

Trans-Missouri Freight Bureau is to stop the practice of loading wool for buyers, the new law making it illegal to do such loading. The Oregon Short Line is understood to be opposed to the proposition and to have notified the chairman of the bureau that it will not be governed by the ruling. It has been customary for 10 years for the railroads to send out men to receive wool for buyers at the different shearing pens along the line of the western roads. It was the duty of these agents to receive the wool from the growers, weigh and check it, mark the sacks, make the invoice and pay the grower with signed blank drafts left with them for that purpose by the buyer. The grower was thus relieved of all trouble and delay. All this is now to be done away with, except on the O. S. L. Growers will have to wait until buyers get their particular lot of wool in order to receive pay for it.

In the federal district court at Chicago last week the Standard Oil Company was found guilty by a jury on an indictment citing 1,463 separate cases of underbilling committed from September, 1903, to March, 1905—each carload shipment in that time at the special secret rate being counted a distinct offense. The law provides a minimum fine of $1,000 and a maximum of $20,000 for each offense, so that if the verdict stands the company will have to pay a fine of at least $1,463,000. The railroad company, the Chicago & Alton, had given a rate of 6 cents per 100 lbs. from Whiting, Ind., to East St. Louis, Ill., when the published rate was 18 cents, and a rate of 7½ cents had been given to the Standard on shipments from Chappell, Ill., to St. Louis, Mo., when the published rate was 19½ cents. These lower rates were never published nor filed with the Interstate Commerce Commission. The chief contention of the defense was that neither the Standard Oil Company, nor its agents, knew or could be expected to know that the rate was a special or a secret rate. But Judge Landis, in charging the jury, held that it was the duty of the defendant "to endeavor diligently in good faith to get from the railroad company the lawful rate" by applying for it.

President Diaz on Railroad Progress in Mexico.

In a message to Congress, President Diaz reviews the progress of railroad building in Mexico as follows:

The Tehuantepec National Railroad, connecting the ports of Coatzacoalcos and Salina Cruz, a new transcontinental route, was recently inaugurated. Although the port works at Coatzacoalcos and Salina Cruz are not entirely completed, there is protection for shipping, with facilities for loading and unloading, thus establishing the first steps toward rapid communication between the Pacific and the Atlantic oceans, after many and costly efforts had been devoted elsewhere to the achievement of an object of so much importance to the commerce of the world.

Since September last the construction of new railroads, subject to federal jurisdiction, has been a little more than 125 miles, and the present length of all the railroads in Mexico under federal jurisdiction is 10,941 miles, which, added to the 2,640 miles of road that were built under state concessions, make a total of 13,581 miles of railroads in Mexico.

Partial plans for location of an important line from Guadalajara to Alamos have been approved by the federal authorities. Four hundred new freight cars have been bought for the Tehuantepec National, of which 68 have been delivered. In addition, 236 freight cars have been built in the shops of that road since last September. On the railroad that runs between Ensenada and Tijuana, repairs have been completed for 60 miles. The federal board of rate revision has examined and discussed 256 rates of railroads of the

Republic, and it is at present engaged in making a general revision of rates of the express companies and in drawing up new regulations.

What Is Greatness?

One hundred and fifty cars loaded with freight for Peekskill are sidetracked between Peekskill and Ossining. It looks as though some of them would not reach this village before summer. A local feed merchant reports a car of corn 46 days from Buffalo, and spoiled; another cargo six weeks and two days from Albany. And this is "America's greatest railroad!" Pray, what and where is America's smallest railroad? Let's give it a chance to show what it can do.—*Highland Democrat*, Peekskill, N. Y.

Trouble in the Canadian Northwest.

D. D. Mann met a committee of the Board of Trade at Winnipeg yesterday to discuss the complete tieup of the Canadian Northern Railway. He assured them that all possible is being done, but the motive power is crippled and the company finds the greatest difficulty in coping with the adverse conditions. The settlers who have been delayed so long in the Winnipeg yards were pulled out yesterday, but many of them have lost valuable stock and the balance of the animals are so weakened by confinement and lack of food that they will die before reaching the end of the long railroad journey yet ahead. The dead animals are lying just where they have been dumped out of the cars. One of the chief causes of the road's predicament is the fact that it has no shops here or along the system capable of repairing properly or promptly the locomotives, and in consequence of the severe winter and trying conditions the engines are in very bad order.—Winnipeg Press Despatch, April 11.

Block Signals on the Ulster & Delaware.

The Union Switch & Signal Company has contracted to equip with automatic block signals the line of the Ulster & Delaware from Kingston, N. Y., to Phoenicia, 25 miles. This line is single track and in the summer carries a heavy passenger traffic, being one of the principal routes to the Catskill mountain region.

Signals for the Pennsylvania Tunnels.

The Union Switch & Signal Company has taken the contract for the block and interlocking signals for the new Pennsylvania Railroad terminals in New York City, the tracks of which will not be laid for many months yet. This is said to be the most extensive signal contract ever signed. The lines covered by it extend from the Passaic river at Newark, eastward across the Hackensack meadows, and underneath the North river, Manhattan Island and the East river, and thence to the Sunnyside yard, about four miles out on the Long Island road.

New Railroad Laws in Iowa.

The Iowa Legislature adjourned last week. The following bills were passed affecting railroads:

Anti-pass law, conforming practically with the federal law.

Requiring roads which have income of $4,000 a mile to sell tickets at 2 cents a mile; those having less, and more than $3,000, 2½ cents a mile, and those having less than $3,000, 3 cents a mile.

Requiring railroads to build fences on both sides of their rights of way.

Authorizing the reconsignment without charge to a new destination of property forwarded by a common carrier.

Authorizing persons, firms or corporations engaged in the business of storing for profit to issue warehouse receipts on goods so stored; to regulate the issuance, negotiation and transfer of such receipts, and to provide punishment for violation of said regulations.

Defining relations between employer and employee with respect to assumption of risk.

Giving railroad commissioners same power over express companies as over railroads.

To require railroad corporations to cut and burn or otherwise destroy certain noxious weeds.

Providing for reports and investigations of accidents on railroads.

Appropriating $5,000 to enable the railroad commission to investigate freight rates.

Enlarging the powers and duties of the board of railroad commissioners.

Requiring vestibules on street cars to be enclosed on all sides.

Permitting city railways and interurban lines to construct lines over rural roads which are 100 ft. wide.

Permitting the construction of tracks and operation of automobile interurban railroads.

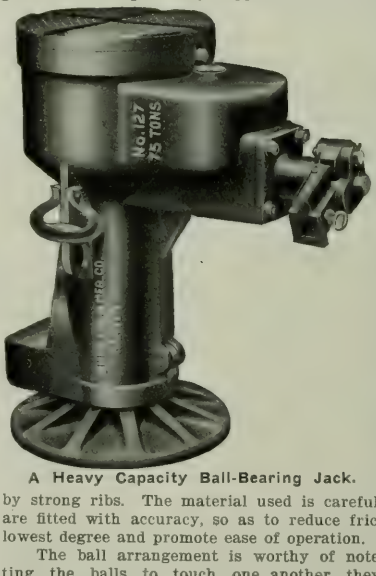
Among the bills that have failed were the reciprocal demurrage law, the reduction of sleeping car rates, the live stock freight speed limit measure, the bill requiring state examinations for railroad telegraph operators, and the bill regulating the hours of service of employees.

Southern Pacific Telegraphers' Wages and Vacations.

The board of arbitration which considered the dispute between the Southern Pacific and the Order of Railroad Telegraphers, handed down its decision April 6 awarding the telegraphers 7½ per cent. increase in pay and a half day's work on Sunday, or in lieu thereof a vacation of 26 days in each year, with full pay. The Southern Pacific gained its contention that the telegraphers should not "legislate" for train despatchers or for station agents whose salaries or commissions equal or exceed $1,300.

A Heavy-Capacity Ball-Bearing Jack.

A ball-bearing bridge jack of 75 tons capacity is shown in the accompanying illustration. Near the top of the screw, supporting the ball-bearing thrust, is a spur gear which meshes with a pinion also horizontally maintained by a vertical, stationary shaft in the gear box. The pinion is keyed to a bevel gear which lies beneath it and through which the shaft also passes, the bevel gear resting on a shoulder which rises to a proper height about the shaft. This latter gear is actuated by a smaller bevel gear vertically maintained and made integral with a horizontal shaft and ratchet. All gears are thus positively supported. The steel parts are machine cut from solid steel forgings, insuring accuracy. The screw is cut with a double pitch, which not only increases the efficiency, but gives greater speed, and this, combined with the special gear mechanism, enables the operator to handle heavy loads without loss of speed. By use of a crank handle the jack is quickly run up to the load, before the bar is inserted to perform the lift.



A Heavy Capacity Ball-Bearing Jack.

The strength of the design is apparent from the illustration. The head and gear box are reinforced against vertical and side stresses by strong ribs. The material used is carefully selected and parts are fitted with accuracy, so as to reduce friction and wear to the lowest degree and promote ease of operation.

The ball arrangement is worthy of note. Instead of permitting the balls to touch one another, they are placed in individual openings in a phosphor bronze cage, thus minimizing the friction, with consequent ease of operation and lower cost of repairs. The cage openings are placed irregularly to give the maximum wearing surface on the thrust plates. These jacks are tested in a hydraulic testing machine to an excess load of about 20 per cent., before shipment. They are made by the Buda Foundry & Manufacturing Co., Chicago.

Initial Carrier Responsible for Delays.

The Supreme Court of Virginia, in the case of Wilkinson against the Norfolk & Western Railway and the Old Dominion Steamship Company, has held that where a shipper makes a claim for loss by delay to a shipment of freight, which has been carried over two or more lines, proof of the delay makes out a prima facie against the initial carrier; the burden of proof is not on the plaintiff to show which of the two or more carriers is responsible. Justice Cardwell, in delivering the opinion of the court, said:

"It would be a manifest denial of justice, as it seems to us, if the law withheld from a shipper, in such a case as this, the right of recovery, where from the nature of the case he is powerless to trace the negligence to the particular carrier concerned, and where, perhaps by agreement between them, each declines to introduce evidence to establish its own freedom from negligence, because the establishment of this freedom from negligence of the one would place the fault on the other."

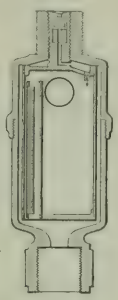
The Graphoil Locomotive Graphite Cup.

Owing to the fact that graphite has a higher specific gravity than most viscous oils it has been difficult to properly mix and feed it with lubricating oil and its application to bearings and rubbing surfaces where its superior qualities as a lubricant would effect a saving has been somewhat limited. This is particularly true of steam engine cylinders and valves. With oil alone the lubricant is washed off and dissipated to a considerable extent under high steam pressures and the action of condensed steam. The accompanying illustrations show a new device for automatically mixing just the right amount of graphite with the lubricating oil which has been designed to meet the conditions peculiar to the cylinders and valve chests of a steam locomotive.

The cup is simple and strong in construction. There is an inner and an outer cup and between these two is a steam space which serves to equalize the pressure in and around the inner cup, and also serves to prevent condensation in the inner cup. Inside



Graphoil Locomotive Graphite Cup.



Section Through Cup.

the inner cup is an upright brass tube, open at the top and bottom. One side of this tube is cut away, and brass wire cloth of suitable mesh is substituted to take the place of that part of the tube which has been cut away. The oil flows or is forced into the inner cup, passes over and takes up the surface of the graphite, then goes through the meshes of the wire cloth on the upright tube, down the tube to the valve chest and cylinder, each drop of oil fed carrying the right proportion of graphite, which adheres to the wearing surfaces and will not wash off.

The graphite cup is constructed to be readily adapted to the oiling system already installed. At the bottom of the cup is a hexagon with female thread to take the oiler plug on the valve chest. At the top is a threaded shank, which also carries a check valve, to receive the union nut by which it is connected to the oil pipe from the sight-feed lubricator in the cab. The check valve effectively prevents any back pressure forcing the graphite up into the oil pipe under any conditions.

The best results are obtained by using Dixon's pure flake graphite No. 2 mixed to the consistency of putty with cylinder oil. A filler is furnished with each pair of cups, which is designed to hold enough graphite to fill a pair of locomotive graphite cups. A full cup is sufficient for an average round trip.

The Graphoil locomotive graphite cup is one of a line of similar specialties for feeding graphite with oil, made by the Comstock Engine Company, Brooklyn, N. Y.

Troubles of Government Ownership in Italy.

Senator Colombo has written a long letter to the *Corriere della Sera*, in which he points out that the government employs no settled or reasonable policy in dealing with railroad problems. For instance, a commission has plainly stated that electric traction would meet the deficiencies in the service between Bologna and Florence only up to about 1915, and that the necessary alternative was a new road with easy gradients and a 10-mile tunnel, which would take seven years to put through and would thus barely be in time; but the authorities merely talk of adopting electricity, and have permanently shelved the question of the new line. The traffic between Milan and Genoa is increasing at a rate that makes it much more likely that it will be doubled in 1913 than in 1920, while, even according to the most sanguine estimate, the new direct line indispensable under such circumstances could only be ready, if begun at once, in 1914. Yet the government proposes half measures. The excuse is that the sums required are too large to be decided on off-hand; but the Senator replies that the Ministry, as far back as 1905, admitted the necessity of making new lines from Bologna to Florence and from Milan to Genoa, without further delay, that private capital is ready to furnish the money required for the latter, and that it would be better to spend $25,000,000 on the former, which is the main railroad of Italy, than to divide the whole of the $182,000,000 voted into a number of small sums, none of which will effect any serious improvement in the present state of affairs.

How serious this is may be judged from the fact that Genoa has been furnished with 11,835 cars less between October and January than during the corresponding period last year; the Railway Administration, which pleads the increased calls upon it in extenuation of its failure to meet them, having acted, on the contrary, as if these calls had diminished. Hence not only the docks and quays, the lighters and other vessels, but all the old hulks that can be found, are filled to overflowing with goods of every kind, and even the sea itself has been laid under contribution to eke out the insufficiency of the available warehouse accommodation, timber being chained together and anchored down in the water. At Genoa the merchandise awaiting transport is estimated at 600,000 to 1,000,000 tons, and of this there are at least 280,000 tons of coal, an accumulation daily increasing by about 8,400 tons. Horses have begun to be resorted to, and some 65,000 tons have thus been carried out of the town during the past month.

Venice, too, has been treated by the railroads as if her traffic had been halved; and as an instance of this it may be stated that between the 10th and the 25th of February that city was furnished with 2,533 coal trucks less than had been applied for. Among the results of this treatment of the Italian ports is that coal is being sent into Italy from Germany, instead of by sea, and that Trieste is beginning to supplant Venice as a landing place for goods sent to the Venetian region.

One great cause of inefficiency is the creation of unfamiliar conditions, which began when the government, in order to fight the Southern (Meridionale) Company, changed the routes by which goods had always been sent, and which was made worse when the "Mediterranea" and "Adriatica" personnel and rolling stock were consolidated. The men have to deal with signals and regulations new to them, while the repair of engines and other vehicles in workshops where they are a novelty leads to a chaos better imagined than described. The 21 subdivisions of authority at headquarters, all independent of one another, are a further constant source of delays and contradictory orders, and the wonder is, the paper concludes, that trains run at all.—Milan Correspondence *London Times*.

The "Spike Strut" Rail Fastener.

The accompanying illustration shows an ingenious and simple device for reinforcing the outside spikes on a rail to prevent spreading of the gage and loosening of the spikes under the tilting action of rails on curves. The strut is headed up like a standard spike but is made larger in the shank. The point is chamfered with a chisel end and the inside of the head is slotted on angle of about 30 deg. to the width of the standard spike shank. In driving the spike strut the track is first set accurately to gage and the strut started straight with the point about the width of a spike from the edge of the rail flange. The bevel of the point will cause the strut to take the proper angle. When the strut has been driven until the head is about an inch from the surface of the tie, the track spike is inserted in the slot in the head of the strut and driven until the two heads are together. Both are then driven home until the track spike firmly overlaps the rail flange. It is claimed that these spike struts will perform the same functions as tie plates or rail braces; that they will hold the track absolutely to gage and will prevent the track spikes from working loose and letting sand and water get under the rail. They are adapted for use on curves and at rail joints, frogs and switches. The Maryland Railway Supply Co., 510 Continental Building, Baltimore, Md., is the maker.



The "Spike Strut" Rail Fastener

American Locomotive Company's Jamestown Exhibit.

The American Locomotive Company's exhibit at the coming Jamestown Exhibition will occupy a plot 100 ft. x 250 ft. in the southern part of the grounds on the southeasterly side of Lee's parade grounds. The exhibit will be housed in a building, especially built for the purpose, 177 ft. long and 20 ft. wide, with the entrance facing the parade. The exhibit will consist of one consolidation type locomotive built for the Southern Railway, with 22 in. x 30 in. cylinders and Walschaert valve gear; a Pacific type passenger locomotive built for the Chesapeake & Ohio with 22 in. x 28 in.

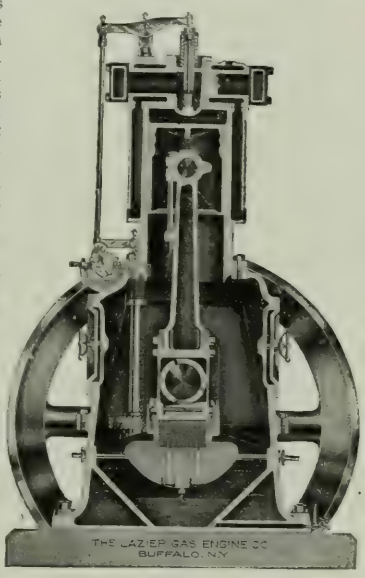
cylinders and piston valves; a 10 in. x 16 in. saddle tank contractor's locomotive and a class 44-16-2½ Atlantic steam shovel. The steam shovel will be outside of the building and will be in operation under its own steam.

A New "Car-Ferry."

General Manager Miller, of the Chicago & Eastern Illinois, with a party of friends has started for New Orleans in two private cars which are to be loaded upon river barges and then towed behind a steamer to New Orleans. The party left Chicago April 13 for Joppa, the southern terminal of the Eastern Illinois in Massac County, on the Ohio river near Cairo. A specially prepared incline has been made to the wharf. There will be a baggage car for the storage of supplies. The trip down the Ohio and Mississippi rivers will be a leisurely one, and after reaching New Orleans a tour of the south will be made.—*St. Louis Globe-Democrat.*

The Lazier Gas Engine.

In designing the Lazier gas engine, shown in the accompanying illustration, the chief aim has been simplicity. The valves are mechanically operated and all of the mechanism by which they are actuated is on the outside, where repairs and inspection can be made readily. The cams and cam shaft run in oil as well as the spiral gears transmitting motion from the main shaft. There are only four of these gears and their operation is almost noiseless. Provision has been made for taking up lost motion in all the moving parts. A new design of extended take-up has been applied to the connecting rod, as shown in the illustration. All the interior parts are lubricated by the "splash" system. Double ignition is provided, so arranged that the two systems may be used singly or in combination, and so that the operator can vary the time of firing the charge at will while the engine is running. The engines are furnished with automatic self-starters. They are made in sizes from 2 to 300 h.p., and will operate on alcohol, kerosene, distillate, illuminating gas or producer gas. It is claimed that with coal at $3 a ton, 10 h.p. hours a day can be produced at a cost of $4 per year. These engines are made by the Lazier Gas Engine Co., Buffalo, N. Y. A. A. Lazier, the president of the company, recently disposed of his interests in the Lazier Engine Manufacturing Co. to form this new concern, which makes the improved type of engines bearing his name.



The Lazier Gas Engine.

A Railroad Commission in New Jersey.

The legislature of New Jersey has passed a law to establish a state railroad commission. The Governor says that he has selected the men to fill the board, but will not announce their names until after he has examined the bill in detail.

Increased Operating Costs.

As bearing upon pending legislation to reduce passenger fares, increase taxes and involve the railroads in large expenditures that yield no return, a statement has been prepared by the Pennsylvania showing the increases that have already taken place in railroad taxation, in cost of materials used by the railroad and in wages.

A careful computation made by the purchasing department of the company shows the following increases in cost of standard railroad materials from 1904 to 1905, the prices for the latter year being generally maintained, or increased, up to the present time: Axles, 25 per cent.; iron castings, 37½ per cent.; pig iron, 21½ per cent.; hemlock lumber, 42.80 per cent.; pig copper, 23.96 per cent.; steel billets, 27.6 per cent.; car wheels, 11 per cent. Thirty other commodities show increases in price, ranging from 1.70 per cent. for white lead, to 26.40 per cent. for phosphor bronze. Freight car equipment costs from 10 to 12 per cent. more. Locomotives about 5 per cent. more. Fuel from 5 to 10 per cent. more.

The figures just given indicate the increased cost of building and maintaining a railroad. The expenses of operation are likewise greatly increased by the larger wages now paid. The 10 per cent. increase in wages, voluntarily made by the Pennsylvania Railroad Company on December 1, 1906, affected about 185,000 men.

Last year the taxes paid by the Pennsylvania lines east of Pittsburg and Erie aggregated $5,202,206, an increase of more than 30 per cent. over 1905.

Electric Railway Earnings in 1906.

The *Commercial and Financial Chronicle* has collected figures of earnings for as many street and electric railways as would furnish the information, and has published the totals, which are summed up in the following table. This includes three classes of roads, those whose returns cover, respectively, the calendar year, the year ending September 30th and the year ending June 30th. The following important companies are not included: The Chicago Union Traction lines, the Cleveland Electric Railway, the Cincinnati Street Railway, the Indiana, Columbus & Eastern Traction, the Public Service Corporation of New Jersey, the Pacific Electric Railway of California, the Los Angeles Interurban Railway, the Omaha & Council Bluffs Street Railway, the Virginia Passenger & Power Company, the Spokane & Inland Empire and the Wheeling Traction. The table follows:

		Gross.		Net.	
	Roads.	1906.	1905.	1906.	1905.
For calendar year..	181	$215,153,525	$192,672,458	$92,442,309	$82,873,597
Year end'g Sept. 30.	85	23,708,187	21,903,055	6,798,100	6,362,720
Year end'g June 30.	202	61,705,741	55,020,038	27,339,786	24,787,759
Grand total	468	$300,567,453	$269,595,551	$126,580,195	$114,024,076
Increase		30,971,902	(11.49%)	12,556,119	(11.01%)

Fifteen Passengers Killed at Chapleau, Ont.

In the derailment of westbound passenger train No. 1 by a broken rail on the Canadian Pacific at Chapleau, Ont., on the night of April 10, 15 passengers were killed and 34 were injured. Five tourist cars in the middle of the train fell down a bank and one of them was entirely submerged in a lake. Of the cars above the water one took fire, and the passengers who lost their lives were in most cases burned to death.

Long Interurban Road in Italy.

Consul J. E. Dunning reports that an electric railway is to be built from Genoa to Milan, Italy, 85 miles.

State Reductions of Passenger Fares.

The Governor of Michigan has signed the law limiting passenger fares, and it goes into effect 90 days after the adjournment of the legislature. On the larger roads of the lower peninsula the rate is to be 2 cents a mile, and on the upper peninsula 3 cents. An officer of the Pennsylvania Railroad has said that the reduction recently ordered in the state of Pennsylvania by the legislature will decrease the passenger earnings of that company about $2,000,000 yearly. The West Virginia act limiting passenger fares to 2 cents a mile, takes effect April 22. The newspapers say that the railroads intend to resist the law on the ground that its exemption of lines less than 50 miles long is unconstitutional.

Another Morse Purchase.

According to press despatches, the Morse Steamship Company has bought the two Joy Line steamers which have been carrying on outside service between New York and Boston. The Joy Line will hereafter operate lines to Fall River, Bridgeport and Providence only.

Coal Handling at Sandusky.

By replacing the old Thornburg car dumper at Sandusky, Ohio, with a McMyler machine of the latest model, the Pennsylvania lines will be able to send out 1,000,000 tons of coal this year from Sandusky; the amount sent out last year was 475,000 tons. The new car dumper on the water front is nearly finished and will be in full operation next month. It is so constructed that when a coal car approaches, a smaller car, called "the goat," rises from a depression between the rails, meets the loaded car and pushes it upon the platform of the dumper. At the same time it pushes off the car which has been emptied. Then the platform bearing the big car, with 60 tons of coal aboard, is raised by cables until it reaches the level of a chute. Cables then clutch one side of the car, turn it over and the coal rushes down the chute into the hold on the wait-

ing vessel. When a car is emptied it rolls off the dumper, down an incline, and into the yard for empties. The dumper has a capacity of 25 cars an hour. This means that every hour 1,500 tons of coal can be loaded into the ships alongside. A 175-car storage is one of the new improvements. The approaches and docks have been rebuilt and the channel near its docks dredged out.

I. C. C. Decisions.

The Interstate Commerce Commission has announced decisions in cases as follows:

In the case of Omaha Grain Exchange v. Union Pacific, it appeared that the carrier has in force a rate of 1 cent per 100 lbs., minimum charge $5 per car, for transferring grain in carloads from Council Bluffs, Ia., to Omaha and South Omaha, Neb. Its rate for transferring grain from Omaha and South Omaha to Council Bluffs for delivery upon its own tracks is $2 per car, which was put in to induce construction and maintenance of a modern and capacious elevator on its line in Council Bluffs, and a higher rate is charged by it on grain transferred to Council Bluffs for delivery to elevators or industries on other lines. The delivery of grain by the carrier in Omaha or South Omaha is for industries or elevators on other lines, for which, under car-service rules, it must allow such other line $2 per car per diem rental. The grain rates from the West to Omaha, South Omaha and Council Bluffs are the same, while from the East the rates to Council Bluffs are less than to Omaha or South Omaha. The charge from Council Bluffs to Omaha and South Omaha was complained of as unjust and unreasonable. Upon all the circumstances and conditions the Commission, in an opinion by Commissioner Clark, holds that the complaint should be dismissed.

The case of James B. Mason against the Chicago, Rock Island & Pacific involved alleged exaction of unreasonable demurrage charges by the carrier, and the complainant asked for an order of the Commission authorizing receivers of interstate freight over the carrier's line of railroad and other lines of railroad hauling interstate freight to deduct from the freight charges a reasonable sum per day for each day the carrier or carriers retain possession of any interstate shipment for a longer time than is required to haul such shipment from point of consignment to place of destination, after allowing every carrier one hour for every thirty miles from point of consignment to place of destination. The Commission, in an opinion by Commissioner Clark, holds that it is without authority to fix rules or regulations for reciprocal demurrage.

In the case of Johnston-Larimer Dry Goods Company against the Wabash and others, the rates complained of were those on cotton piece goods from East St. Louis, Ill., to Kansas City, Mo., and from East St. Louis to Wichita, Kans., but the real question involved was the differential in rates from eastern markets to Kansas City and Wichita, which is 57 cents via all rail and 44 cents via rail and water routes in favor of Kansas City, the rail and water routes being via Galveston, Tex., and two of the lines passing through Wichita to Kansas City. The Commission, in an opinion by Commissioner Prouty, holds that the rate of 35 cents, East St. Louis to Kansas City, is not excessive; that the rate of 66 cents, Kansas City to Wichita, is extremely high for the distance of 222 miles, but for reasons stated a reduction would not benefit complainant at Wichita and might result to its disadvantage and would involve a ruling either that rating cotton piece goods as first class in the Western Classification is wrong, or that the class rates between the Missouri river and Chicago are too high. The opinion states that no reason appears why the classification of cotton goods should be changed, or the class rates reduced at this time. The rates from the East and the differential mentioned were not the subject of complaint, nor are the water and rail lines parties to the proceeding. The complaint is dismissed without prejudice to further proceedings.

In the case of Johnston-Larimer Dry Goods Company v. New York & Texas Steamship Company and others complaint was made that the rate of $1.61½ per 100 lbs. on knit goods from New York and New York rate points via water and rail through Galveston, Tex., to Wichita, Kans., is unlawful, and with this was compared the carriers' rate of $1.31 on that traffic through Wichita to Topeka, Kans. The decision of the Commission, in an opinion by Commissioner Prouty, holds that the difference in rates is justified by competition for traffic to Topeka, which does not exist, and apply with like force at Wichita, and that the rate to Wichita is not, under the circumstances, shown to be unreasonable.

In the case of the Johnston-Larimer Dry Goods Company against the Atchison, Topeka & Santa Fe and others it appeared from the evidence that the carriers' rates per 100 lbs. on cotton piece goods from various producing points in Texas are 96 cents to Wichita, Kans., 50 cents to Kansas City and St. Louis, and 55 cents to Omaha and Chicago. The average distances range from 458 miles to Wichita to 1,038 miles to Chicago. Active market and carriers' competition exist for the sale and transportation of this traffic to the points other than Wichita, to which substantially agreed rates are maintained by the four carriers reaching that point from all markets. A rate from Texas producing points to Wichita of 50 cents per 100 lbs. would be highly profitable to the carriers and complainant. A Wichita jobber formerly had, by the rebate system, a rate as low as 50 cents. Until recently the tariff rate to Wichita from these points was $1.16. The present rates to Kansas City and other Missouri river points and to Wichita exclude the Wichita jobber from competition. The Commission, in an opinion by Commissioner Prouty, holds that the present rate of 96 cents to Wichita is unreasonable, and orders a reduction to 50 cents per 100 lbs. in the rate on cotton piece goods from specified Texas shipping points to Wichita. The rate from Galveston to Wichita is not included in the decision.

In addition to the decisions in contested cases mentioned above the Commission, in an opinion by Commissioner Harlan, announces its decision upon the petition of the Frank Parmelee Company. This company is a common carrier engaged in Chicago in transferring passengers and baggage between railroad stations and between such stations and hotels and private residences, and performs a service connected with interstate passenger traffic, but is, nevertheless, not a carrier subject to the provisions of the Act to regulate commerce. The petition of this company asked for a ruling of the Commission upon the right of railroad companies to exchange free transportation with local transfer and baggage express companies such as the petitioner. The opinion of the Commission quotes the following language from section 1 of the Act to regulate commerce: "No common carrier subject to the provisions of this act shall, . . . directly or indirectly, issue or give any interstate free ticket, or free transportation for passengers, except to its employees and their families, its officers, agents. . . . *Provided*, That this provision shall not be construed to prohibit the interchange of passes for the officers, agents and employees of common carriers and their families." The Commission holds that the proviso clearly modifies the main clause and is to be construed strictly, and that the words "common carriers" relate only to those referred to in the main clause—namely, the carriers subject to the Act. The opinion also holds that while the Frank Parmelee Company, not being subject to the regulating statute, may doubtless give free transportation on its omnibus and baggage express wagons to whomsoever it wishes, no common carrier subject to the jurisdiction of that Act can lawfully grant free transportation to the officers, agents or employees of the petitioner. Notice is taken of the specific exception of the Act as to "baggage agents" entering trains near large terminals to arrange for baggage transfer.

TRADE CATALOGUES.

Mine and Quarry.—The fourth number of Vol. 1 of the quarterly magazine of the Sullivan Machinery Co. contains articles on "Diamond Drills and the New York Water Supply"; "Tunneling with a Channeler"; "American Drills in a French Colliery"; "The Marble Industry in New York State"; "Tapping Water in Mines"; "The Mechanical Sharpening of Rock Drill Steel"; "Channeling Granite with Hammer Drills"; "Amount of Power Consumed in Cutting Coal," and "The Cost of Diamond Drilling." As the titles indicate, the magazine contains much matter of interest and value. All of the articles are fully illustrated, both half-tone and line engravings being used.

Buda Products.—Bulletins 105 to 109, inclusive, of the Buda Foundry & Mfg. Co., Chicago, are devoted respectively to Buda lining-up jacks, Buda replacers, Buda lifting jacks, automatic switch-stands, and Buda tool grinders. Each is standard size (6 x 9) and fully describes and illustrates the subject treated. Buda lining-up jacks were described and illustrated in the *Railroad Gazette* Nov. 30, 1906. The lifting jack catalogue contains 70 pages covering the large line of ball-bearing, cone-bearing, ratchet, friction and other jacks for special and general lifting purposes, made by this company. A Buda ball-bearing jack is described elsewhere in this issue.

Drills.—The Baldwin Steel Co. has published a complete catalogue of Hudson high-speed, tool steel, twist drills, reamers, taps, milling cutters, etc. The pamphlet, which has 79 pages, illustrates each tool and gives full dimensions and prices.

Manufacturing and Business.

The Lackawanna Steel Company, New York, has moved its offices to the United States Express Company's Building, 2 Rector street.

William S. Johnson, for the past 12 years Assistant Engineer of the Massachusetts State Board of Health, has opened an office at 101 Tremont street, Boston, for the practice of civil engineering.

Harrington Emerson has been appointed Standardizing Engineer of the American Locomotive Company, with office at 111 Broadway, New York, reporting to the Vice-President in charge of manufacturing, with authority to investigate and recommend standard methods of shop operation, shop accounting and handling material.

Gen. Eugene Griffin, First Vice-President and Manager of the Sales Department of the General Electric Company, died of apoplexy at Schenectady, New York, on April 11. General Griffin was born at Ellsworth, Me., in 1855, and graduated from West Point in 1875. He resigned as Captain of the regular army in 1889, and during the Spanish War organized and commanded a regiment of volunteer engineers, which saw service in the Porto Rican campaign. General Griffin had been First Vice-President and Sales Manager of the General Electric Company ever since it was organized.

The Federal Railway Signal Co., whose machine shop at Troy, N. Y., was completely destroyed by fire on January 31, has bought the property of the Albany Forge Company, which is on both the New York Central and the Delaware & Hudson at Albany, N. Y. The property consists of a completely equipped machine, pattern and carpenter shop and store room, which, together with machinery recently bought, will enable this company to commence at once the manufacture of signal material on the same scale as before the fire. The shops occupy a plot of 19 acres, giving room for future additions. Arrangements are being made to build an additional two-story building, 100 ft. x 350 ft.; also a machine shop and a building 60 ft. x 150 ft. for a foundry, the plant at Troy having been for months inadequate. On completion of these buildings the offices, foundry and blacksmith shop will be moved from Troy to the new location. The directors of the company are: Robert C. Pruyn, James H. Caldwell, J. T. Cade, Lawrence Griffith and P. G. Ten Eyck. The officers are: J. T. Cade, President; Lawrence Griffith, Vice-President; P. G. Ten Eyck, General Manager; Frederic Pruyn, Treasurer, and C. E. Newman, Secretary.

Iron and Steel.

The Monterey, Fresno & Eastern has ordered 20,000 tons of rails from the Lackawanna Steel Company.

Despatches from Chicago say that car builders are in many cases from 30 to 90 days behind in receipts of iron and steel.

The Carnegie Steel Company recently received orders for about 15,000 tons of rails and has booked a total of about 900,000 tons for delivery this year.

The International Railway Company of Buffalo has given an order for 2,500 tons of girder rails to the Lorain Works of the United States Steel Corporation. Negotiations are pending for between 25,000 and 30,000 tons.

The United States Steel Corporation opened its books on April 18 to receive rail orders for 1908 delivery. Early this week it was said that buying orders aggregating nearly 250,000 tons were awaiting the opening of the books.

The Chicago City Railway has ordered 10,000 tons of rails. The American Bridge Company will furnish the 15,000 tons of steel for the Susquehanna bridge to be built by the Baltimore & Ohio, and 1,600 tons for the bridge over T street in Washington, D. C. About 10,000 tons of steel will be required for the bridge over the Ohio river from Ambridge to the new works being put up by the Jones & Laughlin Steel Company.

OBITUARY NOTICES.

J. D. Sullivan, Superintendent of the Halifax & Southwestern, died suddenly at Bridgewater, N. S., on April 11. Mr. Sullivan was 38 years old.

M. L. Sykes, formerly and for many years Vice-President, Secretary and Treasurer of the Chicago & North-Western, died on April 17 at his home in Mount Vernon, N. Y., at the age of 81.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Engineers' Club of Philadelphia.

At a meeting of this club to be held April 20, there is to be a paper on "The Physical Properties of Cast-Iron" by James Christie.

Franklin Institute.

At a stated meeting of the Institute, April 17, an address was made by Professor V. Karapetoff, of Cornell University, on the "Human Side of the Engineering Profession."

South & Southwestern Railway Club.

At a meeting of this club in Atlanta, April 18, the program included the following subjects: "Electricity vs. Steam as Applied to Railroad Shops," for general discussion. The subject, "Cost of Locomotive Operation," was discussed by W. N. Cox, F. F. Gaines and J. H. Witten. There was also a discussion on the "Advanced Price of M. C. B. Material."

American Street & Interurban Railway Association.

The annual convention of this association is to be held at Atlantic City, N. J., October 14-18, 1907. The days upon which the different associations will hold their meetings have not yet been fixed. Hotel accommodation has been arranged for with 35 of the largest hotels, of which 13 are on the ocean front. A large convention hall, with a seating capacity of 800 people, will be provided on the steel pier for the opening of the American Association Convention, and smaller meeting rooms will be available for the various sectional meetings of the American, Accountants', Engineering and Claim Agents' Associations. Bernard V. Swenson, Secretary, 29 West Thirty-ninth street, New York.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Delaware & Hudson.—L. F. Loree, the new President of the Delaware & Hudson, was born at Fulton City, Ill., on April 23, 1858. He was educated at Rutgers College, and was later admitted to the bar. He began railroad work in 1877 in an engineer corps on the Pennsylvania, and from 1879 to 1881 he was in the Engineer Corps of the United States Army. During the next two years he was leveler, transitman and topographer on the survey of the Mexican National from the Rio Grande river to Saltillo. During the next 18 years he worked his way up on the Pennsylvania Lines West, beginning in 1883 as Assistant Engineer of the Chicago division of the Pittsburg, Cincinnati, Chicago & St. Louis. In 1884 he was made Engineer of Maintenance of Way of the Indianapolis & Vincennes division, and in 1886 was transferred to the Chicago division. Two years later he was transferred to the Cleveland & Pittsburg division, being made Superintendent of that division in 1889. He was appointed General Manager of the Pennsylvania Lines West in 1896. In 1901 he was elected Fourth Vice-President of the Lines West, but in a few months went to the Baltimore & Ohio as President. In January, 1904, he was elected President of the Rock Island Company; he resigned in October and was out of railroad work for nearly two years, spending most of the time abroad. In January, 1906, he was elected Chairman of the Executive Committee of the Kansas City Southern. This last position Mr. Loree will, it is expected, retain for the present in addition to his duties as President of the Delaware & Hudson.

Erie.—D. O. Mills has resigned from the Board of Directors.

Interborough-Metropolitan.—T. P. Shonts, President of this company, has been elected also Chairman of the Executive Committee, which is composed of the operating heads of the Interborough Rapid Transit Company, the New York City Railway, and the Manhattan Elevated.

Interborough Rapid Transit.—See Interborough Metropolitan.

Manhattan Elevated.—See Interborough Metropolitan.

New York City Railway.—See Interborough Metropolitan.

Ocilla & Valdosta.—H. C. McFadden, General Freight and Passenger Agent of the Atlanta, Birmingham & Atlantic, has been elected President of the Ocilla & Valdosta, succeeding J. A. J. Henderson, resigned.

Pittsburg, Binghamton & Eastern.—Thomas H. Watkins has been elected President, succeeding F. A. Sawyer, resigned. The Pittsburg & Eastern is building a line from Clearfield, Pa., to Binghamton, N. Y.

Southern Pacific.—W. B. Cutting has been elected a Director, succeeding D. O. Mills, resigned.

Operating Officers.

Boston & Albany.—W. J. Fripp, Assistant General Superintendent, has been appointed General Superintendent, succeeding J. B. Stewart, resigned.

Central of New Jersey.—Clement F. Merrill has been appointed Assistant Superintendent of the Lehigh & Susquehanna division. Mr. Merrill was born in 1877 and graduated from Amherst College in 1899. A year after that he was in the engineering department of the Illinois, Indiana & Iowa, now part of the Chicago, Indiana & Southern. Then, for 18 months, he was chief clerk to the Trainmaster of the Philadelphia & Reading at Harrisburg, Pa. He then was appointed chief clerk to the Trainmaster of the Central of New Jersey at Mauch Chunk, Pa. Two years later he was made Assistant Trainmaster, with headquarters at Northampton, Pa., where he remained until his recent promotion.

Detroit, Toledo & Ironton.—J. H. Strubel has been appointed Assistant General Manager.

Grand Trunk.—W. H. Farrell has been appointed Acting Superintendent of Terminals at Toronto, succeeding to the duties of

H. H. Brewer, resigned to go to another railroad company. C. L. Mayne, Superintendent of Terminals at Montreal, has resigned to go to another railroad company, and his former office has been abolished. H. F. Coyle, Assistant Superintendent at Island Pond, Vt., has been appointed Assistant Superintendent at Montreal, in charge of terminals and with authority over the Fourth district, and the office of Assistant Superintendent at Island Pond has been abolished. Stanton Ennes, Assistant Superintendent of the Ottawa division, has resigned to go to another railroad company, and his former office has been abolished. J. J. Connelly has been appointed Trainmaster of the First, Second and Third districts, with office at Island Pond.

Traffic Officers.

Atlanta, Birmingham & Atlantic.—H. C. McFadden, General Freight and Passenger Agent, has resigned.

Chicago, Rock Island & Pacific.—William Hughes, commercial agent at Milwaukee, Wis., has been appointed General Agent at that place, succeeding T. O. Jennings, resigned.

Denver & Rio Grande.—B. W. Robbins has been appointed General Agent at Grand Junction, Colo.

Illinois Central.—A. M. Dale, General Agent at St. Louis, has resigned, effective May 1.

St. Joseph & Grand Island.—See Tidewater Railway.

Southern Pacific.—A. W. Reeves, General Agent at Mexico City, has been appointed General Agent at El Paso, Tex. W. C. McCormick succeeds Mr. Reeves.

Southern.—The freight traffic divisions of this company have been rearranged, as follows:

WASHINGTON TRAFFIC DIVISION. Washington, D. C., to Danville, Va. (inclusive); Alexandria, Va., to Bluemont, Va.; Manassas, Va., to Harrisonburg, Va.; Calverton, Va., to Warrenton, Va.; Franklin Junction, Va., to Rocky Mount, Va.

RICHMOND TRAFFIC DIVISION. West Point, Va., to Danville, Va.; Keysville, Va., to Durham, N. C. (not inclusive); Oxford, N. C., to Henderson, N. C.

DANVILLE TRAFFIC DIVISION.—Goldsboro, N. C., to North Wilkesboro, N. C.; Danville, Va., to Charlotte, N. C. (not inclusive); Salisbury, N. C., to Norwood, N. C.; High Point, N. C., to Asheboro, N. C.; Winston-Salem, N. C., to Mooresville, N. C.; Mount Airy, N. C., to Sanford, N. C.; Stokesdale, N. C., to Madison, N. C.; Climax, N. C., to Ramseur, N. C.; University, N. C., to Chapel Hill, N. C.

NORFOLK TRAFFIC DIVISION.—Cities of Norfolk, Portsmouth and Pinners Point, Va.; West Norfolk, Va., to Danville, Va. (not inclusive); Claremont Wharf, Va., to Emporia, Va.; Buffalo Junction, Va., to Buffalo Lithia Springs, Va.; Emporia, Va., to Hitchcock Mill, Va.; N. & S. C. Junction, N.C., to Holloway Mines, N.C.; Shoulders Hill, Va., to Shops, Va.

ASHEVILLE TRAFFIC DIVISION.—Salisbury, N. C., to Paint Rock, N. C. (not including Salisbury); Taylorsville, N. C., to Charlotte, N. C. (not inclusive); Murphy Junction, N. C., to Murphy, N. C.; Biltmore, N. C., to Spartanburg Junction, S. C. (not inclusive); Hendersonville, N. C., to Lake Toxaway, N. C.

COLUMBIA TRAFFIC DIVISION.—Charlotte, N. C. to Augusta, Ga.; Edgefield, S. C., to Aiken, S. C.; Greenville, S. C., to Columbia, S. C.; Hodges, S. C., to Abbeville, S. C.; Spartanburg Junction, S. C., to Alston, S. C.; Charlotte, N. C., to Tugalo River (Madison, S. C.); Lockhart Junction, S. C., to Lockhart, S. C.; Cayce, S. C., to Savannah, Ga. (inclusive); Batesburg, S. C., to Perry, S. C.

CHARLESTON TRAFFIC DIVISION.—Charleston, S. C., to Augusta, Ga.; Columbia, S. C., to Branchville, S. C.; Kingville, S. C., to Camden, S. C.; Sumter Branch; Camden, S. C., to Marion, N. C. (neither inclusive); Gaffney Branch.

ATLANTA TRAFFIC DIVISION.—Atlanta, Ga., to Deercourt, Ga. (Tugalo River); Toccoa, Ga., to Elberton, Ga.; Chamblee, Ga., to Roswell, Ga.; Atlanta, Ga., to Brunswick, Ga.; Cochran, Ga., to Hawkinsville, Ga.; Atlanta, Ga., to Fort Valley, Ga.; Lula, Ga., to Athens, Ga.; Ooltewah Junction, Tenn. (not inclusive), to Atlanta, Ga.; Rome, Ga., to Attalla, Ala. (not including Gadsden, Alabama City, or Attalla, Ala.); City of Jacksonville, Fla.

COLUMBUS TRAFFIC DIVISION.—McDonough, Ga., to Columbus, Ga.

KNOXVILLE TRAFFIC DIVISION.—Bristol, Tenn., to Chattanooga, Tenn. (not including Chattanooga); Morristown, Tenn., to Paint Rock, N. C. (not including Paint Rock); Embreeville Junction, Tenn., to Embreeville, Tenn.; Bulls Gap, Tenn., to Rogersville, Tenn.; Knoxville, Tenn., to Middlesboro, Ky.; Knoxville, Tenn., to Harriman Junction, Tenn.; Clinton, Tenn., to Jellico, Tenn., and branches; Cleveland, Tenn., to Cohutta, Ga. (not including Cohutta); Vasper, Tenn., to La Follette, Tenn.; Clear Fork Branch; Bennetts Fork Branch.

NASHVILLE TRAFFIC DIVISION.—Nashville, Tenn., to Harriman Junction, Tenn. (not inclusive); Carthage Junction, Tenn., to Carthage, Tenn.; Millstone Junction, Tenn., to Millstone, Tenn.; Monterey, Tenn., to Wilder, Tenn.; Campbell Junction to Isoline, Tenn.

MEMPHIS TRAFFIC DIVISION.—Chattanooga, Tenn., to Memphis, Tenn.; Tuscumbia, Ala., to Florence, Ala.; Moscow, Tenn., to Somerville, Tenn.

BIRMINGHAM TRAFFIC DIVISION.—Austell, Ga., to Steens, Miss., and branches (not including Austell); Rome, Ga., (not inclusive), to Oxford, Ala.; Gurnee Junction, Ala., to Blockton, Ala., and Branches; Birmingham, Ala., to Wilton, Ala.; Bessemer Branch (Woodlawn, Ala., to Bessemer, Ala.); Ensley Southern Ry.

MOBILE TRAFFIC DIVISION.—Oxford, Ala. (not inclusive), to Selma, Ala.; Selma, Ala., to Meridian, Miss.; Marion Junction, Ala., to Akron, Ala.; Marion Junction, Ala., to Mobile, Ala.

J. H. Drake is General Freight Agent at Richmond, Va., in charge of the Washington, Richmond, Norfolk and Danville traffic divisions; E. H. Shaw is General Freight Agent at Charleston, S. C., in charge of the Charleston, Columbia and Asheville traffic divisions; Randall Clifton is General Freight Agent at Atlanta, Ga., in charge of the Atlanta and Columbus traffic divisions, and of Florida agencies; H. L. Miller is General Freight Agent at Knoxville, Tenn., in charge of the Knoxville traffic division; R. B. Pegram is General Freight Agent at Nashville, Tenn., in charge of the Nashville traffic division; I. L. Graves is General Freight Agent at Memphis, Tenn., in charge of the Memphis traffic division; R. L. Simpson is General Freight Agent at Birmingham, Ala., in charge of the Birmingham and Mobile traffic divisions.

R. A. Campbell, Assistant General Freight Agent of the St. Louis-Louisville lines, has been appointed General Freight Agent of these lines.

Tidewater.—S. M. Adsit, General Freight and Passenger Agent of the St. Joseph & Grand Island, has been appointed General Freight and Passenger Agent of the Tidewater Railway and the Deepwater Railway, effective May 1.

Engineering and Rolling Stock Officers.

Central of New Jersey.—W. T. Girten has been appointed General Storekeeper, with office at Elizabethport, N. J., succeeding H. S. Hoskinson, resigned to go into other business.

Chicago, Burlington & Quincy.—T. J. Frier has been appointed General Storekeeper, with office at Chicago, Ill., succeeding to the duties of the supply agents on the lines east and west of the Missouri river, which positions have been abolished.

Chicago, Rock Island & Gulf.—P. J. Colligan has been appointed Acting Master Mechanic at Fort Worth, Tex., succeeding to the duties of J. E. Holtz, resigned.

Great Northern.—I. W. Smith has been appointed Master Mechanic at Crookston, Mont., succeeding R. H. Smith, transferred.

Kansas City Southern.—R. L. Stewart, general foreman, has been appointed Master Mechanic at Pittsburg, Kan., succeeding W. B. Dunlevy.

New York Central & Hudson River.—C. P. Diehr has been appointed Master Mechanic at Avis, Pa.

LOCOMOTIVE BUILDING.

The Elgin, Joliet & Eastern will soon be in the market for locomotives and cars.

The Canadian Northern has ordered two eight-wheel 50-ton locomotives from the Hicks Locomotive & Car Works.

The Railway Steel-Spring Co., New York, is said to have ordered one locomotive from the American Locomotive Co.

The Texas Central has ordered four consolidation (2-8-0) type locomotives from the American Locomotive Co., for September delivery.

The J. D. MacArthur Company, Winnipeg, Man., has ordered one eight-wheel 50-ton locomotive from the Hicks Locomotive & Car Works.

The Canadian Pacific, it is said, is building 10 passenger and two switching locomotives at its Angus shops, and has ordered 10 passenger and freight locomotives from the Locomotive & Machine Co., of Montreal.

CAR BUILDING.

The Seaboard Air Line is in the market for 1,500 cars.

The Chicago City Railway is about to order 300 city electric cars.

The Union Railroad is said to be figuring on some freight equipment.

The American Car & Foundry Company has miscellaneous orders for 310 cars.

The American Steel & Wire Co. has ordered 175 cars from the Youngstown Car Manufacturing Co.

The Fairbanks Company, Pittsburg, has ordered 25 flat cars from the Youngstown Car Manufacturing Co.

The Minnesota Game and Fish Commission has ordered one special car from the Hicks Locomotive & Car Works.

The National Tube Co. has ordered some all-steel cars of 40,000 lbs. capacity from the Youngstown Car Manufacturing Co.

The South Manchuria is said to be in the market for 1,000

cars in addition to the 616 ordered from the American Car & Foundry Co.

The Kiushiu Railway, Japan, has ordered some passenger cars from the J. G. Brill Co. and 25 trucks and 25 underframes for cars to be built in Japan.

The Chicago, Rock Island & Pacific has ordered from the American Car & Foundry Company 103 box cars and 179 furniture cars.

The Intercolonial, it is understood, has ordered 130 hopper cars of 30,000 lbs. capacity, 100 box cars of 60,000 lbs. capacity, 70 dumping cars of 30,000 lbs. capacity and five refrigerator cars of 60,000 lbs. capacity from Rhodes, Curry & Co.

The Texas Central has ordered 100 box cars of 60,000 lbs. capacity from the American Car & Foundry Co., for August delivery. These cars will measure 36 ft. 7⅝ in. long, 9 ft. ⅝ in. wide and 8 ft. high, outside measurements. The special equipment includes:

Brasses	More Jones Brass & Metal Co.
Couplers	R. E. Janney

The Northwestern Elevated Railroad Company, Chicago, Ill., as reported in the *Railroad Gazette* of August 3, has ordered 34 motor cars from the Jewett Car Company. These cars will weigh 28,900 lbs., and will measure 34 ft. long, 7 ft. 8¼ in. wide and 8 ft. 6 in. high, inside measurements. The special equipment includes:

Couplers	Stearns & Ward
Curtain material	Pantasote
Draft rigging	Stearns & Ward
Paint	Northwestern Elevated standard
Springs	Pittsburg Spring & Steel Co.
Trucks	Hedley
Wheels	Standard Steel Works

The Intercolonial, as reported in the *Railroad Gazette* of March 22, has ordered one sleeping car from the Pullman Company. This car will measure 72 ft. long, 9 ft. 8 in. wide and 14 ft. 6¼ in. high, over all. The body and underframe will be of wood. The special equipment includes:

Bolsters	American Steel Foundry Co.
Brakes	Westinghouse
Brake-beams	National Hollow
Brake-shoes	Christy
Couplers	Janney
Curtain material	Pantasote
Heating System	Pullman double coil heater, in connection with Safety Car Heating & Ltg. Co.
Journal boxes	Pullman standard
Light	Pintsch gas
Paint	Pullman standard
Platforms	Pullman standard steel, type "A"
Roofs	Pullman standard
Seats	Pullman standard, high back
Springs	Crucible steel
Trucks	Pullman standard
Vestibules	Pullman standard

The Canadian Northern, as previously reported in the *Railroad Gazette*, has ordered one cafe car from Barney & Smith, for June delivery, and 20 refrigerator cars of 30 tons capacity from Rhodes, Curry & Co., for delivery by June 30, 1907. The cafe car will measure 72 ft. long and 9 ft. 10½ in. wide, over all. The body and underframe will be of wood. The refrigerator cars will measure 29 ft. 6 in. long, 8 ft. 3¾ in. wide and 7 ft. 8¼ in. high, inside measurements, and 39 ft. 9¾ in. long, 9 ft. ¾ in. wide and 14 ft. high, over all. The bodies will be of wood. The special equipment for all cars includes:

	Cafe.	Refrigerator
Axles	.....	Rhodes, Curry & Co.
Bolsters	.....	Simplex.
Brakes	Westinghouse.	Westinghouse.
Brake-beams	Westinghouse; M. C. B. & S. make.	Simplex.
Brake-shoes	Christie.	.....
Brasses	.....	Canadian Bronze Co.
Couplers	Chicago.	Latrobe.
Curtain fixtures	Forsyth.	.....
Curtain material	Pantasote, silk lined.	.....
Doors	Mahogany.	.....
Draft rigging	Miner.	Miner tandem.
Dust guards	Wooden.	.....
Heating system	Gold duplex.	.....
Journal boxes	.....	McCord.
Light	Com'rc'l acetylene.	.....
Paint	.....	Sherwin-Williams.
Roofs	.....	Am. Asp. & Rub. Co.
Trucks	M. C. B. & S. standard.	.....
Vestibules	Pullman.	.....
Wheels	Barney & Smith.	Rhodes, Curry & Co.

RAILROAD STRUCTURES.

Binghamton, N. Y.—Announcement has been made by President Underwood, of the Erie, that car shops will be established at this place, and the shops at Susquehanna, Pa., will be abandoned.

Buffalo, N. Y.—According to local reports, the New York Central lines are considering plans for a large storage yard, and shops, to be built at Gardenville, near Buffalo.

Excelsior Springs, Mo.—Work is to be started at once by the Wabash on a new station here to cost about $30,000.

Fort William, Ont.—The Grand Trunk Pacific, it is said, has decided to put up two large grain elevators each to have a capacity of 2,500,000 bushels, and to cost $1,000,000; one to be built at this place and the other at Tiffin.

The Canadian Pacific may build a bridge over the Kaministiquia river to cost several thousand dollars.

Hamilton, Ont.—The Dominion Power & Transmission Co. announces it will put up car shops here.

Joplin, Mo.—The Missouri & North Arkansas, according to local reports, has spent about $150,000 for a site for new terminals and shops, and will shortly begin improvements at an additional expense of $300,000 to include shop buildings and a new station.

Muskoka, Ont.—The Canadian Pacific has decided to make this place a division point, and will put up a roundhouse, shops and an office building.

St. Clair, Pa.—It is reported that the Philadelphia & Reading will put up new shops and a large yard here to cost about $1,000,000.

Smith's Falls, Ont.—The Canadian Pacific is to put up a roundhouse here to have 22 stalls, and will also build a machine shop 40 ft. x 90 ft.

Strathcone, Alb.—The Canadian Pacific has changed its plans for its station to be built here, and will put up a larger building than originally intended, to cost $60,000. A 22-stall roundhouse is also to be put up.

Tacoma, Wash.—Local reports state that the Chicago, Milwaukee & St. Paul has commenced work on its terminals here. A tract of about 200 acres has been bought, and the work will be carried out during the next two years.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Alaska Central.—This company, building a line from Seward north via Susitua valley to the Tanana river, 450 miles, has let a contract to Snow & Watson for building 25 miles, and grading work has just been started on this section. An officer writes that other contracts will probably be let in June for building 30 miles additional. The company has also finished surveys for a branch from Knik, about 150 miles north of its southern terminus, east to Matanuska, 40 miles.

Atlanta, Birmingham & Atlantic.—This company started surveys last year to extend its road from Atlanta, Ga., southwest to New Orleans, about 500 miles. The new line is to cross the Birmingham extension about 100 miles southwest from Atlanta. A report from Selma, Ala., says that the company is to build from Talladega, Ala., on the Birmingham extension, southwest to Selma, and thence to Baton Rouge, La., from which point it will enter New Orleans over either its own line or the line of some other company. This route is to form part of the main line. There is also to be a line built from Selma north to Birmingham, also connecting with the Birmingham extension, giving two routes over the A., B. & A. between Talladega and Selma. On the Birmingham extension track was laid last year as far as La Grange, just east of the Chattahoochee river. The American Bridge Company is putting up a bridge over the river. The roadbed is finished for about 50 miles west of the river, and track laying will be started on this section as soon as the bridge work is finished. On the branch between Chalybeate, Ga., and Atlanta track laying is to be started within the next 30 days.

Barker & Clark's Gap.—See Norfolk & Western.

Brandon & Laurel.—Incorporated in Mississippi to build from Brandon southeast to Laurel, about 65 miles. The incorporators include: A. M. Shields, L. D. May, H. A. Busick and S. L. McLauren.

Brooklyn Rapid Transit.—Work is now under way connecting the Broadway elevated line of this company with the Williamsburg bridge in the Borough of Brooklyn. Under the terms of the contract work must be finished by October 1, and the company expects to begin running its cars over the bridge during that month. The cost of the improvements will be about $100,000.

Canadian Pacific.—The company will shortly call for bids for a line from New Westminster to Eburne, which, when built, is to be electrified by the British Columbia Electric Street Co.

The company is to build a branch this spring from either Bienfait, Sask., or Estevan to Arcola.

Chicago City Railway.—According to local reports, this company is planning to begin work next month in pursuance of the ordinance passed at the last election, on the improvement of the system at a cost of several millions. The first work will be the laying of new rails, some of which have already been ordered. It is thought that the action of the Chicago City Railway will be followed by the Union Traction.

Clear Fork & Oceana.—See Norfolk & Western.

Cumberland River & Nashville.—An officer writes that this company proposes to build from Corbin, Ky., southwest to Nashville,

Tenn., 160 miles. The proposed route is from Corbin down the Laurel river via Cumberland to Burnside, Ky., thence to Monticello, Albany and Nashville. There is to be a bridge over the South Fork river. Contracts let to C. E. Coon and to Peter & Co., of Louisville, Ky., for the section from the Cincinnati, New Orleans & Texas Pacific near Burnside, Ky., to Monticello, about 20 miles. (March 15, p. 382.)

GRAND TRUNK PACIFIC.—Sub-contracts are being let by N. P. and J. P. Davis for building 70 miles on the line of this road from the Quebec bridge east.

GREAT NORTHERN.—According to reports from Moose Jaw, Sask., this company is planning to secure an entrance into Saskatchewan, under the name of the Saskatchewan Central, projected from the boundary of Manitoba west. The proposed route is through the Cannington district via Willow Bunch to Alberta, with branches into the Goose Lake district.

GREAT WEST.—This company has been incorporated with headquarters at Cowley, Alb., to build a line from that town to the Gap on the Crow's Nest Pass railroad.

GULF, BEAUMONT & GREAT NORTHERN.—See Gulf, Colorado & Santa Fe.

GULF, BEAUMONT & KANSAS CITY.—See Gulf, Colorado & Santa Fe.

GULF, COLORADO & SANTA FE.—The Texas Legislature has passed over the Governor's veto a bill authorizing the merger of the Gulf, Colorado & Santa Fe, the Gulf, Beaumont & Kansas City, the Texas Central and the Gulf, Beaumont & Great Northern. The bill requires that an extension of the consolidated lines be built within two years from Longview, Tex., northerly 125 miles to a point on the Red river.

KENTUCKY HIGHLANDS.—Incorporated in Kentucky with $250,000 capital to build from Frankfort, Ky., south to Versailles, thence east to Lexington, about 30 miles. The incorporators include: J. C. Doolan, E. M. Trabu, A. Cox, S. H. Owen, S. S. Bush, J. D. Winster and M. Wordman, all of Louisville. The Illinois Central is reported to be back of this project.

LEWISTON, AUGUSTA & WATERVILLE (ELECTRIC).—According to reports from Lewiston, Me., a company under this name has given contracts to Gore Bros., of Boston, for building nine miles of electric line from Sabattus, Me., to Mechanic Falls; also from Sabattus to Gardner, 21 miles, the latter conditional upon the company obtaining the necessary right of way. On the completion of this work, Lewiston will have connections with Portland and, by way of Brunswick, with Augusta and Waterville, over electric lines.

LOUISIANA RAILWAY & NAVIGATION COMPANY.—This company on April 14 opened for through service its line from Shreveport, La., to New Orleans.

MACON, AMERICUS & ALBANY (ELECTRIC).—Incorporated in Georgia with $200,000 capital to build an electric line from Macon, Ga., southwest via Byron, Fort Valley, Marshallville, Montezuma, Oglethorpe, Andersonville, Americus and Lessburg to Albany, about 150 miles. The incorporators include: W. J. Massee, J. T. Moore, J. N. Neel, M. F. Hatcher and D. W. Davis, of Macon; N. J. Cruger, of Albany; A. C. Riley, of Fort Valley, and J. C. Walker, of Marshallville.

MEMPHIS TERMINAL.—This company at a recent meeting elected the following officers: J. H. Watkins, President; J. L. Lancaster, Vice-President; O. F. Ghrist, Secretary, and F. H. Hamilton, Treasurer. A. W. Briggs is the Attorney. The company proposes to buy its right of way from the Mississippi river bridge to Polk street, in the southern part of Memphis, along the line of Iowa avenue. About two-thirds of this has been bought, and work is soon to be started on the terminal yards and sidings and on the union station. (March 27, p. 427.)

NATCHITOCHES EAST & WEST.—This company, it is reported, has secured funds to make surveys and buy the right of way for its proposed line from Natchitoches, La., southeast to Colfax, 30 miles. C. H. Teal, Natchitoches, is President.

NEW IBERIA, ST. MARTINSVILLE & NORTHERN.—Organized in Louisiana with $500,000, to build from New Iberia north to Port Parre, via St. Martinsville, Breaux Bridge and Arnaudville, 40 miles. F. M. Welch, President; J. R. Oliver, First Vice-President, St. Martinsville; J. Dreyfus, Treasurer; A. B. Romero, Secretary, New Iberia.

NEW YORK & PENNSYLVANIA TRACTION.—Surveys are being made by this company for a high-speed electric line from Somerville, N. J., south to Princeton, 18 miles. Most of the right of way will be 50 to 100 ft. wide over a private right of way. There is to be a bridge 1,800 ft. long over the Raritan river. T. D. Kitchen is the engineer in charge of the surveys.

NEW YORK SUBWAYS.—Bids were recently opened by the Board of Rapid Transit Railroad Commissioners for building the first section of the proposed subway to connect the Williamsburg and Brooklyn bridges. This first section covers the longest and most important section extending from Pearl to Canal streets, in the Borough of Manhattan. The bids were: Degnon Contracting Co. for the tunnel $2,952,000 and $83,000 additional for the pipe galleries, and the Cranford Company, who offered to construct the tunnel for $3,775,000 and the pipe galleries for $50,000 additional.

NORFOLK & WESTERN.—The Clear Fork & Oceana has been organized to build a line from the mouth of Clear Fork on the Guyandotte river in Wyoming County, W. Va., to a point near Knob Fork.

Under the name of the Barker & Clark's Gap, a line is to be built from a point near Clark's Gap in Wyoming County, W. Va., to a point on the Guyandotte river, near the mouth of Barker's creek.

NORTHWESTERN PACIFIC.—Surveys are reported made by this company for extending the Fort Bragg & Southwestern, already built from Albion, Cal., on the Pacific coast, east to Wendling, southeast from that place to a junction with the main line of the N. P., at Cloverdale.

Plans are being made to extend the line already finished to Alpine from Fort Bragg on the Pacific coast east to Willits on the N. P. This road is owned by the Johnson Lumber interests and was built for logging purposes.

OKLAHOMA CITY, EL RENO & SOUTHWESTERN (ELECTRIC).—Incorporated in Oklahoma to build 275 miles of electric lines from El Reno, Okla., to connect Oklahoma City, Chickasha, Anadarko, Hobart and Lawton on the south, and Kingfisher, Hennessy, Enid, Medford, Kiel and Okeene on the north. J. W. Smith, F. Ehler, C. C. Smith and E. B. Cockerell, of Hennessy, and W. R. Blackburn, of Kingfisher, are incorporators.

OKLAHOMA CITY RAPID TRANSIT.—Incorporated in Oklahoma with $2,000,000 capital, to build an electric line from Oklahoma City east to Tecumseh, through Oklahoma, Cleveland and Pottawatomie counties, 40 miles. The incorporators include: G. Silsby, of Saginaw, Mich.; G. M. Cissna, J. H. Surber, D. D. Klapp, E. W. Milburn, G. Weed, M. H. Tennison, S. B. Mitchell and W. E. Howell, of Tecumseh.

OPELOUSAS, GULF & NORTHEASTERN.—See Texas & Pacific.

PACHUCA, ZOMAPAN & TAMPICO.—Richard Honey, of Mexico City, is reported to be building a line to give Mexico City direct connection with the port of Tampico. Mr. Honey built and operated the railroad from Mexico City to Apulco, 102 miles, and sold it to the Mexican Central a year or two ago. The route of the new line is from Pachuca to Tampico, about 250 miles. Survey for the entire line has been made and work on the first 32 miles is under way. The maximum grade of the first 62 miles will be 1½ per cent. In descending from the plateau to the low coast country the grade will be considerably higher than for the first section, and much heavy work will be encountered. Concessions have been granted by the federal government and by the state of Hidalgo. Free right of way for the road through that state is also given.

PANHANDLE SHORT LINE.—This company has filed a charter in Texas to build from Hereford, Tex., south to Stanton, about 210 miles. J. H. Ransom, J. E. Howard and J. L. Fuqua, of Deaf Smith County, Texas; J. C. Archabald, A. R. Donaldson, W. E. Kitter and O. G. Place, of Boulder County, Colo., are interested.

PEARL RIVER VALLEY.—This company, it is said, has located its proposed line from Jackson, Miss., northeast to Carthage, 50 miles, and is to begin work this summer. The line is projected to Birmingham, Ala., 270 miles. F. W. Herrick, Milwaukee, Wis., is President. (March 15, p. 389.)

PHILADELPHIA & READING.—Plans are reported being made by this company to build a double-track freight belt line north of Coatesville, Pa., at a cost of about $100,000. The line is to be finished next fall, and is to connect with the large industrial works in Coatesville.

PORTLAND & RUMFORD FALLS RAILROAD.—This company, recently incorporated to build a line from Portland, Me., south to the coast at Falmouth and Portland, about 30 miles, it is said has leased the property of the Portland & Rumford Falls Railway and the Rumford Falls & Rangeley Lakes Railroad. The new organization has secured large tracts of land on both sides of Portland harbor, and has bought additional land at South Portland as a site for steamship docks, elevators and other facilities for handling heavy freight. At the hearing before the Legislative Committee on the application of the company for its charter, it was stated that the Portland line was to provide an entrance for the Canadian Pacific to that place. Connection is to be made from the northern end with the Canadian Pacific at Megantic, at which point it would also connect with the Quebec Central. (March 29, p. 468.)

Portland & Rumford Falls Railway.—See Portland & Rumford Falls Railroad.

Rumford Falls & Rangeley Lakes Railroad.—See Portland & Rumford Falls Railroad.

Saskatchewan Central.—See Great Northern.

Savannah & Southwestern.—Under this name, a company has applied for incorporation with a capital of $7,000,000, to build a line from Savannah southwest through Baxley, Douglas, Moultrie and Cairo, Ga., Quincey and Apalachicola, Fla., to a point on the gulf coast, approximately 300 miles. L. McNeill, D. G. Purse and J. H. H. Antelman, of Savannah, Ga.; C. W. Dean, of Baxley; W. A. Walker, of Cairo; J. A. Carlton, of Moultrie, and G. W. Quincey, of Douglas, are interested.

Southern.—According to reports from Alabama, this company has suspended work on its improvements in northern Alabama and southern Tennessee, including the extension of the Stevenson & Chattanooga branch, and the tunnel through Lookout mountain. It is also said that the company has canceled the contract for the steel superstructure of the bridge over the Tennessee river at Otis Island.

Southwest Railway.—Incorporated in Texas to build a line from Henrietta southwest through Clay and Archer counties, 35 miles. The incorporators include: E. S. Hughes and H. James, of Abilene; J. W. Broad and N. J. Denison, of Fort Worth, Tex.

Texas & Gulf.—See Gulf, Colorado & Santa Fe.

Texas & Pacific.—It is announced that the Opelousas, Gulf & Northeastern, building from Opelousas, La., northeast to a point on the Mississippi river and southwest to the gulf, will have the section from Opelousas to Crowley, 81 miles, finished about the middle of May. (March 15, p. 393.)

Virden & Taylorville Traction.—Incorporated in Illinois to build an electric line from Virden, Macoupin County, Ill., east to Taylorville, about 26 miles. The incorporators are: H. C. Simon, W. E. Allenson, J. Coldern and T. P. Tenney, of Virden, and E. E. Barclay, of Springfield.

Western Pacific.—According to reports from Utah, contracts for the remaining 326 miles in Nevada have been let to the Utah Construction Co., of Ogden. This company previously had contracts for 110 miles in Utah, 107 miles in Nevada and 174 miles in California. (March 15, p. 394.)

West Virginia Connecting.—This company, it is reported, has surveys made for a line from Bellington, W. Va., to Waynesburg, Pa., and will continue surveys from Waynesburg to Carnegie, near Pittsburg. Contracts for building the line will be let in May. J. V. Thompson and J. V. Maroney are interested.

Winnipeg & Northwestern.—Incorporated to build a line from Winnipeg to the Lobstick river via Lakes Winnipeg, Manitoba and Winnipegosis with branches from Prince Albert to Battleford, from Saddle Lake to Lac du Biche, from Victoria, Alb., to Athabasca Landing and from Shoal Lake to Swan Lake. The incorporators are: Henry Fox, London, England; A. T. Drummond; P. Howland, W. K. George, H. M. Mowat, Toronto.

Yellowstone Park.—Holders of some of the $432,000 outstanding first mortgage 5 per cent. bonds of 1945 have brought suit for the foreclosure of the mortgage, the July, 1906, interest being unpaid. The road is under construction from Bridger, Mont., on the Northern Pacific, to Cook City, 125 miles, including branches, of which 31 miles from Bridger is in operation.

RAILROAD CORPORATION NEWS.

Baltimore & Ohio.—See Chicago Terminal Transfer.

Boston Elevated.—This company has asked permission to issue $8,000,000 additional stock and $5,800,000 additional bonds. There is already outstanding $13,300,000 stock and $7,500,000 4 per cent. debenture bonds of 1935. The new stock is for two subways in Cambridge, and the new bonds are for equipment and the funding of floating debt.

Chicago Terminal Transfer.—Some time ago, the date was announced for the foreclosure sale of this property. On March 30 the Baltimore & Ohio asked permission to assume, before May 3, the date of the sale, the $15,140,000 outstanding Chicago Terminal Transfer first mortgage, 4 per cent. bonds of 1947, including the accrued interest for two years, stipulating that the subsequent sale of the property be made subject to the Baltimore & Ohio lease of the yards and station. On April 16 the United States circuit court gave the B. & O. the right to assume the bonds, subject, however, to the right of the Chicago Terminal Transfer stockholders to attack the lease under which the Baltimore & Ohio uses the terminal. This lease was made in 1903, after the last reorganization of the Chicago Terminal Transfer, while the leases to the Chicago Great Western and the Chicago Junction were made before that reorganization.

Cleveland, Southwestern & Columbus Traction.—This company, which was recently incorporated as a consolidation of three Ohio traction lines operating 170 miles of road, plans to have listed on the New York Stock Exchange $10,000,000 20-year 5 per cent. general mortgage bonds, $2,500,000 5 per cent. cumulative preferred stock and $7,500,000 common stock. (March 15, p. 378.)

Delaware & Eastern.—A special meeting of the stockholders has been called for May 13 to vote on a proposition to lease the property to the Schenectady & Margaretsville. The Delaware & Eastern runs from East Branch, N. Y., to Arkville, 37 miles, and the Schenectady & Margaretsville is a proposed extension of the D. & E. from Arkville north to Schenectady.

Grand Trunk.—An annual dividend of 3 per cent. for the year 1906 has been declared, payable April 26, on the $34,765,000 outstanding third preference 4 per cent. stock, on which 1 per cent. was paid in 1902, 2 per cent. in 1903, nothing in 1904 and 2 per cent. in 1905.

Gulf, Beaumont & Great Northern.—See Gulf, Colorado and Santa Fe.

Gulf, Beaumont & Kansas City.—See Gulf, Colorado & Santa Fe.

Gulf, Colorado & Santa Fe.—The Texas legislature has passed over the Governor's veto a bill authorizing the consolidation of the Gulf, Colorado & Santa Fe, the Texas & Gulf, the Gulf, Beaumont & Kansas City and the Gulf, Beaumont & Great Northern. See Construction column.

Kalamazoo, Lake Shore & Chicago.—This company has bought the South Haven & Eastern branch of the Pere Marquette, including all the rolling stock, right of way and terminals. The branch runs from Latton to South Haven, 40 miles.

Missouri Pacific.—This company has sold to Tailer & Co., New York, $4,043,000 equipment trust 5 per cent. bonds, payable in ten equal annual instalments, beginning May 1, 1908. They are secured on 50 consolidation locomotives, 3,000 coal cars, 750 Rodger ballast cars and 750 stock cars. The Knickerbocker Trust Company is Trustee for $3,350,000 of this issue, and the Mercantile Trust Company is Trustee for the remainder.

New Orleans Terminal.—This company has sold to New York bankers $2,500,000 two-year 6 per cent. notes guaranteed by the Southern and the St. Louis & San Francisco, which leases the property from the New Orleans Terminal. The notes are secured on $4,000,000 first mortgage 4 per cent. bonds of the New Orleans Terminal.

Ocilla & Valdosta.—This road, which runs from Ocilla, Ga., to Broxton, 25 miles, and which has $800,000 capital stock and is building an extension to Fitzgerald, has been sold to H. C. McFadden and associates.

Oregon Short Line.—See Pennsylvania Company.

Pennsylvania.—See Pennsylvania Company.

Pennsylvania Company.—The annual report for the year ended December 31, 1906, shows that the company at the end of the year held $36,393,432 Oregon Short Line 4½ per cent. notes. As it does not appear from the report that these notes were issued in payment of Baltimore & Ohio stock, it is probable that they are a part of certain securities turned over to the Pennsylvania Company by the Pennsylvania Railroad in return for the $50,000,000 4½ per cent. Pennsylvania Company 18-months notes issued in May, 1906, and about $48,000,000 Pennsylvania Company 15-year, 3¾ per cent. loan placed in Paris in June, 1906.

Pere Marquette.—See Kalamazoo, Lake Shore & Chicago.

Philadelphia & Reading.—It is said this company has acquired the Williams Valley Railroad, which runs from Brookside, Pa., on the Reading, to Lykens, 12 miles, and has outstanding $90,000 stock and $120,000 5 per cent. first mortgage bonds of 1923.

St. Louis & San Francisco.—See New Orleans Terminal.

Schenectady & Margaretsville.—See Delaware & Eastern.

South Dakota Central.—G. H. Rollins & Sons, Chicago, are offering at par and interest $200,000 first mortgage 5 per cent. bonds of 1927, being part of an authorized issue of $730,000. The road is in operation from Sioux City, S. Dak., to Rutland, 42 miles, and contracts are being let to extend it to Watertown, 58 miles.

Southern.—See New Orleans Terminal.

Texas & Gulf.—See Gulf, Colorado & Santa Fe.

Williams Valley.—See Philadelphia & Reading.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Report of Committee on Car Efficiency... 567
- Railroad Valuation 567
- First Results of Terminal Electrification. 568
- Character in a Railroad President 568
- An Unprecedented Measure of State Railroad Regulation 569
- Uniform Classification Again 570
- Texas & Pacific 570
- New Publications 571

ILLUSTRATED:
- Ten-Wheel Locomotive for the St. Louis & San Francisco 572
- Norfolk & Western Improvement Work... 575
- Holding Force of Railroad Spikes in Wooden Ties 580
- Building the Florida East Coast Extension to Key West 583
- Track Deformations and Their Prevention 588
- New Reading Rooms and Club Houses on the Santa Fe 590

CONTRIBUTIONS:
- The Profitable Weight and Speed of Freight Trains 572

MISCELLANEOUS:
- Favorable Crop Report 572
- Picked Up on the Road 574
- Railroads in French West Africa 574
- Atchison Merits 581
- The Freight Car Situation 581
- Electric Railway in Turkey 585
- Italian Comment on Baldwin Locomotives 585
- The High-Speed Mania 586
- New Railroad Laws in Texas 587
- Foreign Railroad Notes:
  - German Railroad Employees 579
  - Swiss Railroads 582
  - Austrian Traffic Blockade 582

GENERAL NEWS SECTION:
- Notes 591
- Trade Catalogues 594
- Obituary 596
- Meetings and Announcements 596
- Elections and Appointments 597
- Locomotive Building 597
- Car Building 598
- Railroad Structures 598
- Railroad Construction 598
- Railroad Corporation News 600

VOL. XLII., No. 17. FRIDAY, APRIL 26, 1907.

The American Railway Association meeting will not have done anything before we go to press, but its most important report, that of the Committee on Car Efficiency, is printed in this issue. This committee differs from the ordinary standing committees of the Association, in that it had a pressing duty assigned to it at the outset, with pretty strong unwritten orders to produce results without delay. It has "made good," handsomely. We are justified in saying this much, whatever may be the fate of the committee's recommendations; for simply to stir up the roads, get really informing replies to questions, expose negligent and dilatory practices and summarize for the benefit of all the scattered and half concealed information on the general subject, alone constitutes an important work. The most significant paragraph in the report is that declaring that the committee has not been and will not be content to write letters and issue circulars, but will see that somebody actually moves. The most conclusive fact set forth is, perhaps, that concerning the generally unsatisfactory results of the attempt to prevent misuse of cars by a penalty for diversion. This, with the other fact announced last week—the abandonment, July 1, of a penalty per diem rate for interchanged cars—marks a definite step forward. In approving and recommending the Clearing House idea (to which a strong majority of the standing car-service committee seems also to be committed), the present committee has, of course, embarked on a long and strenuous campaign —unless the Association forbids it to march forward.

Mr. Henry Fink, after some 55 years of railroad service, during which time he has occupied practically all the operating and executive positions there are in a railroad organization, and has held the tiller of his companies through good times and bad, is accustomed from time to time to speak with great clearness and understanding on railroad problems of the day. The objections which Mr. Fink sees in the proposal that railroad properties be valued, as a basis for determination of rates and capital, are, therefore, worthy of careful consideration. They can be expressed as follows:

(1) Cost is not identical with value. The value of a machine depends entirely upon its efficiency as a whole, and not upon the sum of the values of its parts.

(2) Capitalization or value of property has nothing whatever to do with the reasonableness of rates. A railroad really does not make its rates at all, but accepts those made necessary by the competition between markets and producing centers, and by the struggle with other lines for business.

(3) American roads, with perhaps a few exceptions, are not overcapitalized. When you want to find out what the exceptions are, look at the income accounts. If a railroad cannot meet the interest on its bonds and earn a reasonable surplus besides, it is overcapitalized, whether such capitalization be high or low. If it can do these things it is not overcapitalized.

(4) If, in spite of the impossibility of arriving at a just and equitable valuation, official figures are established, it will do infinite harm. Whenever a railroad has occasion to appeal from a decision of the Interstate Commerce Commission to the courts it will labor under the disadvantage that the value of its property has seemingly been established by a federal tribunal, while, as a matter of fact, that valuation is sure to be utterly unreliable and inaccurate.

In short, the proposition to ascertain laboriously the cost of the original grade, earthwork excavation, rock excavation, trestles, station buildings and section houses; to add to that the exact sums spent for cut-offs, occasioning an abandonment of the original line; to add the cost of rolling stock and of mechanical interlocking, and then throw on a lump sum high enough to bring the total up to an amount that anybody would gladly pay for the property because of its earning power, suggests the analogy of pacing off the radius of a circle and then figuring out the circumference to six places of decimals.

Yet, with these disadvantages well established and clearly understood, it may be maintained that valuation as a basis for showing that existing capital is at least not excessive, can be made to serve a useful purpose. President Hadley says, in effect, that the railroads of the country would have nothing to fear from the charge of overcapitalization, if their true value were known. We understand that Mr. John F. Stevens is to be responsible for a physical inventory and appraisal of the plant and equipment of the New Haven road, presumably omitting intangible or franchise values, but bringing out especially the immense value of the company's ownership of real estate in the cities of the system. This urban real estate has, of course, very much appreciated in value during the term of the New Haven company's proprietorship, and a general valuation of every form of the company's property would doubtless make an impressive showing and strengthen its borrowing power. But the tangible assets of the New Haven road no more represent the value of its transportation machine than the paper, presswork and binding of one of Thackeray's novels represent the

value of the book—to use a simile suggested by Mr. W. H. Mallock. The tangible and intangible assets of a railroad are one and inseparable, so far as earning power is concerned, and the value of the property is represented by its earning power and by nothing else whatever, when viewed as a going machine.

Already certain practical results of electrification at the Grand Central Station terminal of the New York Central can be reckoned. The Grand Central terminal has long been one of the most congested and difficult to operate in the country; first, because the yard area immediately about the station has been so small that there was little storage room for other cars besides the express and mail cars which must there be unloaded, and, therefore, most of the locomotives and trains have had to be run back over the main track to the Mott Haven yard, 5½ miles north; and, second, because these as well as all of the regular train movements, have had to be made through the 2¼ miles of the Park avenue tunnel which, particularly in winter and heavy weather, has been seriously obscured by locomotive smoke. On December 11th of last year regular operation by electric traction and use of the Lexington avenue temporary terminal was begun with the Yonkers local trains. Since that time the Croton and Peekskill local trains and all trains both through and local on the Harlem division have been changed over to electric operation and run into the depressed Lexington avenue terminal. Last week electric operation of the Poughkeepsie local trains, which still run into the old Grand Central station, was begun, and this week the Empire State Express and some others of the through trains have begun to be hauled by electric locomotives, which are also all the time doing more and more of the through switching. The electric operation is of two kinds, by motor cars and by electric locomotives; most of the Yonkers, Croton and, on the Harlem division, White Plains locals, being motor car trains; the Peekskill and Poughkeepsie locals and the through trains on both divisions being hauled as far as High Bridge and Wakefield respectively, the present limits of electric operation, by electric locomotives. Under this arrangement the bulk of the present electric trains are operated by motor cars. The saving in switching movements gained by motor car operation, as already more than once quoted in the *Railroad Gazette*, was clearly stated by Mr. Aspinall, General Manager of the Lancashire & Yorkshire (England) before the International Railway Congress in 1905 as follows:

> "Every time a locomotive train comes in and goes out, you have four platform operations and eight signal operations: First of all, the train comes in; then a locomotive follows it, that is two; then the train goes out, that is three; then the locomotive which brought it in goes out, that is four platform operations, which means eight signal operations. The electric motor train comes in, that is one; the motorman goes to the other end of the train and the train goes out, that is two. You have only two platform operations and four signal operations. The result is that [by using motor-car trains instead of locomotives] you double your terminal accommodations."

In the reconstructed Grand Central terminal when finished, the maximum amount of switching is to be saved by having the local trains enter the station on a loop at one side and run out, headed in the same direction, at the other side, but even under present conditions with stub-end operation the saving in switching movements described by Mr. Aspinall can be shown. In the working time-table of the Electric division there is included a summary of the train movements in and out of the terminal. With an increase of three regular trains since last November, the total movements to and from the terminal on week days under the present partial and makeshift system of electric operation, are, according to the current issue (April 7) of the time-table, 752 against 1,213 according to the time-table which took effect November 25, 1906, just before the first regular electric operation was begun. This is a decrease of 461 train movements. There must, however, be subtracted from this, 68 construction train movements included in the old but not in the new schedule. Even so, the saving in train movements is only just short of 400, or a decrease of 32.4 per cent. Of the old total, 381 were light engine movements to and from the engine house at Mott Haven. All of these are now eliminated from the schedule as the steam locomotives which still run into the old Grand Central station are generally run back and forth when not in use attached to their trains, and there is room to store the electric locomotives, which require no daily roundhouse overhauling, in the northeast corner of the depressed Lexington avenue yard. Besides saving all the 381 light engine movements scheduled on the old time-table, the movement of the Mott Haven yard storage trains has been reduced from 118 to 103. These figures, of course, represent only temporary conditions, but as the final arrangements for electric operation must inevitably be more efficient than those in temporary use, the success of electric operation in helping out the terminal congestion has been already proved.

CHARACTER IN A RAILROAD PRESIDENT.

Mr. L. F. Loree's appointment as President of the Delaware & Hudson Company suggests an examination of some qualities found valuable in the head of a great corporation. He is not over-imaginative. This is not saying that he is therein deficient, but that his habit of mind has thus far led him to action based on principle or on necessity rather than on theory. It may help to make this distinction clear by observing that he is not of the Harriman or Hill type, although in breadth of view he has some of the great qualities, as creative corporation officers, of both of these ambitious men. Neither is he comparable to Mr. Cassatt during his last years of service as the executive head of the Pennsylvania, when his dominant imagination led the staff and the company to approval of the boldest and largest undertakings ever made by a railroad corporation.

His character seems to have been logically developed in the early plodding days as a subordinate engineer, in a staff where accuracy and thoroughness was the ideal, and in his later experience with great emergencies. Notable among these was his chance to have service in the rebuilding in six days of the Raritan river bridge, in 1878; and in "the great storm" in the Miami river valleys in Ohio in 1886, when 26 iron bridges, two trestles, three stone arch culverts and seven miles of track were destroyed and regular operation restored in six days. His tendency toward military methods was shown in his responsible work in restoring the main line of the Pennsylvania in 1889, when the South Fork reservoir dam broke and caused the loss of more than 2,500 lives and millions of property. His organization of the commissary and marshalling of men and materials forms a war story, but this was a war with the forces of Nature.

Quite like, but different in that it was war with abhorrent forces, was his command of the Pennsylvania's fight in the Debs-Pullman strike at Chicago in 1894. Here he became a great general, and the story of it, often told, has been best told, with the nicest modesty, by himself. His concluding paragraph unconsciously reveals his own mental and moral development, and for that purpose it is worth reproducing:

> "It is with a great sense of relief that we turn from the contemplation of this opera bouffe exhibition of government to regard one institution that comes with credit out of the disgraceful chaos. Virile, resolute, full of resource, the railroads appear to have appreciated to the full the duties they owed to the public, and to have moved with steady determination to fulfill them. Involved in a quarrel in which they had no more interest than had any other bystander, set on by rioters led by a small but reckless squad of mutineers from their own forces, the constituted authorities affording no bulwark of defense but rather an additional burden to be spurred to action and meantime to be nourished and sustained, their conduct may well be carefully examined as affording evidence that the salt of the earth hath not lost its savor. The country owes to the railroads more than it thinks, for the preservation of peace in 1894. It is likely to be under still greater obligations in the future. Whether we regard the action of their management, dignified in the maintenance of their rights, disdainful of compromise with the wrong-doer, steadfastly holding their course through this troubled sea; or the conduct of their men, moving in small and isolated groups, quietly and indomitably to the performance of their duties, amid the howlings of the mob; there stands revealed an institution and a spirit that may well give heart to them that love the Republic, and that must be reckoned with by them that seek the destruction of the established order."

The results of his later activities are what might have been expected from a character so made. His record as manager of the Pennsylvania Lines West; restorer of the Baltimore & Ohio; disagreement with the Rock Island management; and, after a period of ill health, his wonderful rehabilitation of the Kansas City Southern—these are without exception monuments of success.

His way of giving his conclusions in the solution of a question are indicative of his method of thinking and of solving problems. He makes a statement of the fundamental principles, and applies them to the facts and proposed measures with austere logic. He is convinced and is convincing. This method has its dangers, for an error in the application of principle at any step disturbs the aim and leads one wide of the mark. The visual angle is a constant, but it opens out wider and wider with distance. On the other hand, frequent rehearsal of principles, moral and expedient,

was never more needed than now by the heads of great corporations. It begets adherence and is the only safeguard for men in places of great power.

Mr. Loree, as was Mr. Cassatt, is one of the few heads of railroad corporations who had an engineering school training, and this strange fact is explicable only when we remember that later discovered ability is quite independent of schooling. The late George Morison, one of the foremost bridge engineers in the world, had a classical and legal, not an engineer's, schooling in Harvard University. Although Mr. Mellen, of the New Haven road, had only a brief common school course, he has learned not only the science of railroading and the arts of administration, but he has acquired literary talent, verbal and written, which a classical student may envy. Similar instances might be multiplied. Nevertheless engineering knowledge is the most valuable educational equipment of the railroad president, for he conducts an engineering undertaking.

The engineer's school education, in present curriculums, seems to be faulty. His constructive imagination is developed, but few studies in his course tend to cultivate his initiative and his capacity for deciding things not mathematically demonstrable. He has not enough of history, economics, philosophy and general literature. He does not acquire in school the basis for weighing evidence and judging probabilities, as does the lawyer; and it must be due to this that the legal profession is much more largely represented among railroad presidents, as well as in other high places. But Mr. Loree supplemented his school course by studying law and gaining admission to the bar at an age commonly included in boyhood. During his life, since leaving school, he has been a careful reader and student of the departments of learning mentioned above which the engineering schools omit; and its broadening effect, combined with his time-saving habit of applying engineering methods to the solution of most railroad problems, will evidently enable him to go quite as far in his profession as he may desire.

AN UNPRECEDENTED MEASURE OF STATE RAILROAD REGULATION.

The state of New York is, or should be, one of the most conservative in the union. At any rate it is the home of the largest aggregation of capital, and "capital" is the embodiment of conservatism. But the proposed new railroad law now before the legislature is as radical as any that could be found in Ohio or Georgia, Kansas or Oregon. Moreover, it seems very likely to pass. It is favored by the Republican Governor, and the Republicans in the legislature, a strong majority, though unfriendly to the Governor, are understood to be ready to carry out his wishes because President Roosevelt desires them to do so. Besides a rich variety of radical provisions as extensive and detailed as those of any of the other numerous bills that have been brought out in different states this year, the New York bill provides for the establishment of a single commission in place of the two commissions now having supervision over railroads and over gas and electric companies respectively; and, this accomplished, the state is divided into two districts, one of which is to embrace New York City and the other the whole of the rest of the state, with a separate commission, exercising the combined powers, for each district. Each commission in its own district is to have extensive powers in the regulation of railroads, and the duties of the two bodies are, in general, identical, except that the commission in New York City is to deal more particularly with city railroads, and the other commission, dealing more with steam railroads, is to have jurisdiction in some cases within the city of New York.

The powers granted to the new commissions are so extensive that a number of railroads have combined to lay before the legislature a strong protest against some features of the bill. One of the objections made by the railroads is that the Governor is to have the unrestricted right to remove a commissioner. Another is that no adequate provision is made for judicial review of the decisions of the commissions. A third is that the powers granted to the commissions in the matter of regulating the details of railroad operation are extraordinary and unprecedented. On the first two of these objections we shall, at present, have nothing to say: a suitable limitation of the Governor's power of removal will probably be agreed to by all parties. The question of judicial review is one for the lawyers to settle, and one, which in this case, as in the case of the bill before Congress last year, appears to have been made unduly prominent. But the objection to the details-of-operation clause touches a live question. In this feature of the bill (Sections 51 and 52) it is provided that:

> If, in the judgment of the Commission having jurisdiction, any railroad corporation or street railroad corporation does not run trains enough or cars enough or possess or operate motive power enough, reasonably to accommodate the traffic, passenger and freight, transported by or offered for transportation to it, or does not run its trains or cars with sufficient frequency or at a reasonable or proper time having regard to safety, or does not run any train or trains, car or cars, upon a reasonable time schedule for the run, the commission shall, after a hearing either on its own motion or after complaint, have power to make an order directing any such railroad corporation or street railroad corporation to increase the number of its trains or of its cars or its motive power or to change the time for starting its trains or cars or to change the time schedule for the run of any train or car or make any other suitable order that the Commission may determine reasonably necessary to accommodate and transport the traffic, passenger or freight, transported or offered for transportation.
>
> Each Commission, within its jurisdiction, may make all needful rules and regulations concerning the number and efficiency of employees upon railroads and street railroads, and may prescribe tests to establish the competency of such employees; and may, in the exercise of this power, after a hearing either on its own motion or after complaint, issue such orders as in its judgment may be necessary for the safety of such employees and of the public.

The only thing to say about such statutory provisions as these is that they are utterly unsafe and almost surely dangerous, unless the commission which exercises such remarkable powers shall be composed of men almost supernaturally wise and just. As the railroad lawyers say in their argument, the commissions will have power to determine the number of cars of each train, passenger and freight; the number and frequency of trains, when each shall start, and where stop, and what time they shall make; to draft rules and regulations governing railroad employees, how many and what men shall be employed, their hours of work, and probably the amount of their wages. No commission, however high its character or ability, is competent to take the place of the large body of trained and experienced railroad officers. Though the ultimate power of administration is given to the commissions, the bill does not exonerate the officers of a railroad from the responsibilities which go with that administration. Like the arbitrary features of the Federal Safety Appliance Act, this law can be reasonable only in the hands of a commission which will refrain from enforcing it except in extreme cases.

It has been proposed to insure this desired conservatism in the New York Commissions by making the salaries of the members $15,000 a year and giving them ten-year terms. Such a provision is not a sufficient safeguard. It would tend to give us honorable and conservative commissioners, but the terms of the law imply a need, not of these qualities alone, but also of detailed technical knowledge of railroad working. Giving the same commission charge of both gas and railroads works exactly in the opposite direction. The commissioners cannot all be experts in both of these lines, and their work would therefore have to be delegated. This might be tolerable in a recommending body, at the same time that it would be wholly intolerable in a body with absolute powers.

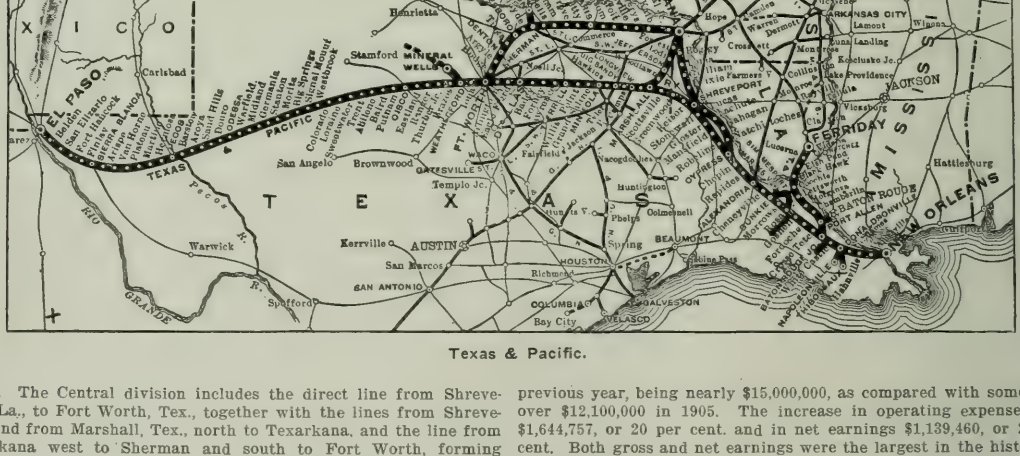
The fundamental and immovable principle that authority and responsibility must be lodged in the hands of the same men, can be safely modified only with the utmost caution. We may readily admit that a state official should watch, criticise and complain with the greatest freedom in all of the details of railroad operation mentioned in the paragraphs of the proposed law which we have quoted, but we should be equally firm in denying the state's power to absolutely and directly rule. It is an old and homely notion, but one which it is still dangerous to ignore, that to profitably advise a man how to do his own work you should know at least as much about it as he knows himself. Even with the new commissionerships filled by the best railroad experts in the state it would be difficult—after a few years, at any rate—to conform to this sound principle, for to improve on the railroad manager's work it is necessary to actually sit in his chair—not in another chair at his elbow. The side adviser has not the stimulus of responsibility which is needed to produce the high boiler-pressure necessary in handling such a big load. Moreover, criticism and persuasion, supplemented when necessary by sharp, intelligent and prompt exposure of bad management, are really the state's best weapons. A competent and public spirited commissioner with these can very quickly make himself felt in the railroad practice of the state; and no mere statute can take the place of these elements. Publicity and criticism are as much better than prescribing brakemen's trips by orders from the State house, as a friendly conference is better than a trial in court to settle an ordinary five-sided quarrel. A weak or poorly-informed commissioner cannot satisfy the best public sentiment of the state, however drastic may be the powers with which he is

clothed. A $15,000 lawyer would be a weak commissioner when dealing with the questions here referred to, and any commissioner would be pretty sure to be poorly informed, because there would be a hundred times as many details as he could attend to.

The Central Freight Association is said to have invited the other freight associations of the country to join it in the attempt to agree upon a uniform freight classification for the whole country —a thing which has been tried unsuccessfully about a hundred times. It is said that the Interstate Commerce Commission has threatened to take up the job unless the railroads soon come to an agreement. Why not let the Commission do it? Only by arbitrary action can the desired unification be accomplished, and arbitrary action will seem much more appropriate coming from that body—residing next door to the White House—than from railroad officers who have to keep the peace with disgruntled shippers.

Texas & Pacific.

The 1,848 miles operated (1,756 miles owned) by the Texas & Pacific may be divided into three fairly distinct groups: the Louisiana division and New Orleans terminal, the Eastern or Central division, and the Rio Grande or Western division. The Louisiana division consists of the main line from Shreveport to New Orleans, with a number of short branches in the sugar cane and rice districts. It also includes a line from Baton Rouge north along the east bank of the Mississippi to Vidalia, which is to form the southern end of the Gould low grade line from St. Louis to New Orleans. Sugar cane, molasses, rice and cotton are the principal items of traffic. The Central division includes the direct line from Shreveport, La., to Fort Worth, Tex., together with the lines from Shreveport and from Marshall, Tex., north to Texarkana, and the line from Texarkana west to Sherman and south to Fort Worth, forming roughly a rectangle. This is a farming and lumbering territory. Cotton is the principal crop. There are also extensive salt works on the direct line half way to Fort Worth.



Texas & Pacific.

The third, the Rio Grande division, has always been the traffic problem of the road. It is 613 miles long, from Fort Worth west to El Paso, the 92 miles on the western end being trackage rights over the Southern Pacific. In all this stretch of track through an undeveloped country there is, with the exception of the Weatherford, Mineral Wells & Northwestern, a 28-mile feeder on the eastern end of the division independently operated, and six miles of branches to coal mines, not a single branch line feeder. Up to within a year or two the local traffic, both freight and passenger, was small and unimportant. The division has been valuable for the sake of its long haul on through traffic, but the Texas & Pacific is in no position to receive a large proportion of the through traffic eastbound at El Paso because the Southern Pacific owns the western connection, and the Southern Pacific's own line runs from El Paso to New Orleans; therefore, it could not be expected to turn over any more traffic than necessary to its competitor. The thinness of the local and, for that matter, the through traffic, on the Rio Grande division, can be judged from the fact that up to a year ago on some 350 miles at the western end there was only one passenger train a day each way, which both carried through cars to and from California and stopped at every local station. Of late there has been a large and steady immigration into the new lands along the division. These, it has been found, with proper agricultural methods and irrigation, are wonderfully productive. Lands in the Pecos river region, for example, 400 miles west of Fort Worth, produce five crops of alfalfa a year. The raising of small fruits and melons is particularly successful, and, while no figures are given for 1906, in 1905 there was an increase of 1,743 carloads of oranges, lemons, green fruits and vegetables carried on the Rio Grande division over the previous year. During the past year this territory has shown even more remarkable development in population, and is fast filling up with an excellent class of settlers. There were 892 carloads of immigrant outfits moved to this region, and immigration is steadily increasing.

A development in this territory, of particular importance, is the beginning of cotton cultivation. For years most of the land was devoted to grazing and cattle raising, but now experiments have shown that much of it is particularly well adapted for cotton growing. With favorable conditions, the cotton crop for the coming season on this division is estimated at 250,000 bales. Cotton is probably the most remunerative single article of the Texas & Pacific's traffic and if, in years to come, cotton growing can be successfully carried on in large amounts on this previously barren western division, it should greatly add to the profits of the road, especially as almost every point in this territory is noncompetitive, and the farther west the point of origin the longer the haul.

In the review of the annual report for 1905, a year ago, it was remarked that the record of the road for the past ten years could be roughly divided into two equal periods: one from 1896 to 1901, when there were considerable annual gains in gross earnings; the other from 1901 to 1905, of small increases or even decreases in gross earnings. The 1905 gross earnings were less than those of 1904 by $300,000; but this closed the stationary period, for last year gross earnings increased $2,784,217, or 23 per cent. over the previous year, being nearly $15,000,000, as compared with something over $12,100,000 in 1905. The increase in operating expenses was $1,644,757, or 20 per cent. and in net earnings $1,139,460, or 29 per cent. Both gross and net earnings were the largest in the history of the company.

The 5 per cent. dividend on the income bonds, paid March 1, 1906, used up almost the whole profit and loss credit balance remaining from previous years. There was enough surplus income from earnings, however, to continue the policy, steadily carried on during recent years, of making betterments and additions out of income. There was charged to improvement account (maintenance of way) $919,155, and to equipment account $599,420, a total of $1,518,575, as against $1,128,118 in 1905. There still remained $1,570,000 surplus for this year, which is more by about $340,000 than the amount of the income bond dividend paid March 1, 1907.

The passenger revenue increased from $2,700,000 to $3,600,000, a gain of 33 per cent. over 1905. Of this increase of $877,000, $644,000 came from local passenger traffic. The average revenue per passenger increased 10 cents, while the average expense per passenger decreased 6 cents, leaving net earnings per passenger of 44 cents, as against 28 cents in 1905, a gain of over 60 per cent. It must be remembered in these, as well as all other comparisons, that the 1906 results are contrasted with a bad year. In 1905 the cotton crop was poor, and the yellow fever epidemic in Louisiana greatly interfered with the traffic and operation of the road.

Of the three divisions, the Rio Grande division shows by far the greatest gains in earnings. Gross earnings were $5,198,762 on the Central division; $5,109,434 on the Louisiana division, and $4,606,412 on the Rio Grande division, while the increases over the previous year were $787,610, $856,518 and $1,140,088 respectively.

Similarly net earnings were: Central division, $1,818,486; Louisiana division, $1,848,188, and Rio Grande division, $1,392,381, while of the increases in net earnings the Rio Grande division furnished $468,785; the Eastern division $358,914, and the Louisiana division $311,761. Thus is reflected in earnings the agricultural development of West Texas.

There was considerably more spent for ordinary maintenance expenses than in the previous year. Maintenance of way cost $867 per mile owned against $744 in 1905. To this must be added the $919,000 spent on improvement account, which works out at $523 per mile, a total maintenance expenditure of $1,390 a mile. Ordinary repairs and renewals of equipment cost $2,184 per locomotive, against $1,624 in 1905; $1,176 per passenger car against $955 in 1905, and $75 per freight car against $47 in 1905. The $600,000 appropriated on equipment account must also be added to these expenditures.

The Texas & Pacific is one of the railroads which represents large possibilities in the future. At present its stock is selling below 30. The net income of the past year after payment of the income bond dividend amounted to 4.6 per cent. on the $38,760,000 stock. Most of this, as in previous years, was appropriated for betterments and additions. When it is considered that during the past five years the appropriations for the improvement of the property out of income have amounted to over $7,000,000, or an average of $1,500,000 a year, it is seen that its possibilities represent not only the natural development of its territory but an equity of the stock in the betterment of the road already accomplished. There is no doubt but that the road is being steadily improved from a physical standpoint and that its territory is growing richer in traffic possibilities. If the future of the agricultural lands in the west of Texas turns out anywhere nearly as rosily as many expect, the Texas & Pacific should within a few years come to be a steady dividend payer.

The principal statistics of operation are given below:

	1906.	1905.
Mileage worked	1,848	1,826
Freight earnings	$9,901,702	$8,223,249
Passenger earnings	3,602,006	2,714,881
Gross earnings	14,914,608	12,130,391
Maint. way and structures.	1,522,081	1,290,685
Maint. of equipment	1,858,040	1,571,413
Conducting transportation	6,077,826	5,124,373
Operating expenses	9,854,923	8,210,166
Net earnings	5,059,685	3,920,225
Appropriated for betterments	1,518,575	1,128,118

NEW PUBLICATIONS.

Railway Problems. Edited by William Z. Ripley, Ph.D., Professor of Economics, Harvard University. 686 pages, 5 in. x 8 in. Published by Ginn & Co., 1907. Cloth. Price, $2.25; mailing price, $2.40.

In the book at hand, Professor Ripley has collected a number of valuable papers, documents and records, which it is of the greatest service to the student of railroad economics to find contained within the limits of a single volume. He has supplemented these papers with an introduction which brings out clearly the purpose of the work and binds its component parts together. The scope of the book can best be considered topically by its chapter "contents," which includes: A Chapter of Erie, by Charles Francis Adams; Standard Oil Rebates, by Ida M. Tarbell; The Building and Cost of the Union Pacific, by Henry K. White; The Southern Railway & Steamship Association (a typical pool), by Henry Hudson; The Theory of Railway Rates, by Frank W. Taussig; two decisions of the Interstate Commerce Commission as to reasonable rates (the Cincinnati Freight Bureau Case, and the Maximum Freight Rate Decision); the Savannah Naval Stores Case, as a further illustration of unreasonable rates; three chapters on relative rates, covering the Hutchinson, Kansas, Salt Case; the Eau Claire, Wis., Lumber Case, and the Chattanooga Case; two decisions on the long and short haul clause; a paper on the trunk line rate system by William Z. Ripley; three chapters on the Southern basing point system and the Southern rate system; a chapter on transcontinental freight rates (the St. Louis Business Men's League Case); a chapter on export and domestic rates; one on freight classification (the Hatters-Furs' Case); and papers on economic waste in transportation by William Z. Ripley; on the Northern Securities Company, as an example of railroad consolidation, by B. H. Meyer; and the Interstate Commerce law, as amended in 1906, by Frank H. Dixon; on reasonable rates, a judicial determination, by Alton D. Adams; on the doctrine of judicial review, by H. S. Smalley; on the English Railway & Canal Commission of 1888, by S. J. McLean; on railway regulation in France, by W. H. Buckler, and on railroad ownership in Germany, by B. H. Meyer. The work is supplemented by an excellent index and it may fairly be described as the most important compilation of literature useful in understanding the railroad problems of the present day that has ever been gathered together in a single volume.

This book should be in every university library and should form an important part of the training of the student in economics. The selection of decisions of the Interstate Commerce Commission is an extremely good one, embracing the important cases that have had direct bearing in shaping legislation and the best informed public opinion as to the things which are to be sought for in railroad regulation by the national government and in co-operation between railroads. Had the collaborator done no more than to select, edit and place in one volume these decisions, his work would have been of considerable importance, but the decisions have been skillfully supplemented with other matter, treating ably of important phases of railroad development, such as the scandalous corruption shared by officers, directors, and the state legislators and judiciary at the time when Daniel Drew, Jay Gould and Jim Fisk were manipulating the Erie.

Text-Book on Geodesy and Least Squares. By Charles L. Crandall, Professor of Railroad Engineering and Geodesy, Cornell University. New York: John Wiley & Sons. London: Chapman & Hall. 329 pages. 6 in. x 9 in.; 102 illustrations. Cloth. Price, $3.00.

The brief historic outline of the inception and progress of geodetic surveying with which the book opens should be of interest not only to the engineer but also to the layman, and it is interesting to note how quickly instruments of precision were designed for the execution of the work. But though the work of measuring the meridian arcs was begun at an earlier period, it was not until the nineteenth century that the methods that are now accepted as standards were fully developed. These methods are taken up in minute detail and discussed with such fulness that it seems almost as though a novice could go into the field and, by following instructions do accurate and satisfactory work. Not only are these descriptions thorough but they are put in so clear and interesting a manner that they hold the attention and fix themselves in the memory without an effort. While the science is exact and requires close mathematical work in its elaboration the first part of the book is not burdened with calculations but is devoted rather to the elaboration of the descriptions of instruments and methods of using them. Full descriptions of the signals, towers and instruments that are used in this class of survey are also given, and though they naturally refer most specifically to the work of the United States Coast Survey, those in use by foreign governments are not overlooked. There is an exceedingly interesting chapter on Base Line Measurement, giving a full account of the instruments used for the purpose and the care and accuracy with which the work is done. In this connection it will come somewhat as a surprise to those who are familiar only with the micrometric rod measurements used, to learn of the accuracy that can be attained with the tape. This method was introduced some years ago by M. Jäderin and was later taken up by the United States Coast Survey. "From the results obtained it was concluded that a probable error of less than one-millionth as derived from a range of different measures could be secured, or including errors from all sources a result true to one five hundred thousandth could be reached."

The last three chapters of the first part are occupied with a mathematical discussion of the figure of the earth, geodetic positions and the determination of the dimensions of the ellipsoid.

Part II., commencing with page 205, is devoted to the discussion of the method of least squares for the adjustment of the geometric variations of a survey. It is the method which "has for its object the finding of the best or most probable values from a given series of observations for a set of physical quantities depending upon physical measurement." This discussion is elaborate and deals with the various cases that can arise in a piece of work, and will require close attention in order to follow the mathematical analyses that are given. These are, however, worked out in great fulness of detail so that the methods can be readily followed, by any one having the requisite mathematical training.

Railroad Pocket-Book. By Fred. H. Colvin. New York: The Locomotive Publishing Co. 217 pages; 4 in. x 6 in.; 97 illustrations. Flexible cloth. Price, $1.00.

This handy little book is a cross between an engineers' reference pocket book and a dictionary, partaking of the nature of both. It is in the form of a dictionary in that definitions and illustrations are given of a large number of terms in common and uncommon use in railroad work, while formulae for a number of calculations and tables of data are given in connection with these definitions. As stated in the preface, no book of this kind can ever be complete, and as it grows it will become more valuable though less convenient to handle. The range of subjects already covered by the definitions is large, and if carried to the limits of its possibilities would make a volume of most imposing dimensions. As it is it is most convenient in form and contains much information that engineers in charge of railroad equipment need to have at hand, and will be welcomed and used accordingly as it is appreciated.

The Railway High Speed Mania. By B. B. Adams, Associate Editor of the *Railroad Gazette*. *Scribner's Magazine* for May.

Mr. Adams discusses fully and intelligently the question of modern high speeds, and shows why they are not in themselves a source of danger, if the requisite preliminary work has been done. Part of his paper is reprinted in the *Railroad Gazette* this week.

CONTRIBUTIONS

The Profitable Weight and Speed of Freight Trains.

Pittsburg, Pa., April 13, 1907.

To the Editor of the Railroad Gazette:

Replying to that portion of Mr. Wild's article of April 8th, in which he takes issue with my statement that the ratio of delayed time to total time would be increased to such an extent as to nullify the benefit that would be derived from handling freight trains at a speed of five miles greater while actually in motion. Reflection will suggest that an increase in the number of trains to be moved over a given piece of track will abnormally increase the delays incident to meeting and passing points; for example, if a road has two freight trains in each direction a day, it is apparent that there will be four meeting points. Now, let us double the traffic and have four freight trains each way per day, and while the volume of traffic is only doubled, the number of meeting points have become 16, or have increased four-fold, increasing by the square of the number of trains.

A reduction of 30 per cent. in the train-load, in the example cited, is a simple matter of calculation, and if the trains on the low-class line were moved with 30 per cent. less tonnage in the train, it will be found that the train-miles would increase 43 per cent. This is also a simple matter of calculation. Now, if we increase the train-miles 43 per cent. on a piece of railroad where the trains are so numerous as to consume 40 per cent. of the total time between terminals at meeting and passing points, is it unreasonable to assume that this large increase in the train-miles will effect an increase in percentage of the delayed time to total time; in other words, it would be folly to assume that the gain of five miles per hour in the average time, suggested by Mr. Wild, could all be put into "moving time." Even if the delayed time to total time between terminals should be only 50 per cent. with the increase of 43 per cent. in train-miles, which could hardly be accomplished, then we would have a net gain of only 2½ miles per hour by the sacrifice of 30 per cent. in the train-load.

Mr. Wild now admits that the difference between the resistance figures used by Mr. Henderson and by myself is slight, but he now bases his criticism on the statement that "there has been a perfect murrain of exact science in the loading of engines on railroads of late years." Every practical railroad man in the country knows that no two railroads use exactly the same resistance table, all resistance tables being based upon empirical formulae, not upon exact science.

In his former communication, under date of February 20th, Mr. Wild states very clearly: "No wonder the ratio of expenses to earnings on the high class line is much higher, considering that it undertakes to do a high-class business at a very low-class rate."

The table criticised showed that the average rate per ton on the high-class line was $1.28. It also showed that over 70 per cent. of the business handled by the high-class line was high-class traffic. It also showed that 75 per cent. of the business of low-class line was coal, ore and stone, and that the average earnings were 66 cents per ton. The reason why the rate per ton-mile was 5.13 mills on the high-class line, as against 5.32 mills on the low-class line, was because the high-class line had an average haul of 250 miles while the low-class line had an average haul of 124 miles. It should be remembered, however, that the low rate per ton-mile does not mean that the high-class road had a very low-class rate, as the figures show the reverse to be true.

The average rate per ton of $1.28 on the high-class road and 66 cents per ton on the low-class line, is the answer to Mr. Wild's criticism that under my theory railroads should receive no more for carrying a ton of dry-goods than for carrying a ton of coal. The reason why the low-class line received only 66 cents per ton is because three-fourths of its business is coal, stone and ore, while over 70 per cent. of the business of the high-class line is packing-house products and general merchandise, which naturally takes a considerably higher rate.

As previously stated, my judgment is that any engine rating system that is based *on both time and load*, which has been the case on the roads with which I have been identified, will unquestionably prevent over-loading of locomotives. An engine rating system where engines are rated up to their maximum capacity would surely be open to criticism, if the engines were loaded down so that they could not make the speed between terminals that the business which they handled demanded. High-class freight, from which railroads receive higher rates, justifies more expeditious movement, but the most economical speed for the movement of low-grade tonnage, handled at very low freight rates, has been determined from practical results on different railroads in this country, to be between 12 and 15 miles per hour while the trains are actually in motion, and if railroads with ordinary gradient conditions are able to show that their low-grade freight trains while in motion are moving at speeds falling between these limits, it will be found that they are moving their trains at the most economical speed at which the traffic can be handled.

As the operating conditions on different railroads are quite varied, some having ample passing tracks and large terminals; some having a single track and others, second, third and fourth tracks; some having light grade lines and others having a number of helper grades; some handling a preponderance of low-grade tonnage and others moving a preponderance of high-class tonnage on which the rates are higher; some having a very heavy density and others a very low density of traffic; it would seem to be the part of wisdom not to attempt to make one scale to fit all of these varied conditions, as the operating managements might be able to show a very good reason for either a low average train-load or a high average train-load. My contention in the first place was that the table prepared by Mr. Wild for universal application would not fit equally on the low-class and high-class traffic line, the high-class road moving its tonnage in units of only 329 tons per train and receiving $1.28 per ton, while the low-class traffic line moved its tonnage in what might be considered large train units of 610 tons, its average revenue per ton being 66 cents. In other words, the same rule would not apply on both roads. My contention is that the management of both roads can undoubtedly justify their methods of operation by the results obtained. The low-class traffic line would make a very unfavorable showing if it was compelled to move its tonnage in as small train units as the high-class line, and the high-class line would not be able to hold its traffic if it operated its trains in the same average train units as the low-class traffic line. The only intelligent way to determine whether engines are over-loaded on a railroad is to take up each railroad individually and analyze the conditions under which it is operated.

B. A. Worthington.

Favorable Crop Report.

The Crop Reporting Board of the Bureau of Statistics, United States Department of Agriculture, finds the average condition of winter wheat on April 1 to have been 89.9 against 89.1 on April 1, 1906; 91.6 at the corresponding date in 1905, and 85.3 the mean of the April averages of the last ten years. The following table shows, for selected states, the averages of condition of winter wheat and rye on April 1, the corresponding averages one year ago, and the mean of the corresponding averages of the last ten years.

The states, as shown, are arranged in order of total wheat production.

State or territory.	Winter wheat.			Winter rye		
	1907. per cent.	1906. per cent.	For 10 years. per cent.	1907. per cent.	1906. per cent.	For 10 years. per cent.
Kansas	99	85	88	97	91	91
North Dakota	..	..	..	86	..	..
Minnesota	..	..	..	93	88	..
Nebraska	99	91	89	97	92	..
Indiana	81	92	79	89	92	87
South Dakota	..	..	..	94	90	..
Ohio	83	93	80	90	93	84
Illinois	95	91	82	95	92	89
Missouri	96	85	85	95	90	89
Pennsylvania	95	91	88	95	91	90
Washington	95	89	90	95	88	..
California	80	91	92	95	94	92
Oklahoma	76	90	87	90	94	85
Oregon	92	83	92	99	97	96
Texas	51*	91	84	55*	93	83
Iowa	96	93	85	99	97	..
Michigan	81	82	81	85	85	87
Maryland	94	93	89	94	92	92

*Low condition due to ravages of insect pests.

Ten-Wheel Locomotive for the St. Louis & San Francisco.

The American Locomotive Co. has recently delivered ten 10-wheel locomotives to the St. Louis & San Francisco from the Schenectady works. These engines are fitted with the Walschaert valve motion, which has been worked out along the line set forth at the December meeting of the New England Railroad Club, in that the center of the valve has been moved out until it is 4 in. outside the center line of the cylinder, by which the motion is carried in a straight line, without offset, from the eccentric crank to the valve stem. The details of the motion are clearly shown by the engravings. The valve has an inside admission and its stem takes hold of the combination lever below the radius bar, while the latter runs on through the link block and link to a block in the arm of the lifting shaft by which it is carried. The radius bar is turned to slide back and forth in this block, and the block itself is carried on trunnions turning in the end of the lifting shaft arm, so that it can always keep in line with the radius bar.

The frames are braced at this point by a stiff ribbed casting to the front face of which the link bracket is bolted. This is a ribbed casting of great stiffness and swings out from the cross brace to carry the link, and thus extends beyond the center of the valve. The bearings for the lifting shaft are bolted to the rear of the same casting. The valve has a diameter of 12 in, with a 5¾-in. travel; a lap of $1^1/_{16}$ in. and a constant load of ¼ in.

This is the principal feature of interest in the engine. Aside

from this, it will be noticed that it exemplifies the fact that, despite the discussions on the subject, there is, as yet, no settled practice in the matter of the location of the injector check. In this case it is but 18½ in. back of the front tubesheet, which is somewhat farther to the front than ordinary current practice.

The following are some of the principal dimensions of the engine:

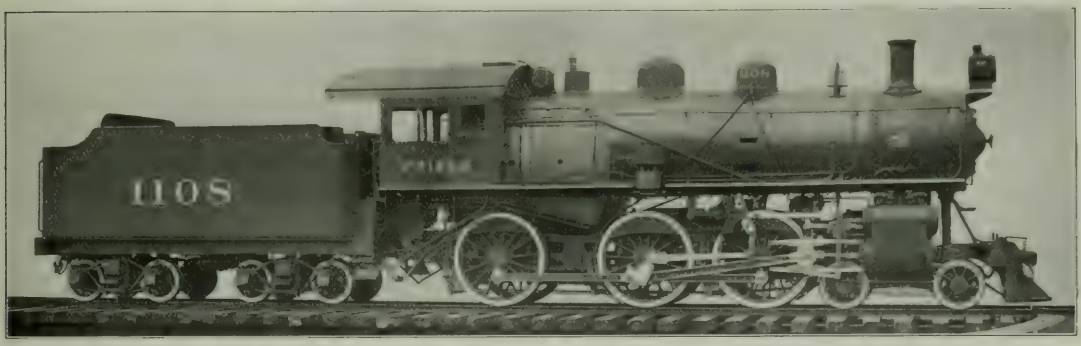
Cylinder diameter	21 in.
Piston stroke	26 "
Weight on drivers	136,000 lbs.
" total	183,000 "
" engine and tender	310,800 "
Heating surface, tubes	2,489.7 sq. ft.
" " firebox	164.6 "
" " total	2,654.3 "
Grate area	47.69 "
Boiler pressure	200 lbs.
Firebox, length	102⅛ in.
Firebox, width	67¼ "
Tubes number	318
" diameter	2 in.
Tubes length	15 ft. 0½ in.
Wheels, diameter driving	69 "
Wheels, diameter truck	33 "
Tank, capacity, water	6,000 gals.
Tank, capacity, coal	12 tons.
Tractive power	28,300 lbs.

$$\frac{\text{Weight on drivers}}{\text{Tractive effort}} = 4.81$$

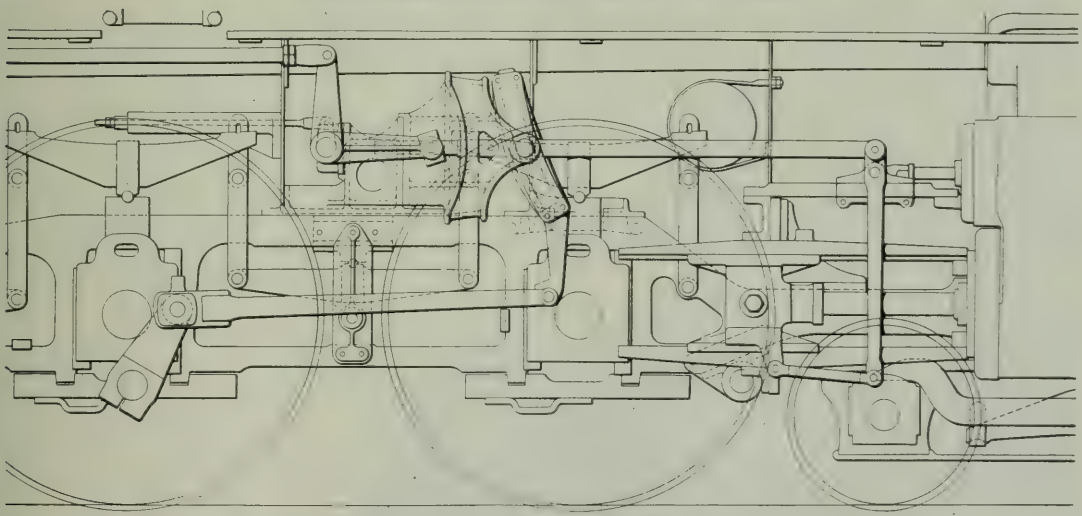
$$\frac{\text{Total weight}}{\text{Tractive effort}} = 6.47$$

$$\frac{\text{Tractive effort} \times \text{diameter drivers}}{\text{Heating surface}} = 735.67$$

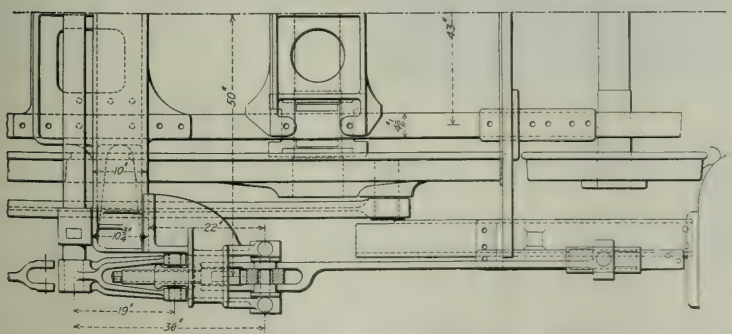
$$\frac{\text{Heating surface}}{\text{Grate area}} = 55.65$$



Ten Wheel Locomotive for the St. Louis & San Francisco.



Side Elevation of Walschaert Valve Gear for 10-Wheel Locomotive; St. Louis & San Francisco.



Plan of Walschaert Valve Gear on 10-Wheel Locomotive.

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = .062$$

$$\frac{\text{Weight on drivers}}{\text{Total heating surface}} = 51.61$$

$$\frac{\text{Total weight}}{\text{Total heating surface}} = 68.94$$

Volume, 2 cylinders = 5.2 cu. ft.

$$\frac{\text{Total heating surface}}{\text{Volume of 2 cylinders}} = 510.44$$

$$\frac{\text{Grate area}}{\text{Volume of 2 cylinders}} = 9.17$$

Equivalent of tube heating surface in firebox heating surface = 685.86

Total equated firebox heating surface = 850.46
(Vaughan's formula)

Picked Up on the Road.

BY GULF.

It is always refreshing to meet a man who fulfils Josh Billings' definition of an enthusiast in that he can prove ten times as much as anyone will believe, and believes ten times as much as he can prove. It is refreshing until the enthusiast becomes a bore. This is the case with some examples of trade literature that are sent out, and among them are some sheets from a large firm that might do well to check the exuberance of spirit of one of its representatives who therein announces with all the positiveness of one who really knows, that the railroads of the country are wasting 50 per cent. of their combustibles in smoke, cinders and sparks. This, if true, speaks so well for the quality of coal that is being used that it should make good Welsh and Pocahontas turn green with envy. If this coal can do its work, any work, satisfactorily with a 50 per cent. wastage it must be fine, and the only regrettable thing about it is that the source of supply is kept such a dead secret. Of course it follows, as the night the day, that that concern has a device to sell that is claimed to be a fuel economizer. But why draw such a long bow that the mark is overshot and the article brought into disrepute? Or are people actually hoodwinked by these blatant absurdities, simply because they are too lazy to think and analyze?

This cock-sure certainty of things that are not so is amusing to an outsider, but pitiable. One is reminded of the truth of the proverb that it is better to know less than to know so much that isn't so. Take the recent meeting of the Electrical Engineers in New York for example. To listen to the paper and the speakers who followed after, and believe what they said, would have settled the conviction that the end of the steam locomotive was at hand and it was only the foolish man who would spend money to repair those in use. The poor old locomotive was

> "Dead, defunct without any doubt,
> And the lamp of its life was entirely gone out."

Away back in the eighties, when they were driving, or trying to drive, street cars with a motor on the platform and a chain leading to the axle, the enthusiasts were talking in identically the same way and proving beyond the shadow of a doubt (on paper) that all hands would soon be piped aft to the funeral of the locomotive. And yet now, 20 years after, the old machine continues to puff and snort and haul its burdens of passengers and freight. For a time the electrical craze moderated, but since the Pennsylvania and New York Central and New Haven have taken it up seriously, the enthusiasts are again in the fore. The fact is, most people believe in the coming of the electric locomotive as they do in the millennium: as something that is sure to come but in the far distant future. The pity about the meeting referred to is that there was no speaker there who knew as much about the practical requirements of railroading as he and the others did about the advantages and economies of electric propulsion (on paper).

There is sometimes a world of suggestiveness for the railroad man in the results obtained in private concerns, which are difficult to duplicate in railroad shops because of the nature of human kind. I happened into a large cotton mill, the other day, that had recently come under a new management and had paid its first dividend in 20 years. No one seemed to know how it had been accomplished but a few chance remarks led to the conclusion that it had been saved. Saved in a multitude of little things, in the use of waste, the filtering of engine oil to use on the other machinery, in the application of a new foot valve and a rearrangement of the suction, by which the engine vacuum was raised from 22 in. to 27½ in.; by the selection of coal that gave the most efficient evaporation per dollar regardless of the pound per pound results; in a constant checking of the engine working to see that the valves were always doing their work at the proper time; and then, in the mill, the belting was inspected to see that it was always kept in the proper tension, proper to drive the looms without slip, and so hold them up to speed, and yet it was no tighter than was necessary, for extra and useless tension means extra friction on the journals, and this, when multiplied by hundreds, comes back to a visible increase in coal consumption. There was nothing great to lay one's hand upon; a mere mass of trifles, but, to paraphrase from Michael Angelo, I believe, trifles pay a dividend, and dividends are nothing to be trifled with. Drop all the rest, and let us ask how many railroad shop superintendents in the country have ever given one thought to the effect of tight belts on the coal pile? I have no doubt that the *Railroad Gazette* would gladly print a full list of all who can honestly claim that distinction. All of which suggests that there is room on every road for an advisory engineer of tact.

But even if the man at the head has thought of the tight belt, who is going to attend to it? It is such an easy matter to draw up specifications, and such a different thing to get them executed! It is almost pathetic at times to read such specifications, with the probable results in mind. I have just been looking over some concrete specifications in which the manner of spreading the sand, of laying on the cement, of mixing the two, of adding the water and the stone, are laid down most explicitly, and then there rises the recollection of similar specifications drawn up for a big New York office building, and of seeing that concrete go into the foundation with the cement as dry as when it came out of the kiln. Such was the gap between requirement and execution! It is like the sand blast on steel work, always suggested and never used.

I hear more or less semi-surprised comment, in view of the recent rapid extension of the use of the Walschaert valve gear, that it has been neglected in this country for so long a time. There is really nothing surprising about it. In the first place, it was not protected by a patent, so no one had a pecuniary interest in its development. Do you suppose that it would have lain dormant for 60 years if it had originated in one of the big locomotive companies, as the details of the compound locomotive did? Just think back 10 or 15 years and recollect how the compounds were forced on the railroads. But, then, why did not the railroad men take it up? Well, the American railroad man does not take things up until the supply man has been around and argued, and proved and demonstrated and finally begged a trial order on a guarantee of its operation. This is a relic of the days when the mechanical department was subordinate to all others, and the heads of the same had neither the courage of their convictions, nor any real convictions to be courageous about. And so they stuck to what they knew, and they thought they knew the Stephenson valve gear.

Speaking about the Stephenson valve gear, do you remember the mystery with which the old-time valve-setter used to shroud his work? It was funny, and his sedate know-it-allness was worthy of Old Burton or Billy Florence. But there is a reason for all things and this is no exception to the rule. Few men about the shop did know anything at all about the motion, and the man who did, guarded his knowledge as a trade secret. Even master mechanics and locomotive designers were not exempt from the ignorance clause. I have known the master mechanic of one of the great trunk lines order a link of 7 ft. radius put on a switching engine with 3-ft. 6-in. eccentric rods because he happened to have a template in the blacksmith shop to forge it from. That same man had hardly an engine on his line on which the valves were square, and is it any wonder? I have known a big locomotive works to turn out engines with the center of the lifting shaft so located that it was impossible to set the valves and have them square. Isn't it fair to assume that the designer, in those days, did not know that the position of the lifting shaft made a difference in the working of the motion? What chance had a delicate mechanism like the Walschaert with such a state of affairs? The Stephenson motion would work somehow, no matter how it was abused in the designing, and though really very delicate, could be made to do. So the old-time railroader remained where he was and let well enough alone.

Speaking of ignorance, that regarding the compound locomotive was sometimes startling, and I am reminded of an incident which I may have told before connected with the introduction of that type of engine. The representative of a certain locomotive-building establishment was in conference with a superintendent of motive power and was urging the advisability of trying one compound in a lot that was to be ordered. The railroad man was obdurate and finally said: "Now, just tell me what the back pressure on your high-pressure cylinder is." The representative said it was between 90 and 100 lbs. "There, that's it, that's what kills the compound engine for locomotive uses. Now if you could only put on a condenser between the high and low-pressure cylinders, as we do in our marine service, and do away with all that back pressure and get a vacuum instead, there might be some sense in building a compound locomotive. Until that can be done there is no use talking compound locomotives to me." And I guess there wasn't!

Railroads in French West Africa.

In French West Africa (Senegal, Guinea, etc.) there are now 857 miles of railroad in operation and capital has been provided for 625 miles more. The longest line, from Kayes, some 200 miles up the Senegal eastward to the River Niger at Kulikoro, and another line from the mouth of the Senegal at St. Louis parallel with the coast and but a short distance inland southeast to the sea at Dakar, are already paying. Together with navigable waters of the Senegal and the Niger they give an outlet to the sea for a great extent of country, even as far as Timbuctoo, the great emporium of the country south of the Sahara. The French are building two other railroads from points further south to reach the Niger.

Norfolk & Western Improvement Work.

II.

YARDS.

BY GEORGE L. FOWLER.
Associate Editor of the *Railroad Gazette*.

BLUEFIELD YARD.

In a previous article published in the *Railroad Gazette* March 15, the general features of the improvements that are in progress of execution on the Norfolk & Western Railway were passed in review and allusion was made to the large yards that have been built at South Norfolk, Roanoke, Bluefield, Williamson and Portsmouth. While all of them are essential to the satisfactory handling of the traffic of the road and thus become ranking in importance, that at Bluefield is the most interesting in that it serves as the originating point of a very large percentage of the business. Bluefield, West Virginia, is located just east of the great fault in the Pocahontas coal measures, and is a division terminal. It is here that all of the eastbound coal is brought in from the operations in the Pocahontas district and the yard has been built for the purpose of weighing, billing and classifying the shipments. Attention will, therefore, first be turned to the Bluefield yard, after which the others will be described in their physical characteristics, and then the methods of operation of each will be dealt with.



Eastern End of Bluefield Yard.

Bluefield is in West Virginia, but it is not far enough to the west to be in what is properly called the mountain section of the state. This is not reached until after passing Bluestone, nine miles further west. The country is, however, rugged and hilly, with a rock foundation underlying a thin layer of earth. The hills are steep, and cut with numerous gullies and water courses, yet rounded in contour by time so that the country presents an intermediate condition between the rolling foot hills of the Alleghanies and the precipitous ridges and hollows that prevail further west. The rock underlying Bluefield is what is sometimes known as a bastard limestone. Technically it is the bluestone formation, consisting of red and green shale sandstone and impure limestone. Its strata are badly tilted, standing at steep angles that sometimes approach the vertical and often scaling off on a sharp incline where excavations are made, leaving a smooth, unbroken surface. More often, however, it disintegrates badly under a shot, with numerous cracks, afterwards crumbling under the action of water and frost. The location of the road at Bluefield is along a narrow valley, with hills of the character just described rising abruptly upon each side; a valley that serves as a pass between the levels of East river and Bluestone river, both of which are tributaries of New river, at points about 25 miles apart.

Given these physical conditions, the work of building a large receiving and classification yard in such a place involves the removal of large amounts of material and the expenditure of large sums of money. The estimated amount of excavation for the construction of this yard is placed at 1,361,000 cu. yds., and the cost at $1,294,000. The total length of the yard is about 19,000 ft., or 3.6 miles, so that there is about 300,000 cu. yds. of excavation to the mile. At its widest point the yard has a width of about 600 ft. and it is bounded on both sides for almost its entire length by the steep sides of a cut, as shown in the photographs, though even this does not fully show the true significance of what it meant to build such a yard in such a place.

In working out the plans for the large yards at Roanoke and Williamson they have been placed between the two main lines in order to avoid all cross overs; but owing to the configuration of the ground and local conditions at Bluefield, this has been impossible at that point, and the yard has accordingly been placed wholly to the north of the main lines, which are shown by heavy lines. These lie parallel to each other and with the ordinary spacing apart until they reach a point about 2,400 ft. west of the passenger station, when the westbound track is swung to the right to make room for an intermediate third track to be used as a running track for eastbound freight as explained later.

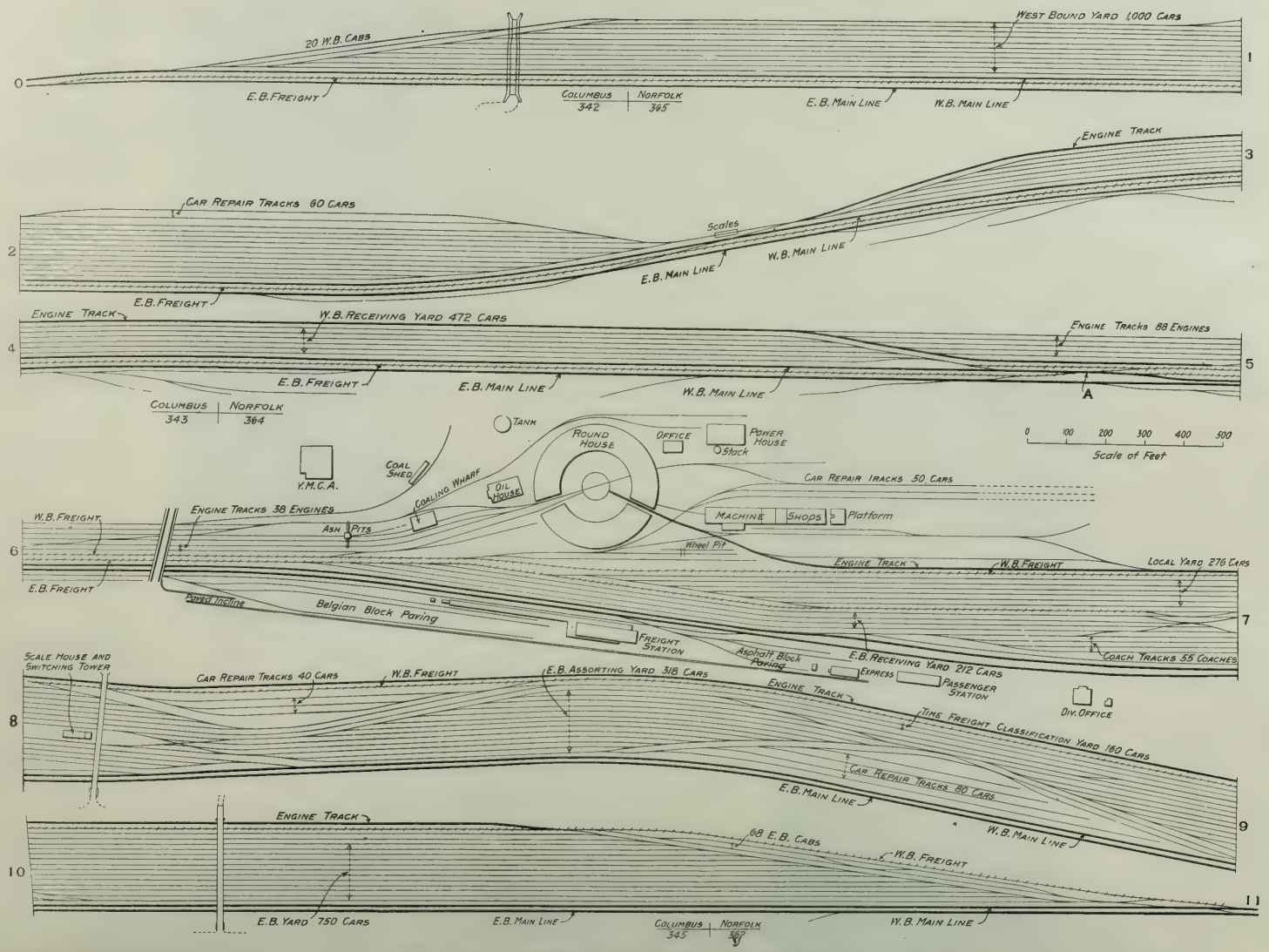
Starting at the eastern end of the yard, the westbound traffic leaves the main track at the extreme end and passes over the special westbound running track that is shown by a hatched line. This track runs along the northern side of the eastbound yards and between them and the running tracks for eastbound engines. At a point about 1,700 ft. from the entrance to the yard, and just before reaching the junction of the engine tracks, the caboose is dropped and falls back to the caboose tracks, at the point indicated for the eastbound cabooses, where they are ready for their trains when the latter are made up. The westbound train then continues its course up the northerly side of the yard between it and the roundhouses and shop, past the neck in which the engine tracks are located and on down to the ladder track at the east end of the westbound receiving yard. The train is there hauled in upon the assigned track and the engine runs through the yard to the west end, where it passes out to the engine track and returns to the roundhouse over the same along the north side of the yard, as indicated by the hatched line. In this, it passes over the engine tracks that have accommodation for 88 engines, and which are served by a ladder track separated from that of the westbound receiving yard. They are all served by a single track that is common to the ash pits. From the ash pits there is a straight run to the coaling wharf, water tanks and roundhouse. From the westbound receiving yard, which has a capacity of 472 cars to the classification yard, the capacity of which is 1,000 cars, there is a direct and easy gravity movement so that the work of classification is practically that of a hump yard.

For outgoing westbound trains there are two routes which the engine may follow from the roundhouse or storage tracks to the west end of the yard. One is to come out on the ladder track, separating the standing tracks from the ash pit tracks, reaching the main westbound track at A, and thence along the latter to the west end of the classification yard, where it can back in to its train and pick up the caboose from the track reserved for them. The other route is to follow the engine running track along the north side of the receiving yard and strike the main westbound track between the two yards. The first route is the one preferred, however, as the engine is thus out of the way of those going toward the roundhouse after leaving a train in the receiving yard.



Bluefield Yard, Looking West.

By following these movements on the engravings, it will be seen that the westbound train clears the main track at the entrance



Plan of Bluefield Yard; Norfolk & Western Railway.

to the yard and, as it is provided with its own running tracks, it does not interfere with nor is it delayed by the work of the eastbound yard. It leaves and enters the main line from the same side and does not cross any of the eastbound freight traffic or the main lines. In this respect it will be seen to resemble the Williamson and Roanoke yards.

The handling of the eastbound traffic is more complicated, not only because of the nature of the shipping and billing, as will be discussed later in connection with the operation of the yard, but because of the amount of traffic originating at this point.

The eastbound trains on entering the yard are run in upon the third track between the two main tracks, as indicated by the hatched line. This track extends the whole length of the westbound yards and then at a point opposite the engine tracks runs upon the westbound main line at A, which it follows for about 150 ft. and then leaves it to enter the eastbound running track as indicated by the hatched line. At a point opposite the ash pits it enters the ladder track of the eastbound receiving yard which has a capacity of 212 cars. This running track extends down through the center of the west end of the receiving yard to a point near the scale house, from which place the cars drop by gravity down to the assorting yard. This assorting yard is needed because of the large amount of coal traffic that originates at Bluefield that must be weighed and billed. The local receiving yard for cars that are already billed has a capacity of 276 cars, and the assorting yard, 318 cars. The receiving yard then delivers direct to the scale tracks, when by way of a split ladder track the cars are run into the eastern assorting yard, and thence on to the classification yard with a capacity of 750 cars, where the trains are finally made up. The eastbound train is thus compelled to haul its caboose into the receiving yard, where it is dropped and hauled back to the caboose tracks at the west end of the yard, by way of the westbound freight running track to the point A, thence along the main track to the extreme end of the yard. From the eastern end of the receiving yard the incoming engines reach the roundhouse by way of a running track lying between the receiving yard tracks, as indicated by the hatched line. On this track the engine reaches the westbound freight running track over which it passes to the storage tracks and ash pits. This causes a minimum delay to any western freight.

It will be seen from the plan that in order that there may be no delay to engines moving between the roundhouse and the head of eastbound trains, a special engine running track has been provided outside of and to the north of the westbound freight running track. An engine leaving the roundhouse thus skirts the whole of the eastbound yard and, taking its train at the east end, hauls it out beyond the caboose tracks and to the main eastbound track, during which movement the caboose is attached and the train hauled across the westbound to the eastbound track. Even at this point the possibilities of delays are reduced to a minimum, for this eastbound traffic crosses the westbound passenger tracks only, and in no way interferes with the freight whose path is crossed by the empty eastbound engines only. As already stated the principle of yard construction that has been followed in all of the work on the Norfolk & Western is to place the yards between the east and westbound main lines so that the traffic entering the yard will not cross the tracks of that moving in the opposite direction. This has been followed to the letter in some of the yards, but where such an arrangement has not been physically possible on account of topography or for other reasons, as at Bluefield, the same principle of the separation of the tracks to accommodate the yards is followed, in that, as in the case under consideration, the westbound traffic is kept clear of and does not cross the eastbound at all, while its own path is crossed by empty engines only. At the same time the eastbound traffic offers a minimum of interference to westbound passenger traffic, since the tracks of the latter are crossed only by trains that are entering a middle siding that is cleared for their reception or are pulling out prepared for a run over the division.

The track arrangement for eastbound traffic is such that cars can be dropped by gravity from any track in the eastbound receiving yard over either of the two track scales, where they are automatically weighed and recorded. From this point, with slight assistance, they can be dropped by gravity to any track in the eastbound assorting yard. From this yard they may be dropped in cuts by gravity to any track in the main yard.

A brick scale house is placed between the two track scales for the accommodation of the clerks who have the work of weighing and billing in hand, as will be noticed later.

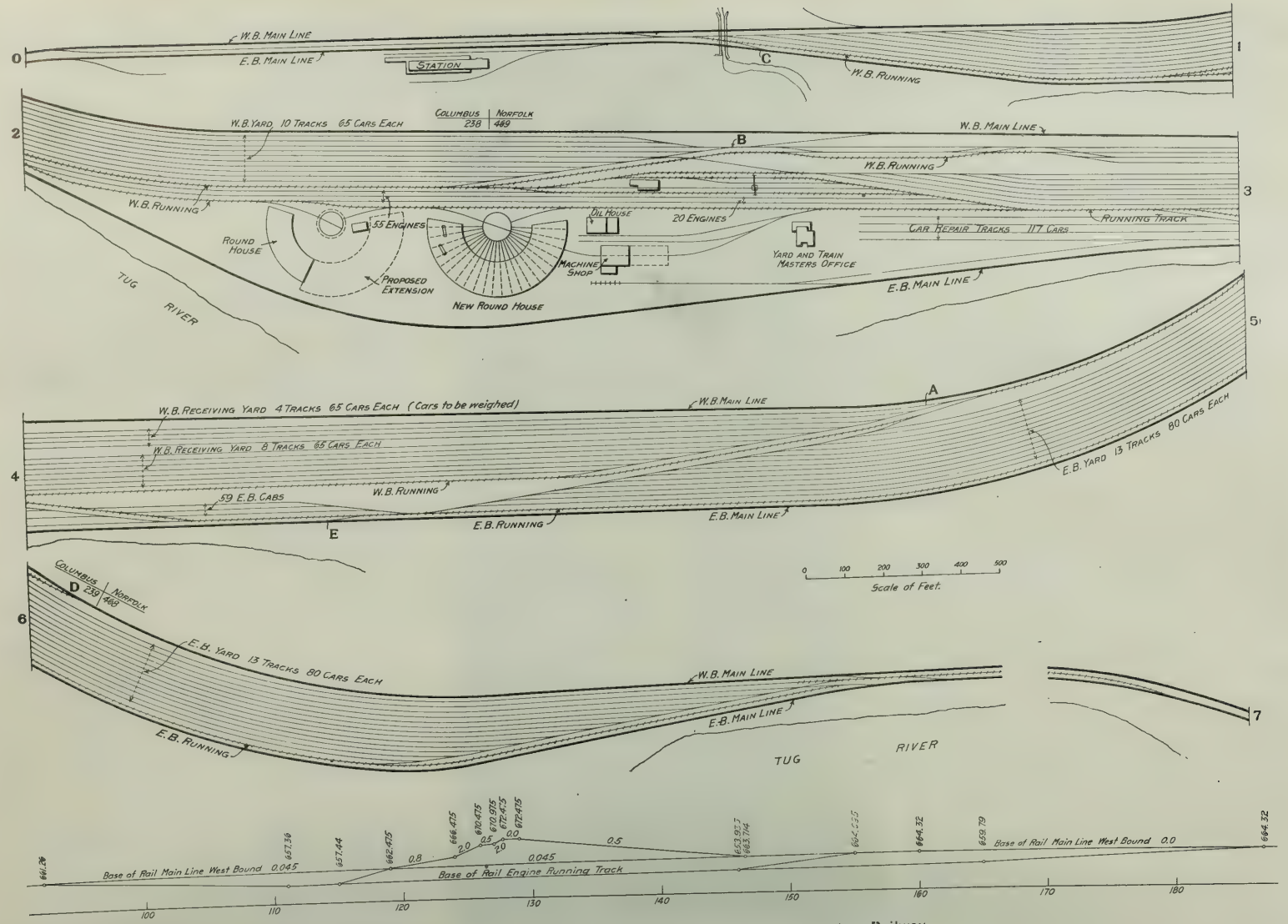
WILLIAMSON YARD.

Williamson is located at the western end of the Pocahontas Division, 105 miles from Bluefield. It is between these two points that the majority of the coal traffic of the road originates. At the eastern end of the division is the Pocahontas field, most of whose output goes east and to the seaboard, being assembled at Bluefield, as we have seen. At the western end there is the Thacker field, with a coal having a somewhat lower fixed carbon, but still of high grade, that is sent west to Columbus, Cincinnati and other points. It is this coal that is handled at Williamson. There is a small assembling yard for westbound traffic at Vivian, 29 miles west of Bluefield on the western edge of the Pocahontas field, where westbound coal and coke from that field is brought in, but this traffic is small in comparison and it is at Williamson that the main westbound assembling is done.



Williamson, West Virginia; Looking Southeast.

Williamson is in the heart of the West Virginia mountains, and is located where there is a slight widening of the exceedingly narrow bottom lands of the Tug river. The width is not great at any point, but the location used is, however, the longest and best piece of land for yard purposes in the entire valley. The next largest piece located immediately west is now occupied by the town of Williamson. The yard was, therefore, built east of this point, where there is a narrow strip of level ground between the river and the hills, though the latter had to be cut away to a considerable extent in order to obtain the necessary room. As will be seen by the reproduction of the photograph, the hills come down with a steep slope to the borders of the yard. The rock of which they are composed is a sort of shaly sandstone that stands well, but also disintegrates under the action of the water and frost and by flaking causes a gradual filling up of the ditches. It is too hard to be handled with a shovel without being first blown down, so that wher-



Plan and Profile of Williamson Yard, Showing Hump; Norfolk & Western Railway.

ever the yard has encroached upon the hills blasting has been needed, with the result that the amount of material moved has amounted to 453,000 cu. yds. and the cost of this part of the improvement has been $580,000.

In this yard the guiding principle, as set forth, of placing the yard between the two lines of the main track, has been followed in its entirety and to this has been added the use of a hump for westbound classification. Like that at Roanoke, as will be seen later, it is so laid out that it can be entered from either direction without crossing any main tracks. The classification yards for each direction are located at the delivery end.

As in the case of the Bluefield yard, the main tracks are indicated by a heavy line and the running tracks by cross hatching. The westbound freight keeps to the main line along the north side of the eastbound yard until it nearly reaches the western end of the latter, when it turns in to a running track at D on which it skirts the northern side of the eastbound yard, over its own running track until its reaches the point A, the entrance to its own receiving yard, which has a capacity of about 780 cars. In this yard the four tracks on the north lead to the hump are the receiving tracks for cars that are to be weighed. The caboose is dropped at the eastern end of the westbound receiving yard and is run down to the caboose tracks over the ladder of the eastbound yard to the caboose tracks. The engine, after leaving its train on the receiving track, passes out at the western end on to one of the cross-over running tracks leading from the westbound ladder track of the same. Leaving the train on one of the tracks of this yard, the engine proceeds to the roundhouse by the engine running track at the south or by the yard track next to the westbound main lines and backs in over the ash pits on its way to the roundhouse.

In the case of an outgoing eastbound locomotive, it leaves the roundhouse on the engine running track south of the ash pits and north of the repair tracks. Then, turning in to the running track next the westbound main line, it crosses the path of the incoming eastbound trains and, skirting the eastbound yard, may turn in upon its eastern ladder track or run to the extreme eastern end before it backs in to its train.

Meantime as it passes the ladder of the caboose tracks it can run in and pick it up and push in over the west ladder track of the eastbound yard to the rear of its train or the caboose may be dropped in to place. In pulling out it can be run out upon the main line at the end of the yard or upon a middle siding where it can stand out of the way of other trains while awaiting orders.

The repair tracks are located near the west end of the westbound receiving yard, and are readily reached over the running tracks from either yard. Direct access to these tracks is obtained over a ladder track that is kept free for this cripple movement.

With this arrangement all engine and train movements can be effected with great facility and without causing the slightest interference with the passenger or through traffic on the main lines. There is a free communication between the yards for the handling



Williamson Yard.

yard to the engine tracks and ash pits from which it goes out upon the eastbound running track and into the roundhouse. There are two entrances to this track, so that the engine can approach the house from either direction, and in this way the tracks are so arranged that the movements in opposite directions for the incoming westbound and outgoing eastbound trains do not interfere with each other in any way.

After the train has been left in the westbound receiving yard any track may be cleared and the cars either pushed over the hump at B and dropped down over the scales into the classification yard, and thus reaches the ladder track of the classification yard. This westbound classification yard has a capacity of 650 cars. When the trains have been made up in this yard, the engine leaves the roundhouse over the engine running tracks that are shown by hatched lines and, skirting the westbound yard, backs into the train that is waiting for it. In pulling out it may pass directly on to the main westbound track and pick up its caboose at the west end of the middle siding that extends on from the end of the engine running track.

Eastbound trains are composed of empties returning to the mines for loads, and through merchandise, which requires little or no classifying at Williamson. Hence there is but one yard for the eastbound traffic which has a capacity of 1,040 cars. These trains follow the main line, and as the caboose reaches the west end of the westbound yard at C, it is dropped and run in upon the center siding. The train then continues on down over the main line to the west end of the eastbound yard at E, where it turns into the of the cars, and engines can be run to and from their trains without in any way interfering with or being delayed by the switching service. The scale tracks are arranged to take care of the westbound traffic only for the reason that much of this is originating coal, while the eastbound consists of empties or of cars that have been previously weighed.

The capacity of the yard is such that about 40 cars per hour can be run over the hump and weighed by a crew of 12 men. At present five day and two night engines are employed. Previous to the construction of the hump all cars had to be spotted on the scales, so that the saving of time is considerable. The traffic passing through the yard now amounts to about 1,500 cars a day or 750 in each direction.

The Williamson yard is the third in importance upon the line, and has a total length of about 14,000 ft. from entrance to entrance. It followed a bend of the Tug river, so that it does not present a straight and unobstructed view from end to end.

(To be continued.)

The number of employees on the 34,132 miles of railroad in the German Empire in 1905 was 606,612, or 17.3 per mile of road, and one out of every 99 inhabitants of the Empire. In this country the same year the 216,973 miles of railroad had 1,382,196 employees, which is 6.37 per mile of road and about one out of every 63 of the population. We had 15 times as much railroad to serve, 45 per cent. more people than Germany.

Holding Force of Railroad Spikes in Wooden Ties.*

Any increase in the practise of prolonging the life of ties by the use of preservatives, with the resulting economy of forest resources, depends largely upon the adoption of improved forms of spikes and fastenings. The use of the improved screw spike has been described in Bulletin 50 of the Forest Service. The purpose of the tests covered in this circular was to compare the relative holding force of common, channeled and screw spikes when driven into railroad ties of both hard and soft woods.

The ties were in different states of seasoning and some had been treated with preservatives. Spikes of the various forms were driven into the same tie. The results do not necessarily show in general the relative capacity of various species to hold spikes. They compare the action of the spikes.

The spikes used, the dimensions of which are shown in the accompanying diagrams, were:

(1) Common spikes, weight 165 spikes to 100 lbs. (See Fig. 1.)

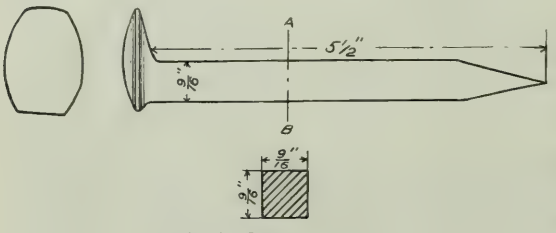


Fig. 1—Common Spike.

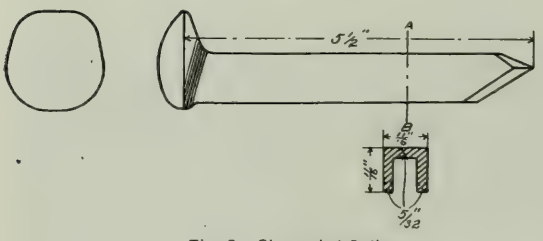


Fig. 3—Channeled Spike.

(2) Common screw spikes, similar to those in use on the French and other continental railroads, weight 85 spikes to 100 lbs. (See Fig. 2.)

(3) Channeled spikes, weight 200 spikes to 100 lbs. These spikes are of about the same form as the common spikes, with the addition of a channel cut lengthwise in the side away from the rail. (See Fig. 3.)

(4) Illinois Central screw spikes, weight 85 spikes to 100 lbs. (See Fig. 4.)

The only apparent difference between the two forms of screw spikes is in the manner of finishing the thread under the head.

Method of Testing.

The common and channeled spikes were driven into the tie in the usual way to a depth of 5 in. For the screw spikes a hole was first bored of the same diameter as the spike at the base of the thread, and the spike was then screwed down to the same depth as the driven spikes. No spike was used a second time. A special steel claw was constructed for gripping the spikes and pulling them from the tie in the direction of their length. The tie containing the spike was placed on top of the fixed head of a testing machine, so that the head of the spike extended into the opening in the center of the head of the machine. The pulling device was then slipped under the spike head and its shank attached to the movable head of the machine. The descent of the movable head drew out the spike.

Results of Tests.

The results of the tests are shown in Tables 1 to 6.

Table 1 compares the efficiency of the common and screw spikes and shows that the latter resist withdrawing with from two to three times the force of the former. The advantage of the screw spike becomes more marked in the softer woods.

Table 2 shows that in soaked loblolly pine the channeled spikes have about 60 per cent. of the holding power of screw spikes, and about 12 per cent. more holding power than common spikes. Because of the channel in the channeled spikes they distort the wood fiber less than do the common kind.

*A report to the U. S. Department of Agriculture by W. Kendrick Hatt, Ph.D., Civil Engineer, Forest Service.

Table 3 shows that in loblolly pine the Illinois Central spikes and the ordinary screw spikes have practically the same holding power, as would be expected from their similarity in form. The force required to pull them is about double that required for common spikes.

Table 4 shows that seasoned ties have a greater holding power than steamed ties.

Table 5 shows that a knotty tie has about 25 per cent. less holding power for common spikes than a clear tie, while with screw spikes the conditions are reversed, since a knotty tie has 35 per cent. greater holding power for these spikes than a clear one.

Table 6 shows that the holding power of a natural tie and of one steamed for four hours at 30 lbs. pressure is about the same. Steaming for four hours at less than 30 lbs. appears to increase the holding power, while steaming for more than four hours at 20 lbs. decreases it. Ties steamed and creosoted or steamed and treated with zinc chlorid appear to have less holding power than those simply steamed.

Table 1.—*Holding force of Common and Screw Spikes.*

Species of wood and kind of spike.	No. of tests.	Condition of wood.	Force required to pull spike. Average.	Maximum.	Minimum.
			lbs.	lbs.	lbs.
White oak					
Common spike	5	Partly seasoned.	6,950	7,870	6,160
Screw spike	5	Partly seasoned.	13,026	14,940	11,050
Ratio	..		1.88		
Oak (probably red):					
Common spike	5	Seasoned.	4,342	5,300	3,490
Screw spike	8	Seasoned.	11,240	13,530	8,900
Ratio	..		2.61		
Loblolly pine:					
Common spike	28	Seasoned	3,670	6,000	2,320
Screw spike	26	Seasoned.	7,748	14,680	4,170
Ratio	..		2.11		
Hardy catalpa:					
Common spike	12	Green	3,224	4,000	2,190
Screw spike	14	Green	8,261	9,440	6,280
Ratio	..		2.56		
Common catalpa:					
Common spike	11	Green	2,887	4,500	2,240
Screw spike	11	Green	6,939	8,340	5,890
Ratio	..		2.42		
Chestnut:					
Common spike	4	Seasoned.	2,980	3,220	2,600
Screw spike	5	Seasoned.	9,418	11,150	7,470
Ratio	..		3.15		

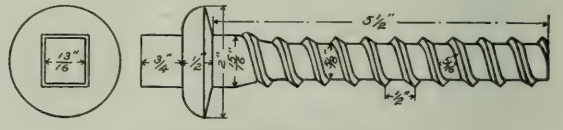


Fig. 2—Common Screw Spike.

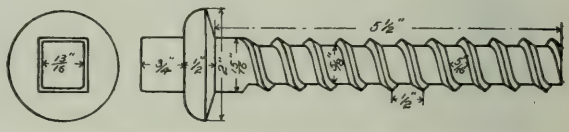


Fig. 4—Illinois Central Screw Spike.

Table 2.—*Holding Force of Channeled, Screw and Common Spikes.*
Soaked loblolly pine ties (natural and steamed).

Kind of spike.	No. of tests.	Force required to pull spike. Average. lbs.	Maximum. lbs.	Minimum lbs.
Channeled	46	4,010	6,640	2,530
Screw	46	6,585	12,070	3,980
Common	44	3,570	5,450	2,450

Table 3.—*Holding Force of Illinois Central Screw Spikes, Common Screw Spikes and Common Spikes.*
Seasoned loblolly pine ties (natural and steamed).

Kind of spike.	No. of tests.	Force required to pull spike. Average. lbs.	Maximum. lbs.	Minimum lbs.
Illinois Central screw	20	7,089	9,660	5,000
Common screw	16	6,945	9,740	4,170
Common	14	3,494	6,000	2,320

Table 4.—*Holding Force of Screw, Common and Channeled Spikes.*
Ties seasoned and soaked.

Seasoning condition.	Screw. No. of tests.	Screw. Lbs.	Common. No. of tests.	Common. Lbs.	Channeled. No. of tests.	Channeled. Lbs.
Seasoned Natural wood	26	7,748	16	3,598	..	.....
" —Natural and steamed.	16	6,945	14	3,494	..	.....
Soaked Natural and steamed..	46	6,585	44	3,570	46	4,010

Table 5.—*Holding Force of Common and Screw Spikes.*
Seasoned clear and knotty loblolly pine ties.

Position of spike.	Kind of spike.	No. of tests.	Force required to pull spike. Average.	Maximum.	Minimum.
In clear wood	Common.	36	3,466 lbs.	6,250 lbs.	1,880 lbs.
In knotty wood	Common.	18	2,615 "	3,750 "	1,610 "
In clear wood	Screw.	40	7,180 "	13,710 "	2,660 "
In knotty wood	Screw.	20	9,763 "	17,200 "	4,890 "

TABLE 6. *Effect of Cylinder Operations on the Holding Power of Loblolly Pine for Screw Spikes and Common Spikes.*

Seasoned ties.

Treatment.	—Screw spike.— No. of tests.	Force required to pull spike.	—Common spike— No. of tests.	Force required to pull spike.
Steam, 4 hrs. at 10 lbs.	32	9,185 lbs.	32	3,983 lbs.
" 4 " " 20 "	32	8,028 "	32	3,942 "
" 4 " " 30 "	32	7,753 "	32	3,471 "
" 4 " " 40 "	30	7,209 "	32	2,805 "
" 4 " " 50 "	30	6,234 "	30	2,528 "
" 2 " " 20 "	32	7,584 "	32	3,369 "
" 6 " " 20 "	30	6,435 "	30	2,842 "
" 10 " " 20 "	32	6,513 "	32	2,763 "
Steamed and creosoted	30	5,281 "	18	2,448 "
Steamed and zinc chloride	26	5,858 "	20	2,657 "
Natural	26	7,748 "	16	3,598 "

Atchison Merits.

The Santa Fe *Employees' Magazine* prints the names of 37 employees of the Atchison, Topeka & Santa Fe who in one month had special merits entered in their records. We quote a few:

George Wrench, engineer, 10, for locating broken rail; operator L. F. McMullen, 10, for recovering goods stolen from box cars; Harry James, conductor, 10, for securing passenger business via the Santa Fe; W. L. Manson, agent, 10, for keeping an exceptionally clean and orderly station; C. O. Sager, brakeman, 10, for firing engine, fireman being disabled; H. C. Wilcox, conductor, Middle division, five, for efficient service in clearing main line at wreck; T. H. Mildren, fireman, 10, for assisting train crew in chaining up car on train 7; C. A. McCammon, fireman, 15, for going into firebox and putting grates in condition for further service; G. H. Southerland, conductor, 10, for getting on top of tank, making examination of float valve and putting it in working order; engineers Charles Colvin and T. W. Anderson, conductor C. E. Barnes and brakeman C. L. Ruth, Western division, 15 each, for prompt action in turning over car that had been derailed on main line, clearing track without assistance of wrecker, and avoiding delay to trains; Conductor Schuster and crew [named], 10 each, for clearing main track after derailment without assistance, where it is believed that a majority of men would have called for wrecking outfit.

The Freight Car Situation.*

The Committee has issued a number of circulars; has employed a considerable force, and has engaged in an extensive correspondence with the railroads, the car service managers and the public. Besides summarizing the answers to its own circulars, it has resummarized the data collected by the Committee on Car Service for the year 1905, and the first half of 1906, obtaining results which will be published as a supplement to this report.

In attempting to ascertain definitely the extent and location of car shortages, the Committee collected information the summaries of which are printed as a part of this report. The totals show that roads representing about 68 per cent. of the mileage, and about 79 per cent. of the cars of the country, or about 1,645,000 cars, had shortages amounting on January 2, 1907, to 83,110 cars, and on February 6, 1907, shortages amounting to 103,105 cars. The total surplus reported on January 2 was 24,517 cars, and on February 6 12,563 cars, but these surplus cars, it was claimed, were in all cases en route for points where they were needed, or would shortly be required, so that it was not practicable for the committee to suggest transfer of surplus cars to the roads needing them. A number of important roads failed to report.

The shortages are, of course, due to lack of car efficiency, of which the measure is miles per car per day. The Committee finds, however, while the efficiency of the cars of the country as a whole may seem less than it has been, that when we apply this usual measure the efficiency per car has actually increased. As shown in the reports of the Committee on Car Service, the average made by the roads reporting, has been in the neighborhood of 24 miles per car per day ever since the Per Diem System went into effect. The latest figures, however (those for the first half of 1906), show an average mileage per car per day of 25.4, while reports from individual roads appear to indicate that there has been no general falling off in the last six months of 1906. This tends to confirm the general opinion that the car shortages of the last six months have not been due to a lessening efficiency of the railroads, but to an extraordinary increase in the demands upon them.

The Committee has obtained a large amount of information, confirming the general impression that a great deal can be done to improve the situation: first, by railroads individually; second, by railroads in their relations with the public, and last, by the railroads in their relations with each other.

In dealing with these three phases of the situation, the Committee has felt that it was its duty, not only to investigate and report, but when opportunity suggested to act in the direction of an improvement in the situation, and it trusts that it has the approval of the Association in this course.

(1) In the matter of opportunities for improvement by individual railroads, the Committee has had instances brought to its attention where improvement in facilities and practice of certain railroads would not only better the situation on such roads, but improve the railroad situation as a whole. It is quite evident that many railroads are lacking in facilities, especially in available motive power, and that this results in congestions which hold uselessly on such lines large numbers of cars which could be usefully employed by other roads. This situation is not infrequently accompanied by an apparent lack of knowledge at headquarters, as indicated by inability of such roads to promptly report the situation. Another form of delay to which the attention of the Committee has been forced is the slow unloading of material which the railroads themselves own, roads in many instances appearing to enforce a more prompt unloading upon their patrons than upon their employees.

It would be manifestly unwise for the Committee to report such cases in detail to the Association, but whenever it has seemed expedient, the Committee has taken up such cases directly or indirectly, sometimes with good results; and with the approval of the Association, the Committee will continue this course. The Committee feels, however, that action by the Association is eminently desirable to emphasize this one point, that it is the duty of every railroad to supply itself with as many cars as it can well use upon its line. This point the Committee will recur to in discussing the relations of railroads with each other.

(2) In regard to the relations of the railroads with the public, the Committee finds that the car shortages would have been considerably lessened, were the rules of the various car service associations more widely applicable and more generally enforced, as there is abundant evidence that the public delays cars more than the railroads. In some parts of the country there is appparently an opportunity for the improvement of the rules themselves, and it seems evident that the fairer the rules, the easier they are to enforce and the more efficient they become. Here, also, the Committee has not stopped at investigation, but it has taken the initiative in calling meetings and obtaining the appointment of committees of railroads to consider and act upon the local application of car service and demurrage rules. The Secretary of the Association has given his active aid in these matters, and the meetings which considered tidewater demurrage on coal at Atlantic ports have already succeeded in securing the adoption of rules covering this traffic, while other meetings in other parts of the country have been arranged to develop the car service programme of the Committee.

The Committee has undertaken the somewhat laborious task of the tabulation of the car service rules in effect in all parts of the continent, and the Committee feels that much good would be accomplished were the Association to revise its code of Car Service Rules, adopted in 1889.

While considering this subject, the Committee cannot pass by the relations of the public to ourselves as evinced in present and proposed legislation on the subject of car delay. Many of the State Commissions have approved very fair car service rules, but there is still in effect in Connecticut a law giving shippers, consignees and reconsigners 96 hours free time, and legislation approximating this is being proposed in other States. The Committee calls the attention of railroads and of the public in general to the absolute necessity of an improvement in this matter. In fact, the public has it in its power, by prompt handling of equipment, to help the railroads in the matter of car shortage more than they can help themselves.

A general law which would prohibit any vehicle of transportation from being put to any abnormal use as a storehouse, would do more to cure car shortages than any other legislation that could be devised.

(3) In considering the relations of the railroads to each other, the attention of the Committee has first been directed to the operation of the Code of Per Diem Rules of the Association and the probable effect of the change in rate from 25 to 50 cents per day, which goes into effect on July 1, 1907.

The Committee has obtained from the highest legal talent an opinion as to the rights of railroads under the Act to Regulate Interstate Commerce, to control the movements of their cars to railroads which refuse to enter the Per Diem Agreement, and this will be presented in a supplement to this report. It will be noticed therefrom that the railroads are not entirely without recourse in such cases, although the traffic and operating departments will have to act together. No cases have as yet arisen where it has become necessary for action of this kind to be taken.

In the case of the Chicago Terminal Transfer Company—which withdrew from the Per Diem Rules Agreement in August, 1906, on account of a misunderstanding with the other Chicago railroads

*Report of the Committee on Car Efficiency of the American Railway Association, presented at the spring meeting in Chicago, April 24. The Committee consists of A. Hale (Baltimore & Ohio), F. A. Delano (Wabash), J. Kruttschnitt, (Union and Southern Pacific), J. R. Kenly, Atlantic Coast Line), and S. Higgins (New York, New Haven & Hartford.

as to proper switching reclaims—at the request of the Chicago General Superintendents' Association, the Committee on Car Efficiency has made a careful examination of the car records of this road for the year 1906, as a result of which the Chicago Terminal Transfer proposes to again sign the Per Diem Rules Agreement. Before making this examination the Committee agreed that it would recommend to the Chicago General Superintendents' Association, the body which settles reclaims in the Chicago District, a reclaim based on the actual time required to switch cars by the Chicago Terminal Transfer. It was further understood by the Chicago Terminal Transfer that in reckoning the time actually required to do the switching, certain delays were to be excluded, for which this railroad agreed to become responsible. Such delays were therefore not considered in reckoning the time on which the reclaim was to be based. These delays included all delay to cars in local service and undue delay either by the public or the railroad. In defining undue delay by shipper or consignee, it was agreed that all days on which car service was paid [by consignee] should be considered as undue delay. It was further agreed that in case of cars loaded in one direction, any delay in excess of eight days should be considered as undue delay, while with cars loaded in both directions the limit should be twelve days. These limits defined "undue delay" by the Chicago Terminal Transfer. The reclaim basis so ascertained was found to correspond very closely with the current reclaim at Chicago.

The Long Island Railroad, having become dissatisfied with the reclaim which it is receiving from the trunk lines, and having made application to the New York General Managers' Association for relief, it has been arranged that a similar examination of its car records be made by the Committee on Car Efficiency, and this examination is now proceeding.

The Per Diem System must of course be preserved in its present form until something better can be provided, but reports to the Committee would seem to confirm the impression that the Per Diem System is not securing to the owners of cars in times of stress either the use of their own cars or the use of an equivalent number.

A comparison of the summaries to answers received to the various circulars shows that for the year 1905 one group of railroads was using 55 per cent. more cars than it owned. This was for the year 1905 the extreme case, so far as groups were concerned, although many single railroads were using a larger percentage of foreign cars than this. For the first six months of 1906 this group was only using 45 per cent. more cars than they owned—a considerable improvement. When we come to the 1st of January, 1907, we find the situation with regard to this one particular group unchanged, but we find another group of roads which are using 70 per cent. more cars than they own, and that the various debtor roads were using 145,703 more cars than they owned, nearly double the shortage reported for the same date.

The situation since January 1 has been largely influenced by severe weather which has visited various portions of the country. Some roads appear to be in better condition and others in worse. Doubtless these conditions have contributed largely to prevent the return of cars to their owners, and many cases have been reported to us where railroads were physically unable to move in the home direction empty foreign cars which they did not need.

Doubtless the 50 cent rate as agreed upon by the railroads entering the Car Hire Agreement will have some effect in hurrying the movement of foreign cars, now that the weather conditions are better, but there is no effective force to direct the movement of cars to the railroads where they are needed, or to the railroads which have the right to expect the use of an amount of equipment equal to what they have contributed to the common fund, for it appears to be now the rule rather than the exception to use foreign cars without regard to ownership.

It is true that the diversion agreement, although it is experimental, has had some effect in returning certain cars to their owners, but it has had a much greater effect in causing inconvenience and expense to the railroads and to the larger industries, and as there is no penalty for delay in effect among the roads which have signed the Diversion Agreement, it has in many instances influenced railroads to hold certain foreign cars for long periods.

The Committee finds that there are two ways out of this very difficult position—one, to adopt the principles of penalty for delay and diversion, which, in the opinion of the Committee, should be applied concurrently. The other way is to accept the principle of an equal car balance, not necessarily between the cars owned by each pair of railroads, but a balance securing to each road a number of cars equal to its own equipment.

To adopt and enforce efficient penalties for diversion and delay would be practically a new policy in this country. There doubtless was a time, when railroads were few and car interchange sparse, when the owner seldom allowed his cars to leave home, and if he did so he secured their prompt return. But this time is so far gone that it is almost forgotten, and the volume of the transactions at that time were such that they could hardly be considered a precedent.

It is true that in Great Britain the English Railway Clearing House enforces the prompt return of foreign cars to their owners under very severe penalty, the sum of three shillings (75 cents) per day being charged on ten-ton cars diverted or delayed. It is, however, understood that in the working out of this system, foreign cars are handled empty to a much greater extent than prevails in this country. The adoption of such a system here would doubtless have the same effect, which we can hardly contemplate with approval in view of our present car shortages, and the Committee feels that it would be much wiser to accept the present situation, and admitting that the cars of the country are being largely used in common, attempt to better matters in a line which shall secure the greatest efficiency of our cars, rather than attempt to adopt a system which would secure less efficiency.

Meetings with this end in view were held early in January both in New York and Chicago, as a result of which the Committee on Car Efficiency consulted the members of the Executive Committee of the American Railway Association, and with their approval co-operated in the formation of the American Railway Clearing House, with an Executive Committee appointed to establish this organization by a number of roads centering in Chicago, and Circular 686 was issued announcing this.

The Clearing House now has 79 reporting members and 46 record members. It is engaged in recording the movements of the cars of its record members, amounting in number to something over 500,000. It is drawing off from its records, locations, car balances and interchange balances which give its subscribers a better knowledge of the situation than has before been obtainable. It is preparing to extend its work in the way of issuing junction reports, counting per diem and clearing car service balances.

It is thought that the information derived from the Clearing House records can be used to advantage in formulating plans for equal car balances, equal interchange, and possibly for the pooling of freight cars, and meetings will be held from time to time under the auspices of the Clearing House and the Committee on Car Efficiency to consider these and kindred topics. The Committee requests the approval of the Association in its participation in this undertaking and confidently requests the aid of members of the Association in its further work.

The Association has instructed this Committee, in reporting upon the causes of car shortages and lessening efficiency of equipment, to recommend remedies, and throughout this report the Committee has made a number of recommendations. In summing up the matter, however, the Committee recommends:

1. That each railroad, so far as is practicable, improve its own facilities, and especially its motive power available for the movement of freight. That the Operating and Traffic Departments co-operate in improving Car Service and Storage regulations, especially in reducing free time allowances.

2. That each railroad in its dealing with the public secure all possible co-operation on the side of their customers in the prompt handling of cars.

3. That this Association reaffirm the principle as stated in the resolution passed October 24, 1906, that each railroad should be assured at all times of the use of a number of cars equivalent to the number it owns, and furthermore that the development of this principle by the American Railway Clearing House be approved by the Association.

Foreign Railroad Notes.

The employees of the Swiss State Railroads ask the government to pay each one of them, whatever his wages may have been, 120 francs out of the net earnings in 1906, on account of higher prices for provisions and rent. The raising of wages for work done in previous years and already paid for would seem to introduce new terrors for employers.

On New Year's Day the greatest railroad system of Austria, and the most prosperous, was transferred from the company owning it to the state, though the company continues to work it temporarily until the state has completed its arrangements. Almost immediately thereafter followed a traffic blockade, which the Railroad Minister explained partly as follows: (The reader might suppose that it was Mr. James J. Hill who was speaking.) The first cause was an extraordinary and unexpected increase in freight traffic which was 10 per cent. greater in 1906 than in 1905. Then in December came extraordinarily bad weather. Trainloads had to be reduced one-half; the deep snows made it impossible to haul away from stations the freight which arrived; and illness disabled as many as one-fifth of the trainmen. Even with all this, the blockade would not have been so serious, but for inadequate track and station accommodations and lack of locomotives and cars. The supply of coal for the railroads' own use became very short, largely because the contractors, taking advantage of a momentary rise in price, preferred to sell to other purchasers what they had mined for the railroads.

Building the Florida East Coast Extension to Key West.

BY F. E. SPOONER.

The Florida East Coast Railway, as is well known to readers of the *Railroad Gazette*, is building an extension from its present southern terminus, Homestead, Fla., south over the chain of keys which parallel the peninsula on the east side, to Key West. Construction work was begun about May, 1905, and great progress has since been made. The writer recently spent three weeks along the route of the extension and visited nearly every one of the 25 or more construction camps.

In view of the many newspaper stories of hardships suffered by



Timber Breakwater on Ocean Side of Fill Between Keys.

laborers, and even of conditions approximating peonage, he made particular efforts to find out the conditions of working and the state of mind of the men employed. Inquiries were made of all classes from the most unintelligent laborer to the engineers in charge. It may be said without reservation that no laborer is being compelled to stay against his will and that a large majority of the men are satisfied. Workmen are arriving at the rate of about 100 a week and less than one-quarter of that number are leaving. At present about 2,800 laborers, of whom four-fifths are white men, are at work. Throughout the different grades—engineers, foremen, sub-foremen and laborers—there was found an enthusiasm for the completion of the undertaking which speaks well for the *esprit de corps* of the organization.

Years ago, when surveyors first went over the Keys to determine the practicability of this extension, while climbing through the thick undergrowth they were almost eaten alive with mosquitoes and terribly poisoned by poison ivy and other poisonous plants. Then 150 negroes were taken on to clear the way. Later, when grading was begun at the Homestead camp, white men came as laborers, and since that time the number has been steadily increased. A *carte blanche* order for men to employment agencies to New York brought out about as tough a crowd as were ever got together. Later the agencies were given up and men went north to recruit, but with little better results; nor are the men who are going to the work to-day of much better class. Nevertheless, although in the ranks to-day may be found jail birds, tramps and election repeaters, the men have straightened up and are doing good work. This is largely because they have no chance to get liquor anywhere. The strictest measures are employed to prevent the men from getting hold of it in any way. Occasionally a small boat tries to escape the vigilance of the engineers and the revenue boats, but it usually is not long before it is captured by the revenue men and scuttled then and there. The men are willing to have this rule enforced, for they have a chance to save money. Ordinary laborers get from $35 to $45 a month; sub-foremen or gang foremen, $60, and foremen $90 a month. Engineers are paid from $175 a month up. All have their board and lodging free.

The colored men live in tents and have their cooking done by colored women, supplies being furnished from the railroad commissary. The white men generally live in what are known as quarter houses, which are hotels on boats with bunks banked one above the other. The bunks, windows and doors are screened with mosquito netting. The mosquitoes are very large and fierce but are not troublesome during the daytime. The men get up at 5 in the morning, take a bath over the side of the boat, have breakfast at 5:30, work from 6 to 11, return to dinner at 11, go back to work at 12 and knock off at 5, with supper from 5:30 to 6. Sundays are rest days when the men bathe and have ample lounging room on the decks of the boats or along the shore under the palm trees.

As already mentioned, the men are secured for the most part in the large cities of the North, particularly New York, Philadelphia and Boston. They are shipped to Florida by boat with their fare paid. This fare, $10, and $2 for board on the way, is charged against their account and deducted from the wages due them, usually at the end of the first month. Of the men who start south about one-fourth desert on the way and never reach the work. Of those who do arrive, many are unfit to work, in which case they are sent to the hospital at Miami, where they receive treatment without expense. This hospital is maintained by the company, its only source of income being the fares of the men who are returning home, and who pay $1.50 for transportation from the Keys to Miami. Over 4,000 cases have been treated in this hospital, of which not 10 per cent. represented diseases indigenous to Florida.

In the camps the only chance to spend money is at the commissary, where certain luxuries, not including liquor, may be obtained. The commissaries are run by a Miami grocer named Lumis,



Laying Temporary Track.

whose profit is limited to an average of 15 per cent. on his sales. Most of the men keep bank accounts with the engineer in charge of their camp, who holds funds subject to their order. Many laborers save as much as $30 a month.

Apparently the stories of peonage can be traced to the following set of circumstances: Men start for the South to work on the extension but desert, go to Jacksonville or Miami, and, having little or no money and no desire to work, are sooner or later arrested as vagrants and put into the chain gang, where they have a man with a gun to watch them and dogs to chase them if they try to get away. When they are released they go north and tell harrowing tales of being guarded by guns and dogs, after going to Florida to work on the extension. What they say about being made to work is true, but they never reached the Florida East Coast extension at all. One of the first "peons" seen was carefully questioned about peonage, to his great amusement. "The job's all right," he said, "and I never saw a man who could not leave any time he wanted to, even though he did not have the price, nor yet have worked off his fare from the North. All he has to do to get away is to refuse to work." Another man told of some of his comrades who, wishing to return to work after leaving, missed a packet boat and hired a launch to get back. Of course, men get tired of the



Big Pine Camp.

life and want a change, and in such circumstances they are encouraged to leave, but are told that their place is waiting for them if they wish to return and half of them come back. Men have gone back to New York and returned bringing others with them.

Much of the trip was made in the "Biscayne," a stern wheel Mississippi steamer. This took 2½ days, making the round trip from Miami to Knight's Key and back again. Keys and coral reefs are scattered all about and a devious course has to be followed, the steamer oftentimes going miles to make a camp in plain sight all the while. From Key West, the "City of Key West," an old auxiliary steamer, was taken to Knight's Key and back. On return to Key West, the "Lady Lou," an old miniature side-wheeler, was taken to nearby camps. Besides visiting nearly all the camps and construction work, the supply yards, machine shops and hospital at Miami were inspected.

South from Miami passenger trains are run as far as Homestead. From Homestead to Jew Fish creek the trip was made by construction train and from Jew Fish creek to Tavernear, by construction train. As the Tavernear creek bridge was not yet finished a five-mile walk was necessary across Plantation Key, where the rails are already laid, making, with the exception of the Tavernear creek bridge, 70 miles of track laid, south from Miami. Within a few weeks the road will be across to Windley's Island. Beyond this is Upper Mattecumbe, Lower Mattecumbe and Long Key, to which it is expected to have passenger trains in operation by the beginning of 1908. From Long Key to Key West, 55 miles, passengers will be carried by steamboat. Key West will then have daily steamboat service. With good fortune the Long Key concrete viaduct of 185 arches should be finished during the summer of 1908, and then trains will be carried right through to Knight's Key,



Ballasting on Key Largo.



Beginning a Coral Rock Fill in Shallow Water.

where the longest viaduct begins. This will take longer than any other part of the work to finish. The Long Key viaduct is to be in 30 ft. of water and 10,500 ft. long. Next in order are Conch Keys, Grassy Key, Crawl Keys Nos. 5, 4, 3, 2 and 1, Key Vaca and Knight's Key. The Knight's Key concrete arch viaduct is in two stretches, the first 7,300 ft. long to Pigeon Key, now the home of myriads of wild pigeons, the other 7,800 ft. long to Little Duck Key. Beyond Little Duck in order are Missouri and Ohio Keys and Bahia Honda, an island owned by the Florida East Coast and originally selected as the southern terminal of the road. From Bahia Honda to West Summerland Key there is to be a concrete arch viaduct 4,950 ft. long; beyond are Big Pine, Torch, Ramrod, Summerland, Cudgeo, Sugar Loaf and Saddle Bunch Keys, Boca Chica Island, Stock Island and Key West. Stock Island is already joined to Key West and the filling is under way between Boca Chica and Stock Island. The right-of-way into Key West is all on made land, and the terminal on a plot of made land of 175 acres. The filling for the terminal is now being finished. The next work to be done at Key West is the building of the water terminals for the steamers which are to run to Havana. There are to be eight wharves 200 ft. apart, each 800 ft. long and 100 ft. wide. It is believed to be the intention to erect a terminal hotel either on this site or on present site of the United States barracks, for which negotiations have been reported. The trip from Key West to Havana is to be made in about four hours.

The distance from Homestead to Key West is 128.15 miles. Of this, 74 miles is to be on land, 25 miles over swamp and nearly 30 miles over water. The finished road will have 97 miles of grade on land, 23.45 miles of embankment in the water and 5.9 miles of concrete arch viaduct over the ocean. The extension is a very expensive piece of work. The weekly expenditure is something over $100,000. The feeding of the 2,800 men employed alone costs $8,000 each week. One feature that adds to the expense of the work is that, under ordinary railroad construction, the work goes on at 25 or 30 different points, and a large fleet of boats has to be used to keep the different construction camps in communication. There are in use along the Keys for this purpose, three tugs, eight stern wheel steamers of the Mississippi river type, 30 gasolene launches, 14 house boats, each with accommodations for 144 men; eight work boats, fitted with derricks and concrete mixers; three floating pile drivers, one floating machine shop and 72 barges and lighters for transportation of supplies. In the 5.95 miles of concrete arch viaduct over the long water spaces between the keys



Concrete Viaduct, 10,500 Ft. Long, 185 Arches, Under Construction at Long Key.

there will be used 176,900 cu. yds. of crushed rock all brought from workings on the Hudson river at a cost of about $2.80 a ton; 106,100 cu. yds. of gravel, from Mobile; 286,800 barrels of cement, from Germany; 5,760 tons of reinforcing steel; 612,000 lineal feet of piling, and 3,580,000 ft. of lumber forms and arches, besides millions of feet of pine lumber and the necessary ties for the whole extension, brought mostly from the piney lands of Florida between Miami and Homestead. As indicating some of the difficulties of the work, one bridge has to be built with 100-ft. clearances each side of a central pier; two bridges, each with 40-ft. clearances, and seven bridges, with fixed openings of 25 ft. Over the 25 miles of swamps



Finished Roadbed on Key West Now Used as a Wagon Road; Florida East Coast Extension.

a trestle is first built and white coral sand then dumped in. This in time hardens to solid limestone rock. There are also many miles of bulkheading, due to allowance for the wearing effects of the ocean, which beats against the right-of-way of the road for a considerable part of its whole extent. The general character of the construction can be seen in the accompanying photographs, taken by the writer. These show particularly the whiteness of the coral rock used in the construction. Work on land, swamp and water is shown with a view of one of the construction camps and a section of the finished roadbed at the southern end of the road.

The working is in charge of J. C. Meridith, with the title of Construction Engineer; W. J. Krome, as Manager of the plant and construction department, directs the forces in the field; W. F. Rue is in charge of the transportation department, and W. J. Rus-



Construction Track Laid on Finished Roadbed.

sell, of the accounting department. The Florida East Coast Railway, as is well-known, is the personal property of Henry M. Flagler, its President. His interest in the work of the extension is great and he visits the line at frequent intervals.

Electric Railway in Turkey.

Last February what is reported to be the first electric railroad in Turkey was opened for traffic in Damascus. It is about 3½ miles long, connects two suburbs with the city and is to be extended further. The electricity is generated by water power at the falls of the Barada, about 25 miles west of Damascus, and is used for about 1,000 electric lamps, as well as for motive power, and now at the hour of evening prayer the great mosque of Damascus is lighted up picturesquely by several arc lights and a great number of incandescent lamps. The railroad and lighting plant are the property of a Belgian company.

Italian Comment on Baldwin Locomotives.

The 20 Baldwin locomotives recently purchased by the Italian State Railway have aroused great interest among Italian engineers, both while being set up at the Cattori establishment on the bay of Naples, and since they have been put into active service. *L'Ingegneria Ferroviaria*, in its issues of February 16 and March 1, subjects them to a searching criticism, from which we extract the most important observations. The locomotives here described are consolidation engines with a front Bissell truck (type 10-36 E).

After noting that the actual total weight came out five tons under that estimated, favorable comment is made upon the boiler, inasmuch as it projects out over the frame and the wheels, so as to make easy the detection and repair of any leak. The center of the cylindrical part of the boiler is not so high above the plane of the trucks as in other recent I. S. R. engines (2.59 meters as against 2.80 and 2.81 in other types). Praise is also given to the manner of connecting boiler and frame, which allows for expansion. The firebox and other plates are criticized as extremely thin, and fears are expressed that they will soon succumb to the bad water used in many parts of the peninsula. The stay-bolts aroused interest because of the central hole and of the lack of threading in the parts exposed to the water; the riveting of the heads is found defective, but the threading is highly praised, as it resisted successfully the strains of severe hot and cold tests. The absence of inner beading and of ferrules in the boiler tubes is noted. The rocking grates are described and figured in much detail. They are surprised that the drop cannot be operated while the engine is moving. A tallow-can shelf is provided over the firebox door. There are two water-glasses, with guard. The blow-off is especially mentioned. The asbestos boiler coating is fully described. Criticism of the exhaust is made because it cannot be varied while the locomotive is in operation. Much attention is paid to the spark-screen, with its deflector, cleaning-caps and smokebox cleaning-pipe. The bell-cord from the baggage car and its bell are novelties, apparently. The duplication of injector valves is praised. They have altered the cab to conform to Italian usage, particularly in substituting aprons which run the entire width of the tender—in order, as the review says, "to guard against the engineer or fireman slipping down through the lateral openings." The rigid connection between locomotive and tender is contrasted with the elastic one of Italian practice. The engines are criticized for having no step, so that when

the tender is disconnected a ladder has to be used to enter the cab.

The construction of the frame is taken up in great detail. They praise the steel castings for their lightness and strength. The suspension of the frame upon the wheels is also favorably criticized. Their experience with these engines has shown them that the system of equalizers employed leads to an exceptional smoothness of running. High praise is accorded the cylinders and housings, both for their simplicity and symmetry and for the unusual solidity of their connection with the engine-frame. The duplication of parts, thus facilitating repairs and substitutions, makes a favorable impression. The steam-chest is thought to be weakened by the holes for the vertical bolts. The eccentric mechanism is found remarkably simple. The connecting-rods are much longer and heavier (about 770 lbs.) than is usual in Italian locomotives. The front truck, and especially the radius bar, are described in detail. The handbrake of the tender they find unsatisfactory because it is higher than the forehead of the average fireman, and they criticize the lack of protection of the pawl and ratchet-wheel against loose coal on the tender floor. The tools and all other accessories fell much below Italian standards in finish; and this circumstance gave rise to the unfavorable impression made upon the engineers and firemen sent to take the engines out—an impression spread abroad through the newspapers, but which is now being modified by the evident good qualities of the engines, as they show themselves in operation.

The High-Speed Mania.*

The most striking impression that has been made on the average traveler by the numerous and extreme increases in railroad speeds during the past 10 or 15 years has been that produced by the quicker click of the wheels in crossing over switches and frogs; and only by reproducing this sound in the reader's ear can its significance be made really appreciable. At 75 miles an hour, which now is a very common speed for stretches of a few miles, a train travels 110 ft. each second; and a passenger in such a train, sitting near the end of a car, where he can clearly hear the movements of the four or six wheels under him and those of the truck under the adjacent end of the next car, will notice as he rushes past a crossing of the track of another railroad a sound which begins like a heavy rumble, but which is all over in about one-fourth of one second—the two hundred and fortieth part of a minute. That is the length of time between the passage of the first wheels of that group over the first rail of the crossing and that of the last wheel over the last rail of the crossing. Such a sound—or aggregation of sounds, crowded together incredibly, like the impressions of a troubled dream—affords some idea of the lightning-like speed at which the train is moving. Experiences of this kind were formerly to the ordinary traveler so rare as to be practically unknown. The ordinary speeds over such frogs were not over half the rate named. The increase of 100 per cent. marks a costly and impressive change.

But is this widespread change really the result of a "mania"—an ungovernable craze? I have used the term in my title because it is common, and often seems justified; but let us see. * * * Speed *per se* is by no means a new thing; the difference is that it has now come to be common. The increase in the number of fast trains and the introduction of such trains for longer distances has been in response to a real public demand. If there is anything like a mania—a demand beyond the bounds of reason—the railroads themselves must be mainly to blame, for the public has no definite knowledge as to what the bounds of reason are. Surely, the great majority of people who travel, whatever they may ask in the way of speed, mean to ask also for safety. Have the railroads increased danger by meeting imaginary needs?

Scores of men must go every day from Philadelphia to New York, returning the same night, or *vice versa*, and many of them can afford to pay the railroad well for saving a couple of hours' time. A business man starting from New York to Chicago in the afternoon can often save a whole day if the railroad will save him four or five hours—the difference between a fast train and a very fast one.

The passenger agent is the only tangible impersonation of the indefinable "public" which is supposed to ask for more than ought to be granted. He tells the locomotive superintendent and the civil engineer that if the company does not run its trains on such and such fast schedules, the net earnings will go to the dogs—that is, the competitive passenger traffic will go to rival roads. Of course, he tells the operating officer to deny his request for an increase of speed if it is not safe to grant it; but so does the merchant instruct his salesman not to bribe a railroad purchasing agent, while at the same time supplying him with the money necessary to pay the bribe. If the general manager tacitly approves the passenger man's demand, it is complied with. If the speed is really risky these three men divide the responsibility for the risk on the basis of some occult reasoning by which each one throws half of it on each of the other two! What the public interest requires is, of course, a single competent officer who can be reached and who cannot shift any part of the responsibility.

Do operating officers, to satisfy the passenger solicitor, who wishes to give the public all that it wants and a little more, run trains faster than is safe? Given a straight and level course, the four main elements of safety at high speed are a good track, a good engine, a clear road, and a clear-headed man on the engine. To assure the engineman *constantly* of a mile and a half of clear track demands elaborate signal arrangements such as few railroads have yet provided. * * *

The clear head in the cab is the most difficult thing to provide, for the "personal equation" baffles systematic treatment. Our best trains have the clear heads, but they are born, not made. It is only on the engineman's vigilance and skill—not on anything in the way of automatic apparatus—that we can have safety at high speed on curves and descending grades.

The railroads have increased the speed of some trains, increased the number of fast trains, made trains heavier by putting on more dining-cars and observation cars—which produce no revenue—without increasing the fare, and at the same time have done many things to make train movement safer; have abolished, at the cost of many millions, grade crossings at the streets of cities and villages, so that the danger of a palatial train being wrecked by a ten-dollar mule-team has been greatly reduced. Two-track lines have been made four-track, thereby removing dangers and delays at way stations. The old time-interval system, with its dependence on red flags, torpedoes, fallible watches, sleepy flagmen walking over ice-covered bridges, and other uncertain factors, has been superseded by the space-interval, which prevents collisions without the aid of these wabbling props, and which, when rightly managed, safeguards trains better without than with them. Cars and engines have been so improved in strength and in other features of design that, in spite of greater weight and greater speed, the number of breakages of wheels, axles and running gear has proportionately decreased. Trains have been running between Philadelphia and Jersey City, 90 miles, in about 1 hour and 50 minutes for 31 years, and the number of such trains has been gradually increased until now there are more than 30 of them every day. New and more powerful engines have been built year by year, so that now six heavy cars are hauled on these two-hour trains with the same ease that at first they took four light ones. There is no doubt that these trains average as few accidents and delays as any trains in the world. The Empire State Express of the New York Central has now been running every week-day for 15 years, and is universally regarded as one of the safest long-distance trains in the world. No passenger has ever been killed on the "Empire State."

Year by year all the fast trains have been made heavier by putting on additional cars, and yet the speeds have been maintained or improved. * * * For nearly two years now the 18-hour trains of the Pennsylvania and the New York Central, the most notable trains in the world, have maintained their remarkable schedules between New York and Chicago. * * * In these great records of speed and regularity there is no evidence of increased danger. In the very few cases where the trains have been derailed no greater damage was done than in similar accidents to other trains. * * * The only possible conclusion is that on the straight and level portions of these lines the tracks are suitable for the highest speed of which the engines and cars are capable; and that for safety on curves and descending grades, where our dependence is on the good judgment and faithfulness of the locomotive engineers, the records of these trains are at least as satisfactory as those of any other trains.

With such records for safety, is there any reason why the passenger traffic manager should not ask his general manager to run these trains? The disastrous derailment to one of the 18-hour trains, in June, 1905, due to a misplaced switch, would have occurred just the same to any one of a dozen similar trains. The accident to an electric train in New York city last February appears at this writing to have been due to some cause other than high speed. The "Pennsylvania Special" when derailed in February was running at a rate far below the top speed.

Yet there are two real elements of danger in our high speed. They are inevitable, and the only thing to do is to reduce them as far as it is possible to do so. One is the increase of traffic, freight and passenger, by which the chances of disaster are increased. A fifty-dollar freight derailment may at any time, by throwing *débris* upon the passenger track, wreck a train carrying 500 passengers; and on a four-track line the chance that this will happen is greater than on a double-track line. On the Pennsylvania between Jersey City and Philadelphia—a typical high-speed line—freight trains are now decidedly more numerous and are longer and heavier than they were 10 years ago, and the danger of a passenger train wreck is an appreciable percentage greater. The danger is a small one, relatively, but still it is a danger. If a passenger making this journey notices the click of the wheels of the long freight trains as he meets or passes them, he will find that he is thus meeting or pass-

*Excerpts from an article by B. B. Adams, Associate Editor of the *Railroad Gazette*, in Scribner's Magazine.

ing a train perhaps 10 to 20 minutes out of the two hours occupied in making the journey. Five years ago the number of meets probably was not much over one-half as great.* The other trunk lines would show similar changes in the volume of traffic.

The other inevitable danger is that due to mistakes of judgment on the part of expert enginemen. (The danger chargeable to negligent or incompetent locomotive runners is another question.) The engineman meets situations every hour, perhaps every mile, where he must unerringly—within the space of a few seconds—rightly regulate the speed of his train, or disaster will follow. No engineman is perfect, and we may expect always to have lapses. The faster the train is running the greater will be the likelihood that a mistake will cause disaster—the runner having fewer seconds or half seconds in which to correct any false move. So, therefore, we must count this as one of the elements in the problem of safety at high speed.

Other factors of danger which are often mentioned seem to have little real influence on safety. Trains running at high speed suffer worse when they collide with each other, and there have been some terrible examples within the last three years; but our fastest trains traverse lines which are pretty well protected from collision by the block system. Again, it is natural to suppose that a train running 75 miles an hour will suffer more if thrown off the track and tumbled down a bank than one running 40 miles an hour; but experience so far has afforded little or no confirmation of that idea. The bodies of passenger cars are now made so strong, with steel frames and braces, that they withstand shocks better at high speed than the old cars did at low speed. One of the noticeable things in wrecks nowadays is the large proportion of passengers who come out uninjured or only slightly injured. * * *

Except in the features here named, any increase in the danger of passenger travel is due not to high speed, but to the abuse of speed. A railroad manager who runs fast trains at all—to say nothing of exceptionally fast ones, like those which I have named—and does not provide the best known safeguards, abuses his authority as a custodian of passengers' lives. To advertise with fine phrases about the block system, when half the block signals have no preliminary warning signals, and thus preclude high speed when a fog prevails, is to deceive the public. The block system in such cases is suitable only for slow trains. To run trains at 80 miles an hour when the distant signals are set for a speed of 40 miles an hour is to constantly skate on thin ice. To speak of a "complete equipment" of block signals when switches at the small stations have no connection either to control the signals or to be controlled by them, is a gross abuse of the word "complete." To boast of the perfect service and safety of the past, when by reason of the youth and insufficient training of the signalmen of the present (as well as of the past) it is known that the good records are partly the result of good luck, is about as bad as a lie. Some roads of quite fair reputation would have to plead guilty in this matter of poorly trained signalmen. To run an old wooden smoking car between sleepers and strong steel mail cars, where the "smoker" will surely be crushed in even a light collision, is to risk the lives of the Italian or Russian emigrants who ride in the smoker.

To run a freight train with any less care than is given to a passenger train—difference in speed considered—is to endanger every passenger train which that freight may meet on the road, or by which it may be overtaken while it (the freight) is in motion. Such difference in care is observable, nearly everywhere, and it constitutes one of our greatest dangers. A superintendent on whose line a reckless engineman runs off the track when rounding a sharp curve at 70 miles an hour has a distinct moral responsibility for allowing such a runner to stay in the service. The railroad officer who complains in the newspapers that labor unions "bulldoze" him so that he dare not dismiss a reckless or low-grade engineman is, indeed, face to face with a difficult problem; but he should at least be able to show that he and all his lieutenants have made a bold, persistent and open fight against the labor union, if he desires the sympathy of the public.

There are a few reckless runners. In a period of three years the government accident bulletins recorded six derailments due purely to excessive speed—not to mention doubtful cases and mixed causes. These six wrecks killed 11 persons and injured 68, and caused something like $150,000 damage. Enginemen of fast trains must be intelligently and vigilantly cautious, which means loss of time, yet must be eagerly alert to *make* time, and must at the same time always be ready at a moment's notice to stop, or to slacken speed resolutely. Many otherwise good runners never succeed in becoming thus mentally facile.

The most practicable thing to do to raise the standard of safety and efficiency in this matter is to get an ideal superintendent—which is a difficult problem. He must be high-minded and sympathetic, knowing his business, and a good disciplinarian; one who will constantly cultivate an *esprit de corps* which shall enable him to bring his ordinary and below-ordinary runners up to the level of his best. This elevation of the personnel is the greatest need in railroad operation to-day. * * * Every railroad superintendent will agree with me, I think, in what I have said about the need of an *esprit de corps* in the service. The combination of railroads into large systems has killed this valuable element in some cases where before it existed. * * * Given a certain degree of inefficiency or unreliability in the men managing slow trains (including signalmen), the only way to protect fast trains from the danger thus produced would be to reduce their speed. While the roads running the fast trains which I have mentioned have attained a high degree of perfection—as the records of these trains show—their officers, if they spoke freely, would be the first to admit that there is still much ground to be conquered.

To generalize profitably about high speed and its risks is impossible without a mass of data about tracks, signals, engines and personnel which no one has gathered. In the two most prominent features of the problem—complete signaling and thoroughly competent engine runners—a few districts or divisions, on a few roads, stand very high. None probably could be marked 100 per cent. in both of these features, but on these best divisions the conditions in this respect are so excellent that the possibility of running into a freight train wreck is probably the worst danger to which a fast train is liable; and this possibility can be averted only by painstaking endeavor in many different directions. * * * Such dangers as beset our very fast trains in great measure beset the other trains on the same lines also; so that whatever ought to be done in the premises, either by the railroad or by the public, can be treated as a part of the broad, general problem of railroad safety. In this field the public—that is, the Federal Government—has a plain duty, that of investigating and making public the facts of all serious railroad accidents.

Our most enterprising railroad officers are doing splendid service, but some railroad men are not enterprising, and even the most capable are usually but parts of a great administrative machine which no man can control. Samuel Spencer was a great railroad manager, but his machine for managing his railroad broke down, and he himself was killed by its failure. Investigation by impartial experts has been a vital factor in the great record for safety which has been made on the railroads of Great Britain. It led to the universal adoption of the block system, which ought to be made universal in America. Some of our state governments investigate a little, but not very effectively. The government could set forth and make prominent our best railroad ideals, and thus greatly encourage and stimulate high-minded railroad officers in their endeavors to attain those ideals.

New Railroad Laws in Texas.

A number of laws affecting railroads were passed at the session of the Texas legislature just closed. The two-cent fare bill was not reached, but it will be submitted by Governor Campbell at a special session. The bills taxing the gross receipts of railroads 1 per cent. and taxing their intangible assets will also come up again at the special session.

The labor union measure prohibiting blacklisting by railroads and other corporations was enacted into law. The bill applies especially to employees discharged during strikes. Violation of the act is punishable by a fine of $1,000 or imprisonment from one month to one year, or both.

Drinking intoxicating liquor on passenger trains is prohibited.

Interurban railways are granted the right of eminent domain.

The anti-free pass bill was passed and is to become a law on July 12. Railroads, street railway companies, all common carriers, express companies, sleeping car companies and telegraph companies are prohibited from transporting persons or property in consideration of anything except money. Special rates may be offered by permission of the railroad commission, but such rates must apply to all alike. Heavy fines are prescribed for violation of law and for misuse of a pass. Persons exempted from the provisions of the act are employees and the dependent members of their immediate families, officers, attorneys on a reasonable annual salary, ex-employees within four months after discharge while looking for employment, telegraph and telephone linemen, newsboys, postoffice inspectors, chairmen and members of grievance committees, customs and immigration agents, state health officer and one assistant, federal health officers, persons in charge of perishable shipments of freight, persons injured in wrecks, physicians and nurses caring for them, state rangers, peace officers and live stock sanitary commissioners. Exchange passes are prohibited.

An eight-hour day is prescribed for railroad telegraphers and

*On the New York division of the Pennsylvania Railroad, Jersey City to Philadelphia, 89 miles, the average number of freight trains run each weekday, east-bound, has increased in five years more than two-thirds. The number of trains in 1901 was 61; in 1906, it was 102. The westbound movement increased in the same proportion. A third of these trains carry fruit, livestock, etc., and run at high speed. The length and weight of the trains have also been increased materially. The number of passenger trains has also been largely increased. The average total number of trains each day, including both freight and passenger, both ways, was, in 1896, 556; in 1901, 590; in 1906, 701.

they are subject to examination by a board of telegraphers to be appointed by the Governor.

All locomotives, except switch engines, must be equipped within six months with electric headlights of at least 1,500 candle power each.

The full crew law requires that there must be on each passenger train an engineer, a fireman, a conductor and a brakeman; and that on each freight, gravel and construction train there must be five men. On light engines there must be three.

Railroad employees must not work more than 14 consecutive hours and must have at least eight hours rest between such periods of work.

The separate coach law which now applies to railroads was extended to street railways and interurban lines.

Railroad companies must report to the railroad commission under oath all rolling stock owned or leased, for the purpose of assessment.

The law relating to terminal railroad companies was amended so as to permit the building of belt lines in certain cities.

The railroad commission was given authority to require railroads to buy additional rolling stock to handle freight and passenger business when occasion demands.

A reciprocal demurrage bill was passed. Railroads, under heavy penalty, must furnish cars within a given time after they are ordered, and shippers must accept the cars when ordered. The law places the matter in the hands of the railroad commission and empowers that body to fix the rate of speed at which freight shall be moved.

Track Deformations and Their Prevention.*†

BY G. CUENOT.
Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway.

VII.

CURVE OF DEFORMATION OF THE COMPOSITE TIE.

The composite tie can be considered as an armored beam, composed of a steel envelope and of a wooden furring; the union between these elements is so intimate, in consequence of the squeezing of the pieces, that these two elements may be considered to form an indivisible whole, the one coming to aid the other, to resist the forces to which they are submitted as a whole. Such a solid may, therefore, well be compared to a beam of armored cement, in which the elements are associated in a manner so intimate, that each

Three sections must be considered: the first, where the furring and the envelope are complete; the second where the envelope is defective in its upper part, that is to say right at the fastenings; the third where the envelope exists alone, without furring, which occurs at the extremities and in the central part of the piece.

COMPARISON BETWEEN THE OBSERVED BENDING AND THE THEORETICAL BENDING.

The table which follows gives, comparatively, the observed and the theoretical flexures calculated by graphical statistics (Fig. 18):

Value of force.	Bending moment. 1st Sec.	2d Sec.	3d Sec.	Flexures. Observed.	Theoretical.
4,409 lbs.	337	377	325	0.12 in.	0.10 in.
8,818 "	674	754	649	0.16 "	0.20 "
11,023 "	843	942	812	0.21 "	0.25 "
13,228 "	1.011	1.130	974	0.23 "	0.30 "
15.432 "	1.180	1.319	1.137	0.28 "	0.34 "
16,314 "	1.248	1.394	1.201	0.28 "	0.36 "

The theoretical flexures approach closely to the observed flexures; a little smaller under the initial forces, they surpass the results of observations by some millimeters, when the forces are increasing. It seems that the rigidity goes on increasing at the same time as the latter, in consequence of the still more intimate connection of the materials. This rigidity is apparent, for they are the supports which react and reduce the flexure.

Whatever it may be, this study proves that the theoretical bending of the composite tie is about three times less than that of the wood tie and of the steel tie, when these pieces are submitted to horizontal forces of 4,409 lbs., but that this superiority diminishes when the forces reach 15,432 lbs. (Bending of the composite cross tie about two times less.)

STRESS OF THE ELEMENTS COMPOSING THE COMPOSITE CROSS TIE.

If one considers the composite tie as an armored beam, in which each of the elements is stressed, while taking the same elongation, proportionately to its coefficient of elasticity, one arrives at the following result for the three sections considered:

Value of force, lbs.	4,409	8,818	11,023	13,228	15,432	16,314
Bending moment: 1st section.....	337	674	843	1.011	1.180	1.248
" " 2d "	377	754	942	1.130	1.319	1.394
" " 3d "	325	649	812	974	1.137	1.201
Resisting moment, cu. cm.:						
1st section—armored part.....	.....	.....	1.764	.....	.....	.....
2d " —notched part.....	.....	.....	1.066	.....	.....	.....
3d " —center & extrmty	.....	.....	1.217	.....	.....	.....
Value of force:						
1st Sec.—Wood, lbs. per sq. in.	270	541	669	811	939	996
1st " —Steel, " " "	5,405	10,810	13,370	16,214	18,775	19,912
2d " —Wood, " " "	498	996	1,237	1,493	1,735	1,835
2d " —Steel, " " "	9,956	19,912	24,748	29,869	34,705	36,710
3d " —Wood, " " "	.....	.....	.....	.....	.....	.....
2d " —Steel, " " "	7,567	15,133	18,917	22,700	26,484	27,991

In order to obtain the forces to which the elements of the

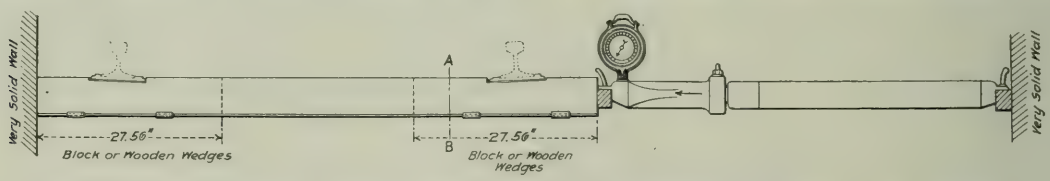
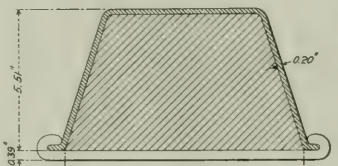


Fig. 17—Tests of Resistance of Blocks and Wooden Wedges of the Composite Tie to Sliding in Their Iron Body.

takes, within the limits of its elasticity, the part of the force which it can bear.

The experiments which were made on the sliding of the wedges, or the single wedge in the interior of the metallic body, have shown the good foundation for this conception. The tie was butted at one of its extremities against a wall, or against a very solid obstacle; the *déclimètre* exercised its force against the other extremity (Fig. 17). The force which was thus exercised was raised to 15,432 lbs. before sliding began. This force is much greater than that which is necessary for bedding the fastenings, since a force of 1,543 lbs. suffices for overturning the head of the screw spike on the plate, which was displaced 0.4 in.; for a displacement 0.6 in. the force was raised to 5,732 lbs. It can be concluded from this that the fastenings will yield before either of the blocks has commenced to slide, and that the plate will never injure the flanges of the skeleton which surrounds it.



SECTION OF COMPOSITE TIE.

For these tests, rails, tie plates, and screw spikes were removed, leaving the wedges and blocks entirely free to slide in their envelope.

Each of the blocks thus forms with the metallic skeleton, a solid whole, which permits of calculating with exactness the forces which are developed in each of the parts of the system.

composite tie are submitted, it was assumed that it was composed of a single material (wood for example), and the moment of inertia of the steel was augmented from this fact in the ratio of the coefficients of elasticity, that is to say, of 20 to 1. It has thus been possible to calculate the position of the neutral axis of the beam, supposedly homogeneous, and to deduce from it the stress of each of the elements, that of the steel being 20 times superior to the stress of the wood.

SUMMARY AND RESULT TO BE DRAWN FROM THE EXPERIMENTS ON OVERTURNING.

If the results set down in the table above are examined, and if they are compared with those which correspond to the wood and steel ties, it is observed that the stress of the material is much less in all the sections of the first than in the two others.

In the mortised part, the material is still stressed within an acceptable limit, 9,956 lbs. per sq. in., under a force very much superior to that to which it can ordinarily be submitted, but that part is quite short, and is reinforced by the plate, which compensates, and more, for the metal cut away for the placing of the fastenings. It is not the same for the steel tie of the State, which is too weak in each of its sections, except right at the fastenings, where it is equally reinforced by the plate or chair. Therefore, it may be said, that the composite tie tested presents two sections a little less resistant reinforced by the plates, while the tie of the State is weak over its whole length, except right at the fastenings. The two situations are, then, inverse with one another, and all to the advantage of the composite tie.

It is the same in the case of the wood tie, which is weak everywhere, and which has not a great rigidity, since it takes a flexure very much superior to that of the composite tie. In order that it may present the same stiffness, it would be necessary to

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†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.

increase the moment of inertia, which ought to be three times higher than that which is actually possessed, that is to say, that the latter should attain about O m 00015 in place of O m 00005. Supposing that the depth of 5.5 in. is maintained, which could not however be increased without difficulty, since it would be necessary at the same time to place a greater quantity of ballast above the tie, it ought to be given a width of 25.6 in., which is certainly inadmissible, for the actual base would be tripled. It is true that

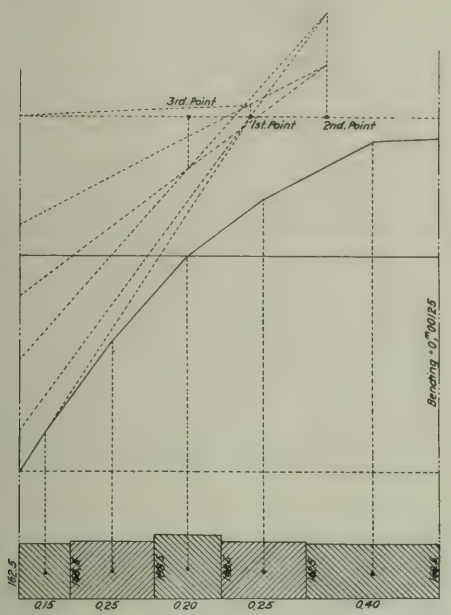


Fig. 18—Graphic Representation of the Bending of Composite Tie (Wood and Steel).

Amount of force.	Theoretical bending.	Amount of force.	Theoretical bending.
2,205 lbs.	0.05 in.	13,228 lbs.	0.30 in.
4,409 "	.10 "	15,432 "	.34 "
8,818 "	.20 "	16,314 "	.36 "
11,023 "	.25 "		

the same result can be obtained with ties 7.09 in. deep, 11.8 in. wide, but we believe that such ties would not be easily found, at least for the price, which would render their use impossible.

STRESS OF TIES IN THE TRACK.

The experiments on overturning, joined to those which have been related above on flexure, permit the determination, with a certain exactness, of the stress of the material composing the ties, under the effect of rolling loads.

In fact, it has been seen that the stress of the wood ties was 711 lbs. per sq. in. for a theoretical bending of 0.24 in.; for a mean bending of 0.10 in. observed on the cross ties with P.L.M.-A. rails, the stress will be about 299 lbs. per sq. in., that is to say, that these

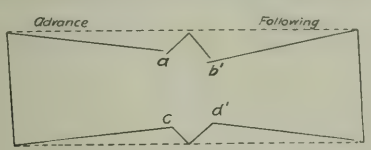


Fig. 19—Shock at the Joint.

pieces are stressed about to the tenth of their resistance within the limit of elasticity.

As regards the ties with P.M. rails, the stress is 142 lbs. per sq. in.

The steel tie has a flexure of 0.10 in., which corresponds to a stress of about 5,405 lbs. per sq. in. (about the eighth of the elastic limit).

The elements of the composite tie are submitted to the following forces for a maximum bending of 0.012 in.:

	1st section.	2d section.	3d section.
Wood, lbs. per sq. in...	27	50	....
Steel, lbs. per sq. in...	540	996	754*

*The stress is counted per square millimeter of section.

The stress is thus for the steel, as for the wood, very much inferior to the admitted resistances, which would permit of reducing, from that point of view, the dimensions of the materials employed.

Space does not permit of discussion of stresses under moving loads, since these are notably inferior, as we have shown.

EXPERIMENTS WITH THE TORSION METER.

Apart from the forces of extraction and overturning, which are the most important, the screw spikes are exposed to excessive turning in their sockets, which reduces the pressure of the rail against its support. This disadvantage is produced above all at the moment of placing the screw spikes, and when they are retightened, the trackman can, if he does not give proper attention, exceed the force necessary, and render useless the work which he does.

The following limits are admitted as the force determining the excessive turning of screw spikes:

Pine, without treenail	132 lbs.
Pine, with treenail	176 "
Hard wood, oak or beech, without treenail	220 "
Hard wood, oak or beech, with treenail	242 "

The force is observed on a register which is attached to an apparatus invented by Mr. Collet, under the name of torsion meter, and which is placed on the head of the wrench for the screw spikes.

The company placed, about three and one-half years ago, 1,056 creosoted pine ties, provided with Collet treenails, on the line from Bourg to Chalon-sur-Saône. In the course of the month of August, 1902, after a traffic of about 13,500 trains, some trials were made with the torsion meter, in order to learn the resistance of No. 6 screw spikes against excessive turning.

The force necessary to obtain this effect on the screw spikes set in the treenails of the original placing, was 159 lbs.; it was 156 lbs., that is to say, sensibly equal, on screw spikes placed in new treenails, which were screwed into new holes, alongside of the treenails of the original placing, in the middle and at the extremities of the cross ties in service.

It is well to remark that while the resistance to excessive turning does not seem to be modified with time, that which the screw spike offers against extraction from a treenail appears to diminish. It is a fact which has been proved by Mr. Ferry, and of which we will seek the explanation further along.

Whatever it may be, it was desired to give an account of the resistance to excessive turning in composite cross ties, compared with ordinary cross ties of oak or pine creosoted. The results of these trials are condensed in the table below:

Kind of tie.	Limit of forces.	Remarks.
Composite ties—Lateral wedge of horn-beam without treenail...	231 lbs.	No excessive turning; at 231 lbs. the screw spike broke.
Composite ties Lateral wedge of oak without treenail.....	231 "	No excessive turning; this force could not be exceeded by 2 men.
New ties of creosoted oak:		
Without treenail	220 "	Excessive turning.
With treenail	275 "	No excessive turning.
New ties of creosoted spruce:		
Without treenail	77 "	Excessive turning.
With treenail.	242 "	Excessive turning.

These trials have shown that the resistance to excessive turning, for screw spikes placed in the blocks of the composite tie, that is to say, squeezed by the play of the skeleton and the cross bars, was at least equal to that of screw spikes placed in ties provided with treenails. The same cause ought to produce the same effects: the squeezing of the fibers of the wood, whether by the treenails or by the pressure exercised by the envelope, sensibly increases the resistance to excessive turning.

The good hold of the fastenings presents considerable interest; for, without an energetic tightening, the rail vibrates on its support, the track becomes jolty, and is deformed vertically, since it is no longer sustained. The tie is hammered, is raised up, and is buried by blows, which disorganize the ballast. This repeated movement, joined with the flexure of the tie and with the compression of the wood, disarranges the fastenings and provokes their tearing out. Finally, if the resistance to overturning is not assured, if the screw spike does not find a sufficient support in the ties, if it is not completely supported by its flange on the base of the rail, if the rail is pushed out, and that principally on curves, to the exterior of the curve, there is a spreading of the track and danger of accident. The track is deformed in the horizontal direction.

SHOCK RIGHT AT THE JOINT.

All engineers who have made a study of tracks, notably Mr. Coüard, affirm that the joint is the weakest point. Mr. Freund, Engineer of Maintenance for the Eastern Railway Company, in a study of the most interesting and best recorded facts, appearing in the *Revue des Chemins de Fer*, January, 1897, pointed out the causes which rendered this point the most defective.

There is produced at the joints an unequal level in the direction of the travel of the trains, that is to say, at the passage of the vehicles, the rail in advance being higher than the following-rail, there is a drop. This unequal level of the rails at the joints is the

result either of the juxtaposition of bars of different height, or of the unequal wear of the splice bearing points of the rails and the splices.

"The difference in the head of the rails is due to the inevitable imperfections of rolling. Sometimes it amounts to a millimeter from one rail to another, and from one extremity to the other of the same rail. It is possible, therefore, to produce jumps when the chances of laying put in juxtaposition, at the same joint, the extremities of the rails of different caliber.

"These jumps are ascendant or descendant, in the direction of the movement. But whatever may be the direction in which they are presented, they provoke shocks at the advance end of the following-rail, which react on the splice bearing points of that rail, and promote its wear, while they are without influence on the bearing points of the rail in advance.

"As to the inequality of the splice bearing points, already thus prepared, its cause can be explained as follows, for the part which does not arise from the imperfections of the fabrication of the rails, and which is clearly shown in the joints where the rails are of equal height.

"In consequence of the compressibility of the wood of which ties are made, of the ballast and of the soil, the track undergoes under the wheels of the vehicles, a depression which, almost insignificant under light loads, can reach and even surpass 0.4 in. under the most heavily loaded wheels.

"This depression induces undulations in the rails, the amplitude of which, for a given resistance of the track to flexure or to sinking in the soil, varies with the load and the position of the wheels. It has in general, its greatest value under the first axle of the engines, when that axle is found in the middle of two successive supports." (See the article of Mr. Freund, *Revue des Chemins de Fer* for January, 1897.)

It is the successive undulations which, bringing the different parts of the splicing in contact with the extremities of the rail, produce an abnormal wear of those parts, and determine the drop of the vehicles from the rail in advance to the following-rail, when the latter pass over the joint. Thus, it results from the examination of a very large number of splices that, in consequence of these oscillations on a line traversed in one direction, the following-rail, by resting on the splicing, makes a kind of notch, b′ (Fig. 19), whose depth is at a lower level than that which the rail in advance produces at a′.

When the load has passed the joint and encounters the following-rail, the latter is inclined, when resting at the bottom of the notch, b′, while the rail in advance is elevated; there is then a considerable fall from the advance-rail to the following-rail, as was found by Mr. Coüard, and that fall is due, except in the case where the rails present an unequal height, to the longitudinal movement of the track previously studied. The flexure of the tie of the following end of the even joint ought also to increase this effect, since the more this piece bends, the more is the difference of level between the advance and following-rails accentuated. The shock which is produced at the joint increases the flexure still more, because it determines the unpacking of the cross tie, which is found suspended at the end of a short time, and which assumes a still more pronounced curve.

(To be continued.)

The Bavarian authorities direct that coffee with sugar be supplied free to trainmen and to a very large class of station and trackmen while on duty, not to exceed one liter (a little less than a quart) per day. This is probably intended to reduce the consumption of a beverage more likely to muddle one's head, popular in Bavaria. Battle Creek may now organize a crusade against coffee in Bavaria.

New Reading Rooms and Club Houses on the Santa Fe.

The Atchison, Topeka & Santa Fe has within the past year made a number of notable improvements for the benefit of its employees. New reading rooms and club houses have been provided at a half dozen places. A fine resort was finished and opened at La Junta, Colorado, in November. Another nearly as good was opened at South Shawnee, Oklahoma. A three-story brick hotel was bought at Chillicothe, Illinois, and made into a club house and reading room. The old Harvey House at Raton, New Mexico, was torn apart and made into a useful and attractive resort for the employees at an expense of $10,000. The reading room at Dodge City has been enlarged and provided with baths and billiard hall and new furniture. Plans have been adopted for a $30,000 building at Barstow, Cal., in place of the one recently burned. Most costly and most complete in all appointments is the Recreation Hall at the Needles, Cal., of which a view is here shown.

This elaborate building, put up at an expense of $65,000, was formally opened for use on January 23. An orchestra of young ladies was brought from Kansas City to furnish the concert and music for the dance. Officials and employees were present from all over the coast lines. Over 300 employees run in and out of Needles. With the great desert on all sides and the Colorado river a mile away; a climate that tries the strongest, and conditions often hard and uninviting, the management deemed nothing too good for the large force of men in the service at that place.

The general style of this building is "Mission"; material, concreted staff. The roofs are tile. There are porticos and shaded retreats on all sides. The architect fought the hot sun and he has won a victory at every point.

The building contains a reading room 33 ft. x 22 ft., a billiard hall 33 ft. x 22 ft., a card room 26 ft. x 28 ft., and a library 26 ft. x 30 ft., all beautifully furnished. The library has 800 volumes, and all the prominent daily, weekly and monthly papers and magazines. In the basement there are three bowling alleys. In the second story there is an auditorium that will seat 600 people with a stage and first class appointments. This auditorium when not otherwise used serves as a gymnasium, for which all modern fittings are provided. Next to the gymnasium there is a plunge bath 50 ft. x 36 ft.



Reading Room and Club House for Employees at Needles, Cal.; Atchison, Topeka & Santa Fe.

The top of the building is designed for a roof garden. In the rear of the main building there is a court, in the center of which there is a fountain. On both sides of this there are sleeping rooms, 20 single and 10 double. These are all provided with hot and cold water. Fred Harvey, the company's caterer, furnishes and operates the rooms, and his organization assists in the management of affairs. Mrs. J. L. Davis is librarian and supervisor.

The price of a tub bath is 25 cents, including a bathing suit and use of plunge.

Two employees may use a billiard or pool table one hour by each paying 5 cents. Bowling is 5 cents a game each player. Rooms are rented for 25 cents for each occupancy. The use of the gymnasium is free, as are all other privileges. On this small scale of prices the income of the building will average $500 a month. The average daily attendance is 250. Special days are set apart for the use of plunge by women and children. Women bowl, play billiards, and use the trapeze, the bars and the swimming pool. This oasis in the desert has a good piano, and there are weekly entertainments and lectures by competent talent from the east.

The weekly entertainments referred to are a feature also at other points on the road, and Mr. S. E. Busser, Superintendent of the reading rooms for the road, has sent us samples of the bills with which he has advertised some of the entertainments. These bills announce a Shakespearian reading by Professor Clark, of Chicago University, at Albuquerque, N. Mex.; a song recital at the same place; concerts at Raton and La Junta, and a miscellaneous entertainment at Gallup, N. Mex. The following extract from the last mentioned bill is characteristic of the whole:

ANNOUNCEMENT!

I am often asked, "Where do you get all these people?" My answer is that they just come our way. Through an old friend I became acquainted with Miss Alfrey: through Miss Alfrey, with the rest of the company. They have all passed a very particular inspection, and I am very much delighted to introduce them to our employees. Each one of these people is accustomed to carry an evening's entertainment *alone*. The combination therefore makes what is known in the Lyceum as "a $200 show." But more than this, each one is delighted to work for the Santa Fe for a brief time and to appear before railroad employees. In their case an announcement and this bill are unnecessary. If any one knows they are coming, everyone will know it very soon. But I wish you to know they are *ours* for a time and to give them an ovation.

P. S.—Our space is limited. Children will not be allowed to occupy chairs. Conversation and changing seats will not be permitted during numbers.

COMPLIMENTS OF THE SANTA FE.

GENERAL NEWS SECTION

NOTES.

The lower house of the New York legislature has passed a bill limiting to eight hours the working day of block signal operators.

The Nebraska State Railroad Commission has ordered the street railroads of the state to cease carrying policemen, firemen and mail carriers free.

The Tennessee State Railroad Commission has ordered the establishment of separate waiting rooms for negroes at every railroad station in the state.

The Illinois Central has nearly completed the erection of its large-size copper telephone wires from Chicago to New Orleans and its other southerly terminals.

The Northern Pacific has notified the railroad commissioners of Montana that the company intends to ignore the new law of that state limiting to 16 hours the time for which railroad employees may be kept continuously on duty.

Judge Goff, in the United States Circuit Court at Clarksburg, W. Va., April 18, dismissed the indictments returned by a grand jury a year ago against the Baltimore & Ohio, charging illegal discrimination in the distribution of coal cars.

At Church's Valley, N. Dak., the station of the Great Northern Railway has been ordered kept shut for one year because it was used for the storage of beer in violation of the law—at least this is what we read in the veracious New York *Sun*.

The Los Angeles limited express of the Chicago & North-Western, the Union Pacific and the San Pedro, Los Angeles & Salt Lake will be again put in service on April 28, after a suspension of several weeks on account of serious floods in Nevada.

A press despatch from St. Paul says that the Great Northern Railway announces that it will comply with the law which has just been passed in Minnesota limiting passenger fares to 2 cents a mile, and also will adopt the reduced freight rates which have been ordered by the legislature.

Near Croydon, England, April 20, a man who was impersonating a signalman bound to the track by robbers in a moving picture representation of a train wrecking scene, was run over and killed by the train. It ought to have stopped, but failed to do so, owing to an error in the instructions.

A press despatch from Indianapolis says that the railroads of Indiana are going to ignore the laws recently passed in that state to require additional brakemen on long trains, and forbidding trainmen to work over 16 hours. This decision seems to be based on the assumption that all trains are interstate.

At a meeting of operating officers of the principal railroads of Canada in Toronto recently an agreement was considered looking to the adoption of uniform train rules on all of the railroads of the Dominion. It is expected that a code will be soon adopted and laid before the Railway Commission for approval.

Press despatches from Jackson say that the Supreme Court of Mississippi, in an exhaustive opinion by the Chief Justice, has sustained the order of the railroad commission of that state prescribing reciprocal demurrage rules. A lumber company sued the Yazoo & Mississippi Valley for delay of a shipment, and it wins its case.

The Chicago, Burlington & Quincy has notified the chairman of the Western Passenger Association that it is going to pay commissions on ticket sales if it shall see fit to do so. This is said to be the first important break in the agreement made about 10 years ago among the principal western roads to cease paying commissions on tickets.

The Interstate Commerce Commission has ruled that the initial line must bear the burden of any mistake in quoting a tariff or selling a ticket. The opinion was given by Commissioner Harlan. Where mistakes occur, although they be honest ones, it is held unlawful for any of the connecting lines to join in sustaining the losses that may occur.

At a conference in Helena, Mont., this week between representatives of the Northern Pacific, the Great Northern, the Montana Railroad, the Butte, Anaconda & Pacific and the State Railroad Commission, an agreement was reached for granting a 2½-cent passenger rate on 500-mile books, to be interchangeable in all states west of North Dakota.

The railroads between Chicago and the Missouri river have agreed to lengthen the minimum time of freight trains eastbound between the river and Chicago to 34 hours. At present the minimum limit is 28 hours, which requires unnecessarily high speed. The railroad men declare that this rate was made when refrigeration was difficult and that now it is unnecessary.

The Minneapolis & St. Louis, after consulting the Interstate Commerce Commission, has decided to withdraw its low price tickets, sold in bunches of 100, recently put on sale between St. Paul and Chicago. These tickets were made good for bearer within one year and were sold at $6, far below the regular fare, thus making it easy for scalpers to cut the rate for single passengers.

According to the *Globe-Democrat* the railroads entering St. Louis from the east have agreed to abolish all of the prevailing arbitrary charges for transportation of freight across the bridges. The railroads already, within the last few years, have absorbed arbitraries amounting to $1,500,000, and it is said that the present action will reduce the freight bills yearly about $300,000 more.

The Grand Trunk and the Wabash are going to sell round-trip tickets from Chicago to all points in Canada throughout the summer at only $2 above half fare, and the same rates will apply to New England points, including Boston, on four days in each month. This news is said to have greatly stirred the other Chicago roads. Boston has never before been included in the "summer resorts."

On the western lines of the Erie Railroad an order has been issued requiring conductors to give a bond of $1,000 each for the faithful performance of duties and the correct accounting of money. It is said that some of the conductors are protesting against the order, declaring that, although it is proper to require a bond for the faithful handling of money, the bond now prescribed adds a new and grave element in the matter of a conductor's responsibility for the safety of his train, as, for example, when he is obliged to run with two or three inexperienced brakemen.

The Circuit Court of Appeals for the Seventh Circuit at Chicago has affirmed a judgment of the Circuit Court requiring compliance with the order of the Interstate Commerce Commission in the case of St. Louis Hay & Grain Company against the Southern Railway, in which a charge of 2 cents per 100 lbs. for the privilege of reconsigning hay at East St. Louis was declared excessive. It was shown that no similar charge was exacted when hay was reconsigned at points on the Ohio river, and the Commission held that the charge was unlawful to the extent of 1 cent per 100 lbs.

A press despatch from Toledo says that the Ann Arbor Railroad will contest a suit which has been brought by the state of Ohio to compel compliance with the laws of that state requiring automatic couplers and air-brakes on freight cars. The road holds that only the Federal government has authority in this matter. This is the same railroad which, according to a report published a few weeks ago, was challenging the right of the Federal government to dictate in this matter. How nice it would be if both the state and the Federal governments could be made to keep their hands off!

The Interstate Commerce Commission, in a decision prepared by Commissioner Prouty, has notified the railroads that its order of September 29 last, holding that party tickets cannot be limited to theatrical or other particular classes, will be adhered to. The objections of the railroads were heard at Washington December 11, but no opinion was announced following that hearing, and some of the roads are continuing to issue theatrical party tickets. If the railroads do not comply with the law as here laid down, the commission will take the question before the courts. Commissioner Harlan and Chairman Knapp dissent.

The railroads centering in Galveston have withdrawn heavy claims for demurrage on 400 cars of export cotton. The steamship companies refused to pay the demurrage, declaring that they have suffered losses aggregating more than $3,000,000 by the detention of steamers in port waiting for cargo. Ships were held in port from 5 to 25 days for cotton which had been delivered to the railroad four, five and six weeks prior to the arrival of the vessels in port. It cost from $250 to $400 a day for every day the vessels were held. More than 500,000 bales for export were five weeks getting from points of shipment, less than 200 miles from Galveston.—And so two wrongs are expected to make a right.

Somebody in Texas estimates that the laws enacted at the recent regular session of the legislature in that state will require expenditures of not less than $20,000,000 by the railroads. The fourteen hour bill, as applied to train crews, will make necessary the establishment of many new division terminals, and the Southern Pacific estimates that the construction of these additional terminals for its lines will cost about $1,500,000. It will cost the Southern Pacific $65,000 to equip all of its locomotives with head electric lights. The full crew bill will mean an additional annual expense to that company of $92,000, and the eight hour bill will increase its expenses at least $80,000 a year. Tax legislation is now pending at the special

session which may increase the tax burdens of the Texas railroads $2,000,000.

The New York and New Jersey Car Service Association has issued revised rules in which provision is made for the "average basis" of settlement with consignees who are willing to sign the form of agreement which has been drawn up by the railroads. Under this agreement a car released within one day will give to the consignee a credit of one day against cars which he may detain. Each customer's account must be settled independently each month and not carried over into another month, nor will any payment be made to the consignee when his credits exceed the debits. Coal and coke shipped to the seaboard, and export grain, now as in the past, are excluded from the demurrage rules. Grain for local delivery is allowed 72 hours, and export freight, not on through bills of lading, 10 days. Freight in bond is allowed 72 hours free time, so as to provide an additional day for government inspection.

The Sundberg investigating committee of the Minnesota legislature has made a report valuing the railroad property in Minnesota at $215,000,000. This is approximately $27,000 a mile. The property is capitalized to the extent of about $400,000,000, or $50,000 a mile. The net earnings, according to the committee's findings, averaged over $5,000 a mile last year, or 18 per cent. on the committee's valuation. A large section of the report is devoted to a drastic review of the Chicago Great Western. "This road," it says, "was built by A. B. Stickney, who raised the funds by acquiring, organizing, reorganizing and 'Harrimanizing' divers and sundry corporations of Minnesota, Iowa and Illinois." The capital stock and funded debt of the road is $143,668 a mile and the committee figures its value at $28,000 a mile. In 1891 there was reported for "purchase of constructed road $6,313,191.52." It was then 815 miles long. "Fifteen years later," says the committee, "this elastic item had been stretched to $50,594,344.28, but the whole line had shrunk 60 miles in length. It has been watered too much."

The Pennsylvania Railroad has published figures showing that on April 1 it had 287 fewer cars on its lines than it had one year ago, although it has within that time added 18,354 cars to its stock. It has 1,862 more of its own cars at home, but it has 16,492 more of them on foreign roads, while the number of foreign cars on Pennsylvania tracks is 2,149 less than one year ago. The figures in detail are:

	Penn. R.R.		
	Cars owned.	At home.	On foreign roads.
April 1, 1907	223,743	143,441	80,302
April 1, 1906	205,389	141,579	63,810
Increase	18,354	1,862	16,492

Foreign cars on Pennsylvania April 1, 1907	54,514
Foreign cars on Pennsylvania, April 1, 1906	56,663
Loss of foreign cars	2,149
Increase in Pennsylvania's cars on foreign roads	16,492
Total decrease of cars on Pennsylvania system	18,641
Less increase in cars owned	18,354
Net increase	287

The Interstate Commerce Commission has issued a decision in what is known as the Peavey elevator case. It is against the Union Pacific. The Commission holds that the arrangement between the Union Pacific and the Peavey elevators was unlawful, as it was in excess of the actual cost of the elevation of the grain, and, therefore, a rebate. The decision was prepared by Commissioner Harlan and his opinion was concurred in by a majority of the Commission. Commissioners Clements and Lane, however, filed dissenting opinions. The question was a subject of investigation by the Commission on its own motion in 1904 and it was then held that there had been no violation of law. Retention in an elevator beyond ten days is now defined as storage and is not a part of the service of elevation. The law recognizes elevation as a facility which the carrier may provide and this authorizes the carrier to grant grain elevation at destination or while the freight is in transit, subject only to the restriction imposed by the act that elevation, like any other service offered by the carrier to shippers, must be open to all on equal and reasonable terms. A carrier may either construct and operate the elevator itself or furnish elevation by arrangement with an owner of an elevator; and the amount of compensation paid by the carrier to the owner of an elevator rendering the service, is of no concern to shippers or to other carriers, unless it operates to affect the rates charged by the carrier upon the grain traffic or by some device a portion of the allowance is returned to shippers and thus becomes a rebate. An allowance made to a shipper of grain who furnishes elevation service under an arrangement with a carrier, is a rebate and an unlawful discrimination when it involves a profit over and above the actual cost to such shipper of the service rendered. It is not a rebate when the allowance does not so exceed the actual cost. The arrangement between the Union Pacific and the Peavey elevators at Council Bluffs and Kansas City is not in itself unlawful. But the allowance of 1¼ cents per 100 lbs. paid by the railroad company to these elevators, controlled by the Peavey interests, who are large shippers of grain and own practically all the grain going into the elevators, is in excess of the actual cost of the service, and is a rebate, and therefore unlawful. The Commission orders that the allowance shall be reduced and shall not exceed three-fourths of a cent per 100 lbs., such order taking effect on June 1, 1907.

Strenuous Railroading in the Mountains.

The work of fire guarding the 2,400 freight cars involved in the blockade on the western end of the Wyoming division of the Union Pacific has been completed. A barrel of water is now stationed at intervals of 15 car lengths along all sidings and in all yards and a guard is on duty at every fiftieth car. The blockaded cars, all of them with loads, if placed in one train would extend a greater distance than 15 miles. There are 765 cars in the Green River yards, the capacity of which is 800 cars, and the remaining 1,600 cars are bunched on sidings and double track between Green River and Thayer Junction, a distance or 40 miles. The Union Pacific bandit-hunting posse is patrolling this 40 miles of track. The Oregon Short Line, the cause of the blockade, will be in a position to accept freight within a day or two, it is hoped.—*Cheyenne Despatch*, April 6.

Permanent Concrete Exhibition.

The Executive Committee of the Concrete Association of America has leased the northern half of the seventh floor of the Brunswick building, on Fifth avenue, between Twenty-sixth and Twenty-seventh streets, New York City. In this space it will install a permanent exhibition of concrete products, construction methods, machinery and materials. A secretary will be in attendance to give information and to take charge of drawings and photographs regarding any exhibit. The proceeds from the sale of exhibit space will be used by the concrete association for educational purposes exclusively. Over twenty firms have reserved space. H. C. Miller, 1 Madison avenue, New York, is in charge of exhibit space.

New Rates on Three Days' Notice.

The Interstate Commerce Commission, in an opinion on the complaint of McRae against the Southern, the Seaboard Air Line and others, alleging that rates on merchandise to McRae and Helena, Ga., from New York, Boston, etc., were unjust in comparison with rates to Cordele and Fitzgerald, says that pending the hearing a conference was had between the complainants and the carriers, and a readjustment satisfactory to complainants was agreed upon, and that therefore permission had been granted by the Commission to the carriers to put such rates in effect on three days' notice; and the complaint is now dismissed.

The Continental Signal Company.

This is the name of a company which has been organized to make and put up block and interlocking signals, by Messrs. George H. Paine (President), W. A. D. Short (Chief Engineer) and Gaylord Thomas (Secretary). The office of the company is at 46 East Van Buren street, Chicago. The President was formerly with the Union Switch & Signal Company and later with Charles Paine & Sons, Civil Engineers, New York City, and with the *Railway Age*. The Chief Engineer was for many years Signal Engineer of the Cincinnati, New Orleans & Texas Pacific, and later of the Illinois Central.

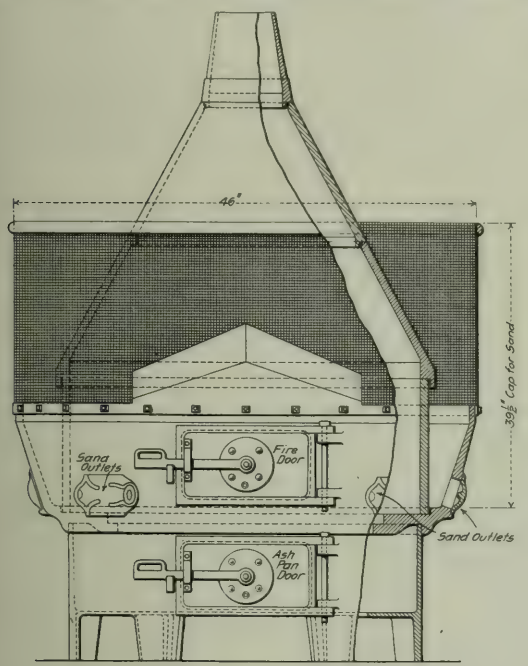
The Ohlen Saws.

The inserted tooth style saws made by the James Ohlen & Sons Saw Manufacturing Company, Columbus, Ohio, are intended for branch work or where a thin-edge saw is required. The No. 13 gage makes only a $^5/_{32}$-in. kerf and is considered preferable to a solid saw. The best known steel for saws is Jessop's English steel, but there are American steels that sawmakers in this country consider equally as good. A tough, even and perfect temper must be imparted, and the temper is varied, depending on the class of work for which the saw is intended. Perfect grinding is important. All lumps and ridges in the blade must be carefully removed, leaving a perfectly smooth service. Immense grindstones, each held in position by a heavy iron pressing against the large supporting arms upon which the saws revolve, obviate any possibility of the saw slipping. These stones are carefully quarried and must have periodic expert examination in service to insure their being kept in the best of condition. Smithing and hammering the material in preparing the blade requires a high grade of skill. All irregularities must be removed as it comes from the furnace, without injury to the steel. Careful inspection is made of each blade, which is placed on a mandrel, and a variation of one-thousandth of an inch calls for further adjustment for every sort of blade. Automatic filers are used

to form and sharpen the teeth, which do their work accurately and quickly. Final inspection by experts is then given the blades and they are ready for shipment.

The Robertson Sand Dryer.

A new design of sand dryer is shown in the accompanying illustration. It differs from the ordinary sand stove in many respects. The arrangement of grates, heating surfaces and sand reservoirs is claimed to be such that all of the heat generated is utilized for drying the sand. As there is a continuous discharge of dry sand from the outlets, there is no trouble from clogging or caking of



The Robertson Sand Dryer.

the sand in passing through the dryer. It requires no more fuel than the ordinary sand stove, while its capacity is five times as great, or about 20 cu. yds. a day.

Thorough drying of the sand and complete destruction of all contained vegetable matter, due to the high temperature attained, is claimed. The resulting product can therefore be stored in a dry place for future use without risk of collecting moisture, which would result were vegetable matter present. Clogging of the locomotive sand pipes may thereby be avoided. This dryer is known as the "Robertson," E. F. Luce & Co., Chicago, being general sales agents.

Before the Telegraph Was Invented.

One of the first systems of aerial telegraphy was attempted in the fifteenth century. The originator was Amontons, at that time considered one of the cleverest scientists of the world. He developed a system of signal telegraphy so that a message could be sent from Paris to Rome in three hours. Those who assisted in the transmission of the message along the line were unable to tell the nature of the message.

Posts were placed from Paris across the Alps at consecutive points, where men were stationed with telescopes. Different signals, representing combinations of letters, were run up at each post. The key to the signal was known only to those who sent the message in Paris and the recipients a thousand miles away. Amontons was not encouraged in his work and discontinued his efforts.

Perhaps the real inaugurators of the system of long-distance transmission of messages were the Gauls. A number of men, stationed at certain intervals over a long stretch of country, sent messages, one to the other, so quickly that Cæsar, in his Commentaries, said the natives forwarded warnings of his approach at the rate of fifty leagues from sunrise to sunset. At night they used signal fires or "hauchees." While tympans were beaten fires were lighted from mountain top to mountain top.

To the tourist wandering through France and over the Pyrenees into Spain the old towers which appear from time to time across the mountain may be seen purposeless and strange. Yet they are vestiges of the greatest system of old-time aerial telegraphy in existence. These towers, both square and round, are situated on the most prominent hillocks. Up to 1844, when experiments assured the success of the electric telegraph, these towers were the means of communication in France. In that year there were 535 stations. The towers were two stories high, with index signals of light wood or iron mounted at the top of a pole on the roof. [The Semaphore.]

This system was originated by Claude Chappe, and was presented to the National Assembly of France on March 22, 1792. Chappe had prepared a secret vocabulary composed of 9,999 words, represented by characters. The convention conducted a series of trials, and, elated by what its members called the simplicity of the scheme, adopted it.

At that time France was at war with nearly the whole of Europe. The first telegraphic national message was received by Carnot, grandfather of a recent French president, telling of the restoration of Conde to the Republic.

The news of the taking of Bruzelles by the French was transmitted from that city to Paris in twenty-five minutes. Messages were sent by placing signals at the top of the poles on the towers. The telegrapher at the one end mounted a ladder and changed them by hand. There was always some one on watch on the towers to note the signals from the others. The line of stations was extended by the first Bonaparte to Milan, Italy, and thence to Mayence, Germany.

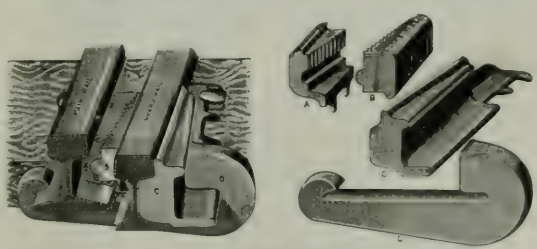
During the Crimean war (1854) by the use of semaphores messages were conveyed from one camp of the allied armies to another. Arms were operated by wires by a man below in a tent.—*Telegraph Age.*

A Work of Supererogation.

Among the auxiliary "items" which had to be dealt with by the Pennsylvania Railroad in establishing its great terminal station in New York City was the building of a church, which involved the expenditure of over half a million dollars, exclusive of the cost of the land. This church, St. Michael's Roman Catholic, has been built on Thirty-fourth street to take the place of one which had to be torn down. The company has made an exact copy of the old one, including the stones of the facade and the stained glass windows, which were numbered as taken out, piece by piece, and set up in the new structure in the same positions as before. The ceilings of the interior have been painted with exact copies of the paintings in the old church. The new buildings—the church includes a school, a rectory and a convent—are superior to the old ones in that they have steel frames and are of fireproof construction. Whether or not this "devotional" service has had any reflex action on the moral character of the soulless corporation is a question on which the interesting notice sent out by the railroad company's press agent is profoundly silent.

The Anchor Guard Rail Clamp.

One of the most difficult pieces of trackwork to properly maintain is the guard rail at frogs and other similar places. The anchor guard rail clamp shown in the accompanying illustrations has been designed to give a simple, durable and strong method of holding the guard rail firmly in place with the proper clearance between the stock rail. It consists of only four pieces, the forged steel clamp D, the two wedges or fillers A and B of malleable iron and the key C,



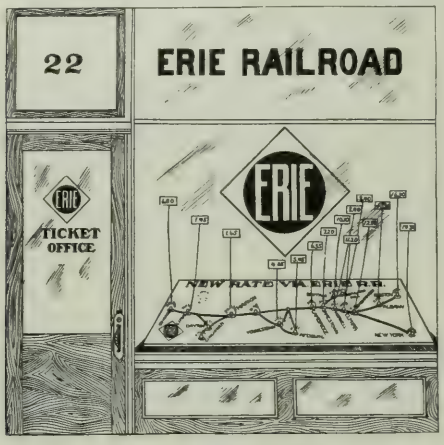
The Anchor Guard Rail Clamp.

also made of malleable iron. To apply the clamp the guard rail is placed in position and the wedge A placed against the web of the stock rail in such a position that the projections on the bottom of it will straddle the yoke D when the yoke is placed against the side of the tie to which the key C is to be spiked. The filler B is placed against A and adjusted for the desired throat, after which the yoke is hooked over the flange of the stock rail and the key C is inserted

between the guard rail and the yoke. The key is driven in tight and the notched end spiked to the underlying tie. This locks the clamp, which cannot be moved until the lock spike is withdrawn. The only tool necessary for its application is a spike hammer. Any wear is readily taken up by adjusting the two wedge blocks. The clamp is made by the American Guard Rail Fastener Co., 929 Real Estate Trust Building, Philadelphia, Pa.

Easter Ribbons.

The free advertisement of the Erie Railroad, shown herewith, is taken from the *Erie Railroad Employees' Magazine*. The picture represents the front of the company's city ticket office in Dayton, Ohio. The little placards showing the passenger fares from Dayton are pasted on the window, and each is connected by a ribbon with the point on the map showing the location of the city



An Erie Advertisement.

to which it refers. On the first day that this map was displayed 3,000 people stopped to look, and (says the passenger agent) to admire. Whether or not the prices placarded were sufficiently below those formerly in force to induce these admirers to go home and call off their agents in the legislature who desire to rob the railroads, we are not informed.

Uses of Bessemer Steel.

Not many years ago nearly the whole production of Bessemer steel was used for making rails. Even 20 years ago only a very few hundred thousand tons of ingots in this country were converted into other forms. Now the use of Bessemer metal for other purposes greatly exceeds that for rails, and these other uses are still increasing rapidly. Witness the tons of Bessemer ingots and of Bessemer rails produced in this country in each of the last four years:

	1903.	1904.	1905.	1906.
Ingots	8,592,829	7,859,140	10,941,375	12,275,253
Rails	2,946,756	2,137,957	3,192,347	3,765,642
Excess ingots	5,646,073	5,721,183	7,749,028	8,509,611

Thus since 1903 the increase in rail production has been 818,886 tons, while the increase in ingot production has been 3,682,424 tons, and the consumption for purposes other than rails has increased 50 per cent.

From Our Wall Street Branch.

Hearne, Tex., April 18.—The employees of the Central received their checks Tuesday and as a result considerable money was put in circulation.—*Houston Post* (Exclusive) Special.

TRADE CATALOGUES.

Draft Rigging.—The McConway & Torley Co., Pittsburg, Pa., has published a pamphlet showing views of some all-steel cars equipped with Buhoup three-stem couplers and vestibules.

Storage Batteries.—The General Storage Battery Co., New York, is distributing a pamphlet giving clear and complete instructions for the installation and operation of Bijur transportable storage batteries.

Wheels.—The Railway Steel-Spring Co., New York, sends a catalogue describing steel-tired wheels. This company makes Paige, Allen, Boies, National, and fused spoke wheels, different styles of each of which are shown.

Thermit.—The Goldschmidt Thermit Co., New York, has published a pamphlet describing some interesting welds made on steamships and locomotives. Some of the photographs show unusually important applications of the thermit welding process, which is well-known to readers of the *Railroad Gazette*.

Louisville & Nashville.—The passenger department of the Louisville & Nashville is distributing a pamphlet entitled "Outings." It is well illustrated and describes resorts along the Gulf of Mexico and in Alabama, Tennessee, Kentucky, Illinois, Indiana and Florida on the Louisville & Nashville; also places in other states reached by connecting lines.

Paint.—The Joseph Dixon Crucible Co., Jersey City, N. J., is distributing a timely pamphlet entitled "Spring Painting." The advantages of Dixon's Silica-Graphite paint are gone into, and other information concerning the paint is given, including the number of square feet of wood and metal respectively one gallon will cover and the colors in which the paint is made.

New York Central Lines.—The passenger department is distributing a convenient and condensed time-table of the more important trains on its lines. It is small enough to be easily carried in the pocket and is made as concise as possible, bulky advertising and unnecessary description being omitted. The make-up of each train is noted and some desirable general information given.

Generators.—Bulletin No. 143 of the B. F. Sturtevant Co., Hyde Park, Mass., describes generating sets with horizontal engines. Figures describing generating sets in sizes from 20 k.w. to 150 k.w., using class HC1 engines, are given. The generators are of the eight-pole type direct-connected to the engine by flange couplings. The bulletin is illustrated with half-tones of a 75-k.w. generating set and parts.

Industrial Railroad Equipment.—The Ernst Wiener Co., New York, is distributing a small pamphlet calling attention to industrial railroads of all gages and the equipment for them which the company is prepared to furnish. It supplies complete lay-outs, including curves, switches, turntables, etc.; steel dump cars, skips, coal cars, ladle cars for foundries, cane and plantation cars and similar equipment.

Drills.—The Cleveland Twist Drill Co., Cleveland, Ohio, is distributing reference tables printed on bristol board so as to be conveniently hung in shops. The tables show dimensions of shanks; cutting speeds for different sizes of drills; dimensions of standard drills, bolts and nuts; decimal equivalents of fractions of an inch for use with micrometer calipers; and suggestions for the regrinding of drills.

Electric Fans.—The Sprague Electric Company, New York, has published a catalogue of small direct-current and alternating-current electric fans. These fans are made in 12-in. and 16-in. sizes and in different styles. The company also make fans with wooden blades to be suspended from the ceiling. The catalogue illustrates the different fans, gives measurements, voltage, rotations per minute, etc., and price list, as well as a telegraph code.

Alundum.—The Norton Co., Worcester, Mass., sends a pamphlet describing alundum. This abrasive is made by the company in electric furnaces at Niagara Falls. Bauxite, an amorphous oxide of aluminum, is fused at a temperature of between 6,000 and 7,000 degrees fahrenheit; it crystallizes into alundum on cooling, and is then crushed and rolled. The alundum is then screened and grinding wheels for different kinds of work are made from the various sizes of grain.

Reinforced Concrete Factory Buildings.—Under the title of "The Typical Factory" the Trussed Concrete Steel Co., Detroit, Mich., has prepared a pamphlet describing the new automobile plant of the Geo. N. Pierce Co., Buffalo, N. Y., which was built throughout of reinforced concrete on the Kahn system. It covers an area of over 280,000 sq. ft. and was built in about six months. Each building is described briefly in detail and there are many excellent half-tone engravings. The book is prepared in very attractive form and is printed in two colors on plate paper.

Air Compression.—Catalogue 58 of the Sullivan Machinery Co., Chicago, is entitled "Modern Practice in Air Compression." It is a 112-page, standard size (5 x 9) volume. After classifying and giving all necessary data concerning Sullivan compressors of different types and classes, also air receivers, water separators, unloading

devices and reheaters, information is given on volumetric efficiency, compression at different altitudes, transmission of compressed air and compressor computations. The latter part of the book is devoted to Sullivan rock drills, pick machines, diamond drills, channeling machines and heavy hoisting engines. There is a very complete index.

Locomotive Efficiency.—The Baldwin Locomotive Works have published in pamphlet form a paper by W. P. Evans, of the Baldwin Locomotive Works, read before the Pacific Coast Club on February 17, 1906. An abstract of this paper was published in the *Railroad Gazette* of May 4, 1906. The pamphlet also contains some interesting remarks on the extra work department of the company; this department was organized many years ago to keep in stock extra interchangeable parts of locomotives. The department handles orders for these duplicate parts and keeps a record of alterations made to locomotives built by the company. It also overhauls locomotives. The annual output of duplicate parts supplied in recent years is the equivalent of about 100 new locomotives.

Corrugated Bars.—The Expanded Metal and Corrugated Bar Co., St. Louis, Mo., has published a book containing "a few illustrations of work done with the corrugated bar, some information about corrugated bars, and simple formulae and tables for use in designing." The illustrations of work done fill 80 pages and embrace practically every type of construction to which reinforced concrete is at present applicable, including buildings, railroad structures and miscellaneous structures of great variety such as dams, tunnels, reservoirs, sewers, viaducts, etc. The formulae and tables occupy the last 12 pages of the book. The publication is in attractive form. The illustrations of work done are fine half-tone engravings printed on plate paper, and there is an appropriate embossed cover design in colors.

Centrifugal Pumps.—R. D. Wood & Co., Philadelphia, Pa., sends an interesting pamphlet describing centrifugal pumps for water works and high pressure fire service. The advantages claimed for these pumps include compactness, elasticity and high power. The pamphlet shows various installations of the company's pumps driven by steam engines and gas engines. Considerable space is devoted to a comparison of the cost of power derived from steam pumping engines and from gas engines using gas from suction gas producers, which use coal, lignite, peat, coke or other fuel. For fire service the advantages of a high pressure pipe system supplied with water from a central pumping plant, thus eliminating the fire engine, are pointed out. One high lift centrifugal pump installed in a large modern building can supply all the water needed for fire protection. The pamphlet gives examples of such installations in different cities, and the results of tests. Figures showing the size, capacity and horse-power required for different pumps are included.

Manufacturing and Business.

The New York office of the Federal Railway Signal Co. will be moved from 60 Wall street to 42 Broadway on May 1.

The Steel Rail Supply Co. is now in its new offices on the 15th floor of the United States Express Company's Building, 2 Rector street, New York.

Shirley E. Johnson, recently with Fisk & Robinson, bankers, has been elected Vice-President of the Continental Engineering-Construction Co., New York.

H. S. Hoskinson, for the past five years General Storekeeper of the Central of New Jersey, has resigned to go to the Dressel Railway Lamp Works, New York.

The Stover Foundry & Manufacturing Co., Myerstown, Pa., has moved its New York offices to the 11th floor of the West Street Building, 140 Cedar street.

Thomas Scattergood, President of the American Water Softener Co. since its organization in 1902, died of pneumonia in Naples, Italy, on April 18, after a short illness.

On May 1 the Clinton Wire Cloth Company, Clinton, Mass., will remove its New York office from 33 Park Place to 261 Broadway. At the same time, the Chicago office will be removed from 237 Lake street to 30 and 32 River street.

The Standard Coupler Company has removed its New York offices from 160 Broadway to the sixteenth floor of the United States Express building, 2 Rector street. The Chicago offices have been removed from the Monadnock block to the Fisher building.

J. S. Watson, Manager of the Link-Belt Company's drive chain department, sailed for Europe via the Hamburg-American Line steamship "Amerika" on April 25. While abroad Mr. Watson will visit the chain-making plant of Hans Renold at Manchester, England.

M. C. Robbins, who was advertising representative of *Engineering News* in the West for eight years, has resigned that position in order to devote his entire time to the interests of the *American Architect* and the *Municipal Journal and Engineer*, both weekly papers, published by the Swetland Publishing Co., New York. Mr. Robbins is Vice-President and Western Manager of the company and will have offices in the Monadnock building, Chicago.

The Myron C. Clark Publishing Co., New York, has moved its main office to 353-5-7 Dearborn street, Chicago, where one-half of the ninth floor of the Ellsworth building has been leased. This company publishes a weekly technical paper, *Engineering-Contracting*, and several monthly periodicals; also a large line of engineering and technical books. The eastern office of the company will be continued at 13-21 Park Row, New York City, where the main office was located previous to April 15. The Boston office is at 170 Summer street.

A. C. Nash, General Manager of a company which has been organized to build electric street lines in the city of Chihuahua, Mexico, and to build interurban lines leading out of that city, has ordered from the United States enough rails to lay 10 miles of track, and is now in the market for 30,000 cross-ties. Enrique Creel, Mexican Ambassador to the United States, is at the head of one company. The same interests own the steam railroad which runs from Chihuahua to Santa Eulalia. This line will be converted into an electric line and made a part of the general system.

On May 1 the Chicago branch of the Niles-Bement-Pond Company will be moved to the sixth floor of the new Commercial National Bank building, Clark and Adams streets. The Pratt & Whitney Company will abandon its show room and offices at 46-48 South Canal street, and will combine its machinery sales department with that of the Niles-Bement-Pond Company. The show room and stock of Pratt & Whitney's small tools and the small tools sales department will be on the ground floor of the new Plamondon building, Clinton and Monroe streets. George F. Mills, who has for several years looked after the interests of these companies in Chicago territory, will continue as manager of the Chicago offices.

Reuben Wells, who has resigned as Manager of the Rogers Works of the American Locomotive Company, thus terminating a service of 20 years, was born in Chester County, Pa. After serving his apprenticeship in the Philadelphia & Reading shops at Reading, Pa., he went to Shelbyville, Ind., in 1852, as Master Mechanic of three small roads. The next year he was transferred to Jeffersonville, Ind., as Master Mechanic of the same roads together with the Jeffersonville & Indianapolis, all of which lines were afterward consolidated under the name Jeffersonville, Madison & Indianapolis. The diverse duties of the Master Mechanic at that time may be realized from the following instance. In the summer of 1863, two army corps from the Army of the Potomac had to be moved to Nashville, Tenn., as quickly as possible and with no more public notice than was necessary. The army officer in charge of transportation arrived in Indianapolis only a few hours before the first of the troops, and as both the President and Superintendent of the road were out of reach, Mr. Wells was for six days in entire charge of the road, operating it exclusively for the transportation of the troops from Indianapolis to Louisville. During this week, therefore, he acted as Superintendent, Master Mechanic, yard master and even train despatcher. Mr. Wells was with the Jeffersonville, Madison & Indianapolis for 25 years, during five years of which he was a Trustee of Purdue University. In 1878 he went to the Louisville & Nashville as Superintendent of Machinery; he was appointed General Manager in 1884, and the next year was made Assistant to the President. In 1885 it was decided to change the gage of the 1,300 miles of road from 5 ft. to standard. This work was given to Mr. Wells. Preparations had been under way for several years, but the actual change was made in the 24 hours beginning at midnight on Saturday. The details of this work make an interesting story, which cannot be gone into here. In 1887, Mr. Wells left the Louisville & Nashville to become Superintendent of the Rogers Locomotive Works. He was made Manager of the works in 1900, retaining this position after their acquisition by the American Locomotive Company.



Reuben Wells.

W. J. McBride, First Vice-President and General Manager of the American Car & Foundry Co., with office in St. Louis, Mo., has resigned to become First Vice-President of the Haskell & Barker Car Co., Michigan City, Ind., effective June 1. Mr. McBride was with

the Peninsular Car Co., Detroit, Mich., prior to the organization of the American Car & Foundry Co. in 1889. He was made Manager of the last named company at the time of formation and has continued in active charge up to the present time. Edward F. Carry, heretofore Second Vice-President and Manager of the Chicago office of the American Car & Foundry Company, succeeds Mr. McBride. Mr. Carry was formerly and for some years with the Wells & French Car Company, Chicago, where he served in various positions. He was Secretary of the company at the time it was acquired by the American Car & Foundry Company; he was then appointed district manager of the last named company. He was later elected Third Vice-President, and in June, 1903, was promoted to be Second Vice-President and Manager of the Chicago office. Since that time he has been also a Director and a member of the Executive Committee. Mr. Carry belongs to a number of Chicago clubs, including the Chicago Athletic, the Kenwood, the Exmoor and the Midlothian.



E. F. Carry.

The Central Inspection Bureau, New York, has an order from the Newburg & South Shore for the inspection of 100 all steel gondola cars to be built by the Pressed Steel Car Co. This company also has orders from J. G. White & Co. for the inspection of a large number of dump cars for export shipment, and from the Philadelphia Rapid Transit for inspecting a large amount of lumber.

Iron and Steel.

The New Orleans & North-Eastern is reported to have ordered 4,500 tons of bridge steel.

Of the 153,000 tons of rails to be ordered by the Pennsylvania for 1908, 100,000 tons are to be for the Lines East and 53,000 tons for the Lines West.

Negotiations are pending for bridge steel for 6,000 tons for the Great Northern, and for the Chicago, Lake Shore & Eastern between 2,000 and 3,000 tons.

Orders are pending for rails for 1908 delivery, the United States Steel Corporation having fixed the selling price at $28 per ton, which has prevailed for the last six years.

Contracts are reported let to the American Bridge Company by the Japanese Government for steel for 468 single span bridges, ranging in length from 7 ft. to 105 ft., to be built on the Manchuria Railway.

The Interborough Rapid Transit Company, New York, will soon give an order for 1,500 tons of structural material for reinforcement work in Brooklyn, and the Degnon Construction Company for about 5,000 tons of steel bars and shapes for subway work. The Southern has ordered 880 tons of fabricated steel from the Phoenix Bridge Company, and the Michigan Central has given an order for 3,500 tons of steel for bridges to the McClintic-Marshall Construction Company.

OBITUARY NOTICES.

Isaac A. Whitcomb, founder and President of the Raymond & Whitcomb Company, died suddenly on April 17 at his home in Somerville, Mass. Mr. Whitcomb was 70 years old, and originated personally conducted tours in this country.

Nicholas T. Smith, Treasurer of the Southern Pacific Company, died on April 23 at his home at San Carlos, San Mateo County, California. Mr. Smith was born November 29, 1829, at Schodack, N. Y., and entered the railroad service in 1871 as Cashier and Paymaster of the Southern Pacific. For the last 31 years he had been Treasurer of the company. He was also Treasurer of the Central Pacific and other subsidiary lines.

Edgar L. Somers, Freight Traffic Manager of the New York, New Haven & Hartford, died of heart trouble on April 21 at his home in New Haven. Mr. Somers was 58 years old. He was born in Cuyahoga Falls, Ohio. After being agent of several fast lines, he was, in 1893, appointed General Western Agent of the New York Central & Hudson River and of the Lake Shore & Michigan Southern. He went to the New York, New Haven & Hartford in 1903.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Association of Railway Superintendents of Bridges and Buildings.

The secretary of this association announces that the next annual meeting will be held in Milwaukee, Wis., October 15, 1907, instead of Salt Lake City, as previously announced.

New England Railroad Club.

At the annual meeting of this club in Boston, Mass., March 12, C. H. Wiggin, of the Boston & Maine, was elected President; F. C. Cleaver, of the Rutland Railroad, Vice-President, and C. W. Sherburne, Treasurer. E. L. Janes is Secretary.

Iron and Steel Institute.

At the annual meeting of the Institute to be held May 9-10 in London, the programme includes the following papers:

"Use of Steam in Gas Producer Practice." By Prof. W. A. Bone, D.Sc., and R. V. Wheeler.

"Sentinel Pyrometers and their Application to the Heat Treatment of Tool Steel." By H. Brearley and F. Colin Moorwood.

"Induced Draught with Hot-Air Economizers for Steel Works and Blast-Furnace Boilers." By A. J. Capron.

"Influence of Process of Manufacture on some of the Properties of Steel." By F. W. Harbord.

"Distribution of Sulphur in Metal Ingot Moulds." By Joseph Henderson.

"Steel-Making from High Silicon Phosphoric Pig Iron by the Basic Bessemer Process." By Arthur W. Richards.

"Steel-Making from Pig Iron containing Chromium, Nickel and Cobalt." By Arthur W. Richards.

"Electrically Driven Reversing Rolling-Mills." By D. Selby-Bigge.

"Ageing of Mild Steel." By C. E. Stromeyer.

"Carbon Tungsten Steels." By Thomas Swinden.

"Nomenclature of Iron and Steel." Report of a Committee of the International Association for Testing Materials.

Reports on Research Work carried out during the past year will be submitted by C. A. F. Benedicks (Sweden), O. Stutzer (Germany), E. F. Law (London), E. Hess (United States), P. Breuil (Paris), H. C. Boynton (United States), L. Guillet (France), W. H. Hatfield (Sheffield), A. Campion (Glasgow), E. G. L. Roberts (London), E. A. Wraight (London), and W. Rosenhain (Teddington), Carnegie Research Scholars.

The Council has decided to hold the autumn meeting of the Institute in Vienna on September 23, 24 and 25. After the meeting there will be alternative excursions to Bohemia and Styria, by invitation of the Prague Iron Industry Company and the Austrian Alpine Mining Company respectively.

American Society of Civil Engineers.

The thirty-ninth annual convention of this society is to be held in Mexico City, Mexico, during the week beginning Monday, July 8, in "Mineria" (Engineer School and Mines Building). The local committee will arrange excursions and entertainments to points of professional and general interest, such as the new water-works now under construction, the drainage works of the Valley of Mexico, etc., and special excursions to the works of the Mexican Light & Power Co. at Necaxa and to Orizaba. Hotel accommodation in the City of Mexico can be secured through the local committee. The charge on the European plan will be from $1.50 up, or on the American plan from $2.50 upward. It is understood that a special rate will enable members to buy tickets in some cases at one fare for the round trip, and in others at not more than the usual convention rate of a fare and one-third. A special train may be run from St. Louis direct to the City of Mexico.

The topics selected for general discussion at this meeting are as follows:

Water Supply.—Is it a better policy to buy and control watersheds, or to rely upon filtration to correct the effects of pollution.

Foundations. What is the best system of construction for foundations of heavy structures on ground such as that of the City of Mexico?

Will iron or steel used in foundations, independently or in combination with other materials, last indefinitely when in direct or indirect contact with water?

Will the strength and durability of concrete in foundations be affected if before setting there is: (1) An excess of water; (2) lack of compression; (3) too rapid desiccation?

Pavements.—Will the paving materials of the present be used in the construction of the pavements of the future?

Electric Railways. What are the factors which determine the maximum economical grade for electric railways?

In establishing direct lines with heavy grades, under what conditions will it be found practicable to use electric locomotives and gas-engine generating stations, rather than traction by steam locomotives?

Gas Engines. What is the best apparatus and most economical system for cleaning producer or furnace gas, to be used in gas engines?

To what extent is ordinary producer gas, made from bituminous coal, used in gas engines, and what practical results have been obtained by any methods for removing tar or soot?

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Chicago Terminal Transfer.—A. C. Emery, Purchasing Agent, E. N. Layfield, Chief Engineer, both of this company, William C. Lane, President of the Standard Trust Co., and L. L. Stanton, Second Vice-President of the Standard Trust Co., have been elected members of the Board of Directors of the Chicago Terminal Transfer, succeeding A. O. Slaughter, deceased, and A. E. Goodhart, W. W. Heaton and H. W. De Forest.

Galveston, Houston & Henderson.—J. H. Hill, formerly Manager, has been elected Secretary and Treasurer, succeeding A. A. Van Alstyne, resigned. F. A. Lister, Acting Manager, has been appointed Manager.

Louisiana & Northwest.—H. C. Brown, Vice-President and General Manager, has resigned.

Operating Officers.

Canadian Pacific.—John Vaughan, Superintendent at Montreal, Que., has resigned to go into other business.

Central of Georgia.—E. H. Daniel, Trainmaster at Columbus, Ga., has been appointed Trainmaster at Macon, Ga., succeeding F. M. Woodall. J. R. Hendon succeeds Mr. Daniel.

Grand Trunk.—F. L. Lamplough has been appointed Trainmaster at Ottawa, Ont.

Great Northern.—F. S. Elliott, Assistant Superintendent at Larimore, N. Dak., has been appointed Assistant to the General Superintendent at Spokane, Wash. F. D. Kelsey succeeds Mr. Elliott.

International & Great Northern.—J. R. Jones has been appointed Assistant Superintendent of the San Antonio division, succeeding H. S. Corrington, resigned to go into other business.

Mississippi Central.—M. H. McCabe, General Superintendent, has resigned.

New York Central & Hudson River.—No official announcement has confirmed the newspaper reports to the effect that a change is about to be made in the organization for operating the Electric division. The new organization is reported to be as follows: A. R. Whaley, who is now Superintendent of the New York division of the New York, New Haven & Hartford, is to be made General Superintendent of the Electric division of the New York Central. Mr. Whaley will also be Manager of the Grand Central Station under the terms of the contract between the Central and the New Haven. It is said that Ira A. McCormack will be made Assistant to the General Manager.

New York, New Haven & Hartford.—See New York Central & Hudson River.

Northern Pacific.—E. W. Mason, chief despatcher of the Seattle division, has been appointed Trainmaster of that division.

Traffic Officers.

Atlanta & West Point.—Edward T. Eckles, Assistant General Freight Agent of the Nashville, Chattanooga & St. Louis, has been appointed General Freight Agent of the Atlanta & West Point, succeeding M. M. Ansley.

Atlanta, Birmingham & Atlantic.—J. J. Campion has been appointed General Freight and Passenger Agent, succeeding H. C. McFadden, resigned.

Chicago & Eastern Illinois.—W. E. Hughes, commercial agent at Milwaukee, has been appointed General Agent at Milwaukee, succeeding T. O. Jennings, promoted.

Erie.—C. W. Colby has been appointed General Agent at San Francisco, Cal., succeeding A. C. Hilton, transferred.

Nashville, Chattanooga & St. Louis.—J. W. Steadwell has been appointed Assistant General Freight Agent, succeeding Edward T. Eckles, resigned to go to the Atlanta & West Point.

National of Mexico.—E. A. White, Assistant General Freight Agent, has resigned.

Northwestern Pacific.—J. J. Gerry has been appointed Acting General Freight and Passenger Agent, succeeding to the duties of R. X. Ryan, deceased.

Engineering and Rolling Stock Officers.

Chicago, Rock Island & Gulf.—F. W. Williams, formerly Master Mechanic of the Delaware, Lackawanna & Western at East Buffalo, N. Y., has been appointed Superintendent of Motive Power of the Chicago, Rock Island & Gulf.

Fort Worth & Denver City.—George Siemantel has been appointed General Master Mechanic, with office at Childress, Tex.

Maine Central.—H. C. Manchester has been appointed Assistant Superintendent of Motive Power, with office at Portland, Me.

Mexican Central.—C. P. Webber has been appointed Assistant Chief Engineer.

Missouri Pacific.—L. J. Miller has been appointed Master Mechanic at Atchison, Kan.

LOCOMOTIVE BUILDING.

The Southern, it is reported, has placed an order for locomotives.

The McCloud River has ordered two locomotives from the Baldwin Locomotive Works.

The Tamasopo Company has ordered one locomotive from the Baldwin Locomotive Works.

The United States Government has ordered one locomotive from the Baldwin Locomotive Works.

Swift & Company, Chicago, has ordered one locomotive from the American Locomotive Company.

The Vissalia Electric Railway has ordered one locomotive from the Baldwin Locomotive Works.

The Aberdeen & Rock Fish has ordered some locomotives from Joseph E. Bowen, of Norfolk, Va.

The Atlantic & Western has ordered some locomotives from Joseph E. Bowen, of Norfolk, Va.

The Elgin, Joliet & Eastern is in the market for eight consolidation and 12 switching locomotives.

The Keokee Coal & Coke Company has ordered one locomotive from the Baldwin Locomotive Works.

The Hines Brothers Lumber Company has ordered one locomotive from the Baldwin Locomotive Works.

The Carbon Steel Company, St. Louis, has ordered one locomotive from the Baldwin Locomotive Works.

The International Harvester Company, Chicago, has ordered one locomotive from the Baldwin Locomotive Works.

The Buffalo, Rochester & Pittsburg, it is said, has ordered 20 locomotives from the American Locomotive Company.

The Cleveland, Cincinnati, Chicago & St. Louis, it is understood, has ordered two decapod locomotives from the American Locomotive Company.

The Japanese Government has ordered through Frazar & Sale, 63 Wall street, New York, six locomotives from the Baldwin Locomotive Works.

The Carnegie Steel Company, Pittsburg, as reported in the *Railroad Gazette* of February 15, has ordered two locomotives from the Baldwin Locomotive Works.

The Atchison, Topeka & Santa Fe, as reported in our advance sheet of April 20, has ordered 31 compound Prairie (2-6-2) locomotives and seven Pacific (4-6-2) locomotives from the Baldwin Locomotive Works. The Prairie locomotives are for July delivery, and the specifications are as follows:

General Dimensions.

Type of locomotive	Prairie.
Weight, total	248,200 lbs.
Weight on drivers	174,700 lbs.
Diameter of drivers	69 in.
Cylinders	18 and 30 in. x 32 in.
Boiler, type	Wagon top; steel
" working steam pressure	225 lbs.
" number of tubes	342
" maker of tubes	Tyler Tube Co.
" diameter of tubes	2¼ in.
" length of tubes	18 ft. 10⅜ in.
Firebox, length	108 "
" width	71¾ "
" material	Lukens basic steel
" grate area	53.7 sq. ft.
Heating surface, total	4,029 "
Tank capacity	9,000 gals.
Coal capacity	14 tons

Special Equipment.

Air brakes	Westinghouse
Axles	Cambria Steel Co.
Bell ringer	Gollmar
Boiler lagging	Magnesia
Brake-beams	National Hollow
Brake-shoes	Am. Brake-Shoe & Foundry Co.
Couplers	Tower
Headlights	Pyle National Electric Headlight Co.
Injector	Ohio
Journal bearings	Hewitt
Piston rod packings	United States
Valve rod packings	United States
Safety valve	Crane Co.
Sanding devices	American Locomotive Sander Co.
Sight-feed lubricators	Chicago
Springs	Simplex Railway Appliance Co.
Steam gages	American
Tires, driving wheel	Standard
" truck wheel	Standard
" tender wheel	Standard
Wheel centers	Standard

The design of the Pacific locomotives has not yet been definitely decided.

The Chicago, Lake Shore & Eastern, as reported in our advance sheet of April 17, is in the market for eight simple consolidation (2-8-0) locomotives and 12 simple six-wheel switching (0-6-0) locomotives. The specifications are as follows:

General Dimensions.

	Consolidation.	Switching.
Types of locomotives	Consolidation.	Switching.
Weight, total	188,000 lbs.	130,000 lbs.
Weight on drivers	169,000 lbs.	.....
Diameter of drivers	51 in.	
Cylinders	22 in. x 28 in.	19 in. x 26 in.
Boiler, wrkg. stm. press.	200 lbs.	.....
" number of tubes	372	270
" material of tubes	National Tube Co.	
Firebox, length	96 in.	
Firebox, width	72 in.	33½ in.

Special Equipment.

Air brakes	Westinghouse
Injector	Simplex and Ohio
Sight feed lubricators	Nathan
Tires—driving wheel	Standard

The Texas Central, as reported in our advance sheet of April 13, has ordered four simple consolidation (2-8-0) locomotives from the American Locomotive Co., for September or October delivery. The specifications are as follows:

General Dimensions.

Type of locomotive	Consolidation
Weight, total	135,000 lbs.
Weight on drivers	120,000 lbs.
Diameter of drivers	51 in.
Cylinders	19 in. x 26 in.
Boiler, working steam pressure	180 lbs.
" number of tubes	275
" diameter of tubes	2 in.
" length of tubes	12 ft. 6 in.
Firebox, length	104 in.
Firebox, width	43 in.
Tank capacity	4,500 gals.
Coal capacity	9 tons

Special Equipment.

Air brakes	Westinghouse

CAR BUILDING.

Swift & Co., Chicago, are in the market for 400 produce cars.

The Boston & Albany will build 20 cabooses at its own shops.

The Ashland & Western, it is said, will soon be in the market for 24 box cars.

The St. Louis Southwestern will build 450 flat cars at its Pine Bluff, Ark., shops.

The Guayaquil & Quito has ordered 21 passenger coaches from the American Car & Foundry Co.

The Pacific & Idaho Northern has ordered one passenger coach from the American Car & Foundry Co.

The Illinois Central is having 500 dump cars built at the Memphis shops of the American Car & Foundry Co.

The Illinois Traction System, Champaign, Ill., has ordered two electric cars from the Niles Car & Manufacturing Co.

The Interstate has ordered six additional hopper and five box cars, both of 80,000 lbs. capacity, from the Ryan Car Company.

The United States Steel Corporation, it is understood, has ordered 200 steel box cars from the Pressed Steel Car Company.

The Louisville & Nashville will build at its South Louisville shops seven passenger, three vestibule, three baggage and mail and one baggage car.

The Colorado Southern, New Orleans & Pacific has ordered 12 passenger, four baggage and four combination baggage and mail cars from the Pullman Co.

The Chicago, Rock Island & Pacific has ordered 103 box cars from the Ryan Car Co., instead of from the American Car & Foundry Co., as reported in the *Railroad Gazette* of April 19.

The Mexico, Oaxaca & Yucatan Railway, 10 Wall street, is about to draw up specifications for from 4,000 to 5,000 flat, box, fruit, gondola and stock cars of 40 tons capacity, and also for 40 passenger coaches.

The Tampa Northern has ordered three coaches and two combination cars from the Hicks Locomotive & Car Works, and is in the market for 100 flat cars of 80,000 lbs. capacity and 100 box cars of 60,000 lbs. capacity.

Milliken Brothers, Inc., Bowling Green Building, New York, have ordered twenty 50-ton steel flat cars from the Middletown Car Works. The cars are for use in the new Staten Island iron and steel plant operated by Milliken Brothers.

The Chicago, Lake Shore & South Bend, as reported in the *Railroad Gazette* of February 8, has ordered 24 heavy interurban coaches from the Niles Car & Manufacturing Co., for delivery to begin this fall. These cars will be 57 ft. long and 10 ft. wide.

The South Manchuria has placed an additional contract with the American Car & Foundry Company for 1,000 30-ton freight car trucks, which are to be shipped to Dalny, the seaboard terminus of the system, where the car bodies will be built. The contract, which calls for May to September deliveries, was closed through the Japanese contracting firm of Okura & Co., Bowling Green Building, New York.

RAILROAD STRUCTURES.

Galveston, Tex.—A bill has been passed by the Texas Legislature to permit the County of Galveston to build a causeway over Galveston bay to connect that city and the island with the mainland. The bill authorizes the lease of the structure to the railroads.

Ilwaco, Wash.—A contract is reported let by the Ilwaco Railway & Navigation Company to the Portland Bridge Company for 2,500 ft. of trestle, a dock 300 ft. long at Cook's Landing and several small bridges on the line of the I. R. & N. extension. The bridges are to cost $45,000.

New York, N. Y.—Bids for the temporary terminal of the Brooklyn bridge in the Borough of Manhattan, which was recently opened, were as follows: W. H. Gray Co., $84,560; Snare & Triest Co., $95,800; Cooper & Evans Co., $104,410, and the Charles Meads Co., $114,100.

San Francisco, Cal.—The Western Pacific, it is said, has decided to immediately commence the construction of its terminal along the north training wall of the Oakland estuary. The work will involve the filling of a mole 1,000 ft. wide and between 4,000 and 5,000 ft. long. The construction of the mole, together with the erection of a passenger station and slip approaches at its western end, will take about 17 months to finish, and will cost about $2,500,000.

Waterville, Ohio.—According to reports, a contract has been given by the Lima & Toledo Traction Company, and work is to be started at once on a reinforced concrete bridge, 1,400 ft. long, over the Maumee river, south of this place. The Lima & Toledo Traction is building a line into Toledo, and on completion of the bridge will be ready to open its line between Toledo and Lima.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Abitibi & Hudson Bay.—A bill to incorporate this company, promoted by Ottawa capitalists, has been reported by the Railway Committee of Parliament and passed. The bill provides for a line from a point on the National Transcontinental (Grand Trunk Pacific) East division between Frederick House river and Abitibi lake, Ont., to a point on James Bay and East Main river, about 200 miles. The capital of the company is to be $2,000,000. The provincial directors include: T. G. Brigham and H. Fisher, of Ottawa, and John Aylen, of North Bay.

Arkansas, Louisiana & Gulf.—Contracts, it is said, are about to be let for building this proposed line from Pine Bluff, Ark., south to Monroe, La., 150 miles. (March 15, p. 379.)

Asheville & Henderson.—This company, which was recently incorporated in North Carolina, is making surveys for its proposed line from Asheville to a point in Henderson County, about 20 miles. C. E. Van Bibber, 60 Wall street, New York, is Chief Engineer. (April 5, p. 499.)

Atchison, Topeka & Santa Fe.—The Southern Kansas has been granted authority by the Texas Legislature to abandon that part of its line, which now runs southwest from Panhandle, Tex., to Washburn, 25 miles, and to build a direct line from Panhandle to Amarillo, west of Washburn.

Atchison, Topeka & Santa Fe.—The Barnwell & Searchlight branch from Barnwell, Cal., on the California Eastern branch to the mining town of Searchlight, Nev., 23 miles, has been opened for traffic.

Barnwell & Searchlight.—See Atchison, Topeka & Santa Fe.

Baton Rouge, Hammond & Eastern.—Contracts, it is reported, are to be let next month for building this proposed line from Baton Rouge, La., east about 170 miles. (March 15, p. 380.)

Brazos Valley, Brenham & Gulf.—Incorporated in Texas with a capital of $1,000,000 to build from Brenham, Texas, to Waco, 131 miles. The general offices are at Brenham. The incorporators are: John H. Baker, of Topeka, Kan.; F. W. McGuire, of Dallas; R. E. Pennington, D. E. Teague, W. E. Reichardt, E. G. Langhammer, Robert Striekert, D. C. Giddings, T. C. Giddings, T. A. Low, F. W. Wood, Arthur Wangemann, O. A. Seward, H. F. Hohlt, C. W. Winklemann and Frank Brown, Jr., all of Brenham.

Canadian Pacific.—This company, it is reported, will soon improve its line between Toronto Junction and Bolton Junction, 23

miles. The work includes straightening the line and reducing the grades. The present light rails will be replaced with heavier sections. The cost of the work is to be about $175,000.

Carlyle & St. Louis.—See East St. Louis & Suburban.

Cleveland, Brooklyn & Elyria (Electric).—This company, which was recently formed in Ohio, with J. J. Breitinger as President and J. H. Kniseley as Secretary, both of Cleveland, is back of the projected Orrville, Doylestown & Barberton, which is designed to form part of an electric line from Cleveland, via Barberton and Orrville to Columbus. The C., B. & E. claims to have an entrance into Cleveland, and is to have a line south from Strongsville through West Ritchfield, to a connection with O., D. & B. at Barberton.

Cleveland, Cincinnati, Chicago & St. Louis.—The Saline Valley has been incorporated in Illinois to build a line from Harrisburg, in Saline County, Ill., west to Marion, in Williamson County, about 20 miles. The incorporators include: C. E. Schaff and S. W. McCune, of Chicago; J. J. Parris, of Harrisburg, Ill., and W. C. Brown, of New York.

Colorado & Southern.—The extension of the Trinity & Brazos Valley, from Teague, Tex., north to Waxahachie, 67 miles, has been finished. (March 15, p. 382.)

Colorado, Texas & Mexico.—Work has been started on this line from Mangum, Okla., towards the Red river. President M. R. Locke is quoted as saying that the proposed line is to be finished to Chilicothe, 46 miles, about October 1. The line is projected to Abilene, Tex., 269 miles. About 14 miles is already built. (March 15, p. 382.)

Copper River & Northwestern.—This road is under construction from the tidewater terminal at Katalla, Alaska, through the Copper River valley to the interior of Alaska, about 500 miles. A breakwater about one mile long will be built at Katalla. This road is one of the J. P. Morgan and Guggenheim interests in Alaska, and will be built by the Katalla Company, M. K. Rogers, President and General Manager, Seattle, Wash.; John Krey, Chief Engineer, Katalla, Alaska. Contracts for the whole or any part of this work will be let immediately. (March 15, p. 382.)

Dayton, Lebanon & Cincinnati.—Announcement is made that this road, which was recently sold under foreclosure to F. P. Tillatson, Trustee for the stockholders, is to be extended from Lebanon Junction, Ohio, the present terminus, west four miles to the union station at Dayton.

Denver & Rio Grande.—An officer writes that there is no truth in the report that this company is making surveys for a line from Farmington, N. Mex., south to Gallup.

Duluth & Northern Minnesota.—Work, it is reported, is under way on an extension of this road from Schaff Lake, Minn., to Cross river, 40 miles. Surveys are reported being made for a further extension of 40 miles to Gunn Flint lake, the work to be done by the company's men.

East St. Louis & Suburban.—The Carlyle & St. Louis has been incorporated in Illinois to build an extension of this road from Lebanon east to Carlyle in Clinton County, 25 miles. The completed line will parallel the Baltimore & Ohio Southwestern from East St. Louis to Carlyle. The incorporators include: T. E. Ford, of Carlyle; J. C. Eisenmayer, of Trenton; B. H. Hiemann, of Aviston; J. C. Kluthe and H. Humert, of Breese. The office of the company is to be at Carlyle.

Erie.—Authority has been granted by the New York State Railroad Commission to build, under the name of the Suffern Railroad, a line one mile long, through Suffern to the state line.

Galveston & Houston (Electric).—Incorporated in Texas, with $3,000,000 capital to build an electric line from Galveston, Tex., north to Houston. The route has been located, and construction work is soon to be started. Stone & Webster, of Boston, Mass., who are interested in the street railways of Galveston, Houston and other Texas cities, are said to be the largest stockholders of the company.

Greensboro, Seaboard & Great Western.—Incorporated in North Carolina to build from Sanford, N. C., northwest via Greensboro to Walkertown, 80 miles. C. A. Bray, of Greensboro, is interested.

Hamilton & Northern.—See St. Louis & San Francisco.

Hidalgo & North-Eastern.—See National of Mexico.

Lake Champlain & Lake Placid Traction.—Incorporated in New York, with $1,500,000 capital and with office at Ausable Forks, to build an electric line from Westport west to Lake Placid; also north to Ausable Forks, about 50 miles. The directors include: A. L. Washburn, W. T. Halliday, E. S. Goodrich, N. C. Spencer and H. F. Smith, of Hartford, Conn.; W. L. Kiley, G. S. Haley and T. D. Trumbull, of Glens Falls, N. Y., and R. L. Trumbull, of Ausable Forks.

Manufacturers' Railway.—According to local reports, this local St. Louis railroad, controlled by A. Busch and associates, will soon increase its capital stock from $450,000 to $10,000,000, to make improvements to include an elevated structure from Second and Arsenal streets, to Dorcas street, St. Louis, and a tunnel from that point under the Mississippi river, to East St. Louis. A line is also projected from St. Louis, west to Springfield, Mo., about 240 miles. Surveys for the proposed line are to be made shortly.

Mexican Central.—See National of Mexico.

Mexican Roads.—A concession has been granted to Senator Jose Castellot for a railroad from Del Rio, on the Toluca & Morelia division of the National Railway, to the Hacienda de la Compania, San Jose Malacatepec, and the Hacienda de San Bartolo, and thence in the direction of Zitacuaro to the limits of the state of Mexico.

Midland Valley.—Plans are under consideration for building an extension of this road from Jenks, Ind. T., west by Sapulpa to Cushing, Okla., on the A., T. & S. F., about 52 miles.

Missouri Pacific.—An officer writes regarding the report that this company is to build a cut-off from Memphis, Tenn., southwest to Marianna, Ark., that although the company has for a long time had the right of way between these points, there is no present intention to build. (April 12, p. 531.)

Missouri, Tennessee & Georgia.—This company, it is reported, will build from Caruthersville, Mo., southeast to Florence, Ala., 150 miles. I. H. Dugan, Humboldt, Tenn., is President.

Nashville Interurban.—This company has projected a line from Nashville, Tenn., southwest via Franklin, Spring Hill and Columbia to Mount Pleasant, 90 miles. H. H. Mayberry is President, and D. A. Proctor, Chief Engineer, Nashville, Tenn.

National of Mexico.—Surveys are being made, and it is announced that the Government has adopted plans for immediate building of the proposed extension of the Hidalgo & North-Eastern from its northern terminus at Pachuca, east to Tuxpan. It was originally intended at the time this road was taken over by the Mexican Government, to extend it to Tampico, but it has since been decided to extend the Mexico City & Apulco division of the Mexican Central to Tampico.

New York Subways.—The Board of Rapid Transit Railroad Commissioners has let the contract for building the first section of the proposed subway loop, to connect the Williamsburg and Brooklyn bridges between Canal and Pearl streets, in the Borough of Manhattan, to the Degnon Contracting Co. at $2,952,000 for the tunnel and $83,000 additional for pipe galleries.

North Coast.—This company, it is said, has filed with the Washington state railroad commission a map showing the route of its proposed road, which indicates that it intends to build a branch from Tieton Pass to Portland, Ore. The main line is to run from Spokane, Wash., to Yakima, thence to Tieton Pass and northwest to Tacoma and Seattle, about 600 miles, with a branch from Kiona Junction to Walla Walla, Wash. Surveys made from Spokane to Randle, 320 miles, and grading under way from Kiona to Granger, 40 miles. Surveys under way from Randle to Portland and Seattle, and from Walla Walla to Kiona Junction, a total of 280 miles. (March 15, p. 388.)

Orrville, Doyleston & Barberton (Electric).—See Cleveland, Brooklyn & Elyria.

Pearl River Valley.—Contracts are reported let by this company to C. D. Smith, of Memphis, Tenn., and Birmingham, Ala., for building its proposed line from Jackson, Miss., northeast to Carthage, 50 miles. (April 19, p. 565.)

Peninsular.—Surveys, it is said, are being made for this proposed line from Tampa, Fla., east via Plant City, and Bartow, to a point on the Atlantic coast, about 125 miles. Rights of way secured, and contracts for the work shortly to be let. E. C. Stuart, Bartow, Fla., is President, and the W. H. Evers Engineering Company, Cleveland, O., Engineers.

Pennsylvania.—Grading has just been finished at Mexico, Pa., on the revision of alinement and improvement of grade between Port Royal and Van Dyke, and track is now being laid. In about two weeks the entire section is to be turned over to the operating department for service. This improvement on four and a half miles which formerly had but two tracks will now have four tracks, and is the last link to be finished in the four-tracking of the entire line between Altoona and Harrisburg, except the section between Mount Union and Ryde, where similar work is now well under way. An important feature of this work is the removal of an old 6 degree curve at Mexico, one of the sharpest and most troublesome curves on the line. By making a cut 100 ft. deep and 1,600 ft. long, re-

moving about 750,000 cu. yds. of earth, this curve will have been cut to 1 degree 50 minutes. This improvement was begun in January, 1906, and will be finished June 1. When this work and the Mount Union-Ryde improvement are finished the Pennsylvania will have a four track line from Philadelphia to Altoona, with the exception of a short stretch on the Conestoga Bridge, where there are two tracks. Six tracks have been laid between Gallitzin and Petersburg. Work is rapidly progressing in four-tracking the Pittsburg division.

Rocky Ridge.—Incorporated in Pennsylvania with $30,000 capital to build a line five miles long from Rocky Ridge, on the East Broad Top Railroad, to Evanston station in Huntingdon County. R. S. Seibert, of Orbisonia, is President. E. Roberts, of Philadelphia, and J. D. Dorris, of Huntingdon, are interested.

St. Louis & San Francisco.—The Hamilton & Northern has been incorporated in Texas to build a line from Stephensville, on the Fort Worth & Rio Grande division, south to Hamilton, 40 miles, and eventually from Hamilton to iron ore fields at Llano.

Saline Valley.—See Cleveland, Cincinnati, Chicago & St. Louis.

Suffern Railroad.—See Erie.

Susquehanna & New York.—This company has increased its capital stock to secure funds to build an extension on which work is now under way from a point between Crandalltown, Pa., and Short Run, southeast to a point near Newberry, where a connection is to be made with the Northern Central, about 20 miles. Edward Whalen is the contractor.

Temiskaming & Northern Ontario.—The Ontario Government, it is said, has decided to build the branch from Cobalt to Sudbury, and appropriated $12,000 for preliminary surveys. (March 29, p. 468.)

Tennessee & North Carolina.—This company, which operates a line from Newport, Tenn., south to Mt. Sterling, N. C., 21 miles, it is said, is planning to build an extension from Mt. Sterling southeast to Canton, 20 miles; also from the northern end, west to Knoxville, Tenn., 50 miles.

Texas State.—The State Penitentiary Board has been authorized to borrow $150,000 from the State, to extend the short railroad now owned by the State. The road is to be extended from its eastern terminus at Rusk east to a connection with the Texas and New Orleans, and from its western end to a connection with the International & Great Northern. The line, when these improvements are made, will have a total length of about 38 miles. (March 22, p. 428.)

Toledo & Indiana (Electric).—This company is planning to build an extension of its line from Bryan, Ohio, to Waterloo, Ind., in connection with the proposed St. Joe Valley, projected from Butler, Ind., to Robinson Park, 10 miles north of Fort Wayne.

Wolcottville & Coldwater.—Surveys are reported being made for this proposed road from Wolcottville, Ind., northeast to Coldwater, Mich., 35 miles. The office of the company is at Wolcottville. O. G. Wales, President, Chicago, Ill.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—See Southern Pacific.

Buffalo, Rochester & Pittsburg.—It is stated that this company sold $1,000,000 one-year, 6 per cent. notes in March of this year. Part of the proposed $35,000,000 consolidated mortgage bond issue will be used to meet these notes. (April 12, p 532.)

Chicago Southern.—A syndicate is being formed to raise money to finish building this road to Chicago. It is projected from Quaker Hill, Ind., the western terminus of the Southern Indiana, owned by the same interests, to Chicago Heights, Ill., 40 miles, of which 22 miles are built and most of the rest graded. It is to enter Chicago over the Chicago Terminal Transfer.

Dayton, Lebanon & Cincinnati (Electric).—The property of this company has been sold under foreclosure for $200,000 to F. G. Tillatson, Trustee for the bondholders. The road runs from Lebanon, Ohio, to Lebanon Junction, about four miles east of Dayton, and it is expected that the road will now be completed into Dayton. The road has been in the hands of a receiver for some time. Under the reorganization plan a new company is to be formed with $1,000,000 stock and $300,000 first mortgage, 20-year, 5 per cent. bonds.

Delaware & Eastern.—A syndicate under the management of Searing & Co., New York, is being formed to finance the reorganization of this company. The Delaware & Eastern is in operation from East Branch, N. Y., to Arkville, 37 miles, and it is proposed to consolidate with it the Schenectady & Margaretville, which is a proposed extension from Arkville north to Schenectady, and the Hancock & East Branch, which was incorporated to extend the Delaware & Eastern from East Branch to Hancock on the Erie. When completed the line will be 154 miles long, and will compete with the New York, Ontario & Western and the Delaware & Hudson in carrying anthracite from Pennsylvania to New England points. The reorganized company is to have $10,000,000 authorized capital stock, of which $5,000,000 is to be issued at once, and $20,000,000 50-year, 5 per cent. bonds, of which $6,000,000 will be issued at once to pay for construction and to retire old bonds. The holders of the present $1,000,000 bonds of the Delaware & Eastern are asked to exchange their holdings at the rate of $1,000 in bonds of the old company for $1,050 in bonds and $250 in stock of the new company. The old capital stock is to be exchanged for bonds of the new company at the rate of $50 per share.

Grand Rapids & Indiana.—See Traverse City, Leelanau & Manistique.

Long Island.—The President of this company is quoted as follows:

> "If all goes well, the tunnels under the East river, the station of the Pennsylvania Railroad in Manhattan and a large part of the improvements of our own system should be completed and in operation during the year 1909. When the great tunnels and terminal improvements shall have been completed, those who live on Long Island will be able to save more than 30 minutes a day between any point on Long Island and Herald Square, and as much as 40 minutes a day between points on the Island and Wall street, via Flatbush avenue, Brooklyn, and the Battery subway. The population in the various boroughs of New York City, as compared with Long Island, I believe would reveal something like the following: Manhattan, 160 persons to the acre; Brooklyn, 42; Bronx, 15; Queens, 4; Richmond, 2; Nassau, 0.5; Suffolk, 0.2. We estimate that in ten years there will be 15 persons to the acre in Queens, one to the acre in Nassau, and about 1 to each three acres in Suffolk. At this ratio of increase, the population in round numbers at the end of the 10-year period will have increased in Queens from 230,000 to 1,000,000, in Nassau from 75,000 to 100,000, and in Suffolk from 80,000 to 120,000."

New York Central Lines.—It is reported that an issue of equipment trust notes is about to be made. Heretofore equipment has been paid for out of the proceeds of stock or bond issues. It is understood that part of the $50,000,000 three-year notes issued in January by the New York Central & Hudson River, the Michigan Central and the Lake Shore were to be used to pay for new equipment, but the amount so appropriated does not cover all the equipment ordered.

Phoenix & Eastern.—See Southern Pacific.

Richmond-Washington Company.—Lee Higginson & Co., Boston, and Henry & West, Philadelphia, are offering for sale $1,000,000 collateral trust 4 per cent. bonds of 1943 recently sold to them, making the total amount outstanding $9,500,000. The company is a holding company for the Richmond, Fredericksburg & Potomac and the Washington Southern through which it controls the line from Washington to Richmond. Its capital stock is jointly owned by the Pennsylvania, the Baltimore & Ohio, the Chesapeake & Ohio, the Southern, the Atlantic Coast Line and the Seaboard Air Line, all of which guarantee the above bonds.

Southern Indiana.—See Chicago Southern.

Southern Pacific.—Epes Randolph, President of the Gila Valley, Globe & Northern, who represents the Southern Pacific interests in Arizona, is reported to have announced at Phoenix that the Southern Pacific has become a joint owner with the Atchison, Topeka & Santa Fe of the Phoenix & Eastern, which runs from Phoenix east to Dudleyville, 106 miles. The Phoenix & Eastern is now operated as part of the Santa Fe, Prescott & Phoenix. About 10 miles east of Dudleyville, the route of a projected extension eastward runs through the Box canyon of the Gila river, where there is location for only one line. The right of way through the canyon has been under litigation between the two companies for some time, the last decision having been in favor of the Santa Fe. By extending the line east about 25 miles along the Gila river, connection could be made with the Gila Valley, Globe & Northern. When this has been done the road is to be operated by the Santa Fe and the Southern Pacific jointly.

Toledo Railway & Terminal.—This property is to be sold under foreclosure on May 28. The minimum selling price, it is understood, is $2,000,000. (April 12, p. 532.)

Traverse City, Leelanau & Manistique.—The property of this company, which runs from Traverse City, Mich., to Northport, 30 miles, has been sold under foreclosure to the Union Trust Company, Detroit, which was the receiver of the company. The foreclosure suit was begun a year ago, and it was then intended that the road be operated by the Grand Rapids & Indiana under lease.

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EDITORIAL ANNOUNCEMENTS.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns OUR OWN opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:

Progress Toward a Freight Car Pool 601
Imaginary Difficulties with Night Signals 601
Pogue Overtures from Texas 602
A New England Railroad Situation 602
Locomotive Performance Data Developed at Purdue. 603
New York Central & Hudson River 604
New Publications 605

ILLUSTRATED:

Electric Locking 610
Track Deformations and Their Prevention 618
Increased Commodity Costs 623
Combination Parlor, Sleeping and Dining Cars for the Canadian Northern. 625

CONTRIBUTIONS:

Superelevation 605
Continuous Rails for Uniform Track Structure 606

MISCELLANEOUS:

Higher Pay in Prussia 606
Pennsylvania Report on Motor Cars . . . 606
The Railroad Commission of New Jersey 608
New Railroad Laws in Indiana 609
Value of Grade Reductions. 614
American Railway Association 615
Freight Handling at Port of New York. 617
Wisconsin Railroad Commissioners Report 622
Foreign Railroad Notes 624
New Bavarian Organization 624

GENERAL NEWS SECTION:

Notes 625
Trade Catalogues 628
Obituary 628
Meetings and Announcements 629
Elections and Appointments 629
Locomotive Building 630
Car Building 630
Railroad Structures 631
Railroad Construction 631
Railroad Corporation News. 632

VOL. XLII., No. 18. FRIDAY, MAY 3, 1907.

The American Railway Association is in favor of making a strong effort (which will involve the expenditure of much time and money) to bring about the general pooling of freight cars, as a remedy for the widespread misuse of cars. This much seems certain: though the railroad officers who, believing the thing possible, have carried this vote, also recognize, as does every careful student of the subject, that unknown difficulties may impose unending delays. Hence the adoption of a penalty for diversion as a temporary relief. Even this partial measure of relief is slow—not to be put in effect for five months—indicating what a tremendous problem is being dealt with. The hardest thing in connection with a pool is to find the big, impartial man—the Albert Fink—to administer it. Somebody, either with or without a velvet glove, must exercise the iron hand very often. As an experiment in this line the Association has voted that the chairman of the Car Service Committee is a suitable person to fill that kind of a position—a well-merited compliment to Mr. Hale. The only test of a man's ability to successfully do arbitrary things is actual trial, and in the proposed diversion rule we shall have such a trial. Mr. Carnegie's beautiful essay on the essentials of natural justice leaves his readers sad and unsatisfied, because he gives them no light on how to find the most essential element of a court of justice—a judge. The railroads have recognized and avoided that rock. The most diverting feature of the diversion rule is that under which a road which is in hard luck will be dealt with tenderly. This is tempering Justice with Mercy—with a big M. The fact that the St. Louis & San Pedro has stolen some of your cars will excuse you for stealing some from the Cape Cod & Baltimore Air Line. However, it is a condition of the business world and not a theory of the halls of justice that now has to be dealt with, and the 95 per cent. provision is not to be criticized. Rather, it may prove the one relief valve that makes the machine workable. Moreover, an arbitrator who finds himself unable to do justice is always at liberty to denounce injustice by publishing the reason for his inability.

For a scholarly, accurate, detailed and interesting account of the dangers of color blindness and some other defects of the human vision, the reader in search of a few minutes' entertainment could not do better than turn to the article on "Railway Disasters at Night," by a professor in Johns Hopkins University, published in the *Century Magazine* for May. But the article tells nothing about railroad disasters, either by night or by day, and there is no hint that the discussion is 15 or 20 years behind the time. The author's one point, that illuminated semaphores should be used for railroad signals, so as to have shape instead of color, by night as well as by day, is put forth simply as an academic proposition, with no reference to practical working conditions. It is astonishing that a conservative popular magazine should print such an inconclusive and wholly theoretical study. One would almost conclude that the writer of the article was born in a psychological laboratory (not Dr. Scripture's, however), and had never been out of it; but the practical side of the question is so completely ignored that it seems a more reasonable supposition that he knows of the hard realities, and omits mention of them—as the colored preacher omitted mention of chicken stealing—because it would throw a coldness over the spirit of his audience. The editor of the *Century* should have told his readers that the railroads have long since done away with the dangers of color-blindness, by taking color-blind men off from their engines; that illuminated blades for semaphore signals have been tried persistently and have been found ineffective from a scientific standpoint, as well as useless practically (because, with the danger from color-blindness removed, colors [red and green] are simpler and more satisfactory); that night shape signals were used in all the semaphores of the Boston & Albany for 15 years, and yet were finally rejected as no better than color signals; that records of actual disasters from color-blindness or the other visual dangers mentioned are as hard to find as hen's teeth, though the question has been a live one for 30 years; and that the mazes of lights to be seen from the cabs of fast express engines in city yards at night, which are held up as the greatest danger of all, have been scaring *passengers* in locomotive cabs—even railroad superintendents—for the past forty years, and yet have worried the enginemen themselves only in exceptional cases. Enginemen have made blunders of many kinds, but blunders due to confusion of lights are of the rarest. In other words the arrangement of the signal lights in our great yards is in fact simple though seemingly it is confused. The really valuable feature of this magazine article is in its second paragraph: the declaration that "the perils of travel spring from something

more central than signal posts or wires or colored lights; there can be no substitute for earnest and intelligent good will." With every manager, superintendent and locomotive runner exercising this quality, railroading will be safe even with "clumsy appliances and outworn aids." Intelligence and conscience in every cab would make many of our signal refinements unnecessary.

Railroad Commissioner L. J. Storey, of Texas, recently addressed a convention of lumbermen in a tone so fair and reasonable that it must have given fresh courage to the much legislated against railroads of that state. Commissioner Storey said that the principal problem nowadays was to determine how best to secure more and better railroads and better service with less friction between shipper and carrier, on just and equal terms, without discrimination for or against any person, place or thing. He said further that this increase of railroad mileage and this better service and increase of facilities could not be secured by an unwarranted and radical reduction, as demanded by the demagogue as he goes forth every two years in search of votes, denouncing the railroad commission as a failure and as a servant of the corporations. We are frank to confess that we had not heretofore heard the Texas Railroad Commission described as a servant of the corporations, and we feel that there must have been a change somewhere; perhaps it has been occasioned by the Texas commission being constant, while a wave of legislative radicalism has swept past and over it to a new high-water level. At all events, Commissioner Storey cannot be placed among those who legislate for votes and for revenge, for he is flat against the proposed two-cent passenger bill, and he said that a majority of his commission had voted it down because they believed the time had not come when all the roads could stand such a reduction of their revenues. We venture to say that this is not precisely the test which the western and southern legislatures have been applying. Commissioner Storey shows that all the roads in Texas had a balance, after payments for the 1906 fiscal year, of $1,122,504, and that a two-cent passenger law would have changed this to a deficit of $3,283,447. One may be permitted to wonder whether the Texas legislature and the other state legislatures that are trying to get more work out of a horse by reducing its feed, are interested in calculations of this kind. Whether they are or not, the Texas commissioner's speech at least points a moral that may be a comfort to those viewing newly created state commissions with alarm, and that is that it may be accepted as the maxim that commission legislation, year in and year out, is going to be less radical than direct legislation, and that the sooner the state legislatures leave such topics as two-cent passenger bills, restriction of capitalization, and reciprocal demurrage to their commissions, the better it will be for all concerned. The wisdom of a legislative body is pretty sure to vary inversely as its size, and a railroad commission is much smaller than a state legislature.

A NEW ENGLAND RAILROAD SITUATION

While great and stirring events in the general railroad situation in this country have been absorbing the interest both of the public and of railroad managers, and while civic and economic policies in their bearings on corporations have been thrust forward prominently, there has been developing a situation in New England worth more than passing notice. In some remote aspects it is related to state polity. But it concerns more immediately the interests of the affected railroad corporations themselves.

Previous to a date that may be roughly fixed at a quarter of a century ago the railroads of the six New England states were substantially independent corporations. There had been mergers of certain lines whose operation and interests were almost identical and, in some cases, those mergers affected a considerable volume of traffic. Nevertheless the New England railroad system as a whole was made up of segregated units representing all railroad types—short roads, through roads, rival roads and not a few roads in large industrial valleys doing a profitable local business. The first long step in consolidation came with the Boston & Maine absorptions of the later eighties and early nineties merging under centralized control the large properties north of Boston and stretching over Maine and New Hampshire. Next the vaulting ambitions of President McLeod led to antagonism with the New Haven, to the conflict for control of the Connecticut River road, and to the events which forced the New Haven to take in the Stonington and Old Colony systems right away. There followed what was dubbed at the time "The Partition of Poland," by which, under agreement, tacit or formal, northern New England went to the Boston & Maine, southern New England to the New Haven, with the conservative and unassertive—not to say old fogy—Boston & Albany as a kind of neutral line of boundary posts between.

Thus there was created a kind of triple alliance, a balance of railroad powers and pacific conditions not much disturbed by events until a few years later. The Boston & Maine meanwhile contented itself with its Fitchburg and Massachusetts Central acquisitions. The New Haven's purchase of the Housatonic and New York & New England were merely defensive steps inside its own territory, and the Boston & Albany, while maintaining its regular prosperity, jogged along unaggressively and its transfer to the New York Central did not change its essential status. Such unity of interest was also in evidence as the joint occupancy of the Boston South Station by the Central and New Haven companies.

This balance of power condition, which promised to last long, has during the last three years suffered a rude change. While two of the parties have "stood pat," the third—the New Haven corporation incarnated in President Mellen—has gone ahead by leaps and bounds. Historically it has been like a swift campaign of Bonaparte against dilatory Austrian or Prussian. Pursuing the martial figure of speech, southern New England under Field Marshal Mellen is in arms while central and northern New England have not even equipped their reserves. The preliminary Mellen strategy has been picturesque as well as defensively prudential. It has included the Ontario & Western purchase to the coal fields and the great lakes, with potential western extension; the purchase of a vast electric railway system reaching into the territory of the other two old divisions of "Poland"; new terminal plans at New York City, modifying, if not menacing, the old terminal arrangements below Woodlawn; and now, at the last, an expansion of the marine branch from the sound to the ocean, reaching southward to half a dozen through railroad systems with an incidental "big stick" to club the Morse interests. Against this policy, primarily defensive but with large offensive powers, involving great outlay of funds, the only resistive measure has been the feeble effort of the New York Central to reach Boston from New York City by a cut-off through northwestern Connecticut—a plan that appears to have been thwarted by the obstructive change in the Connecticut general railroad law.

This campaign of tireless energy in southern New England as against inertness in the center and north, has had some other striking features. Theoretically nowadays it should have given legislative offense and roused public fear as extending and solidifying monopoly. Practically the effect seems to have been exactly the reverse. The two southern New England legislatures have been acquiescent, even concessive; and even the Massachusetts legislature and executive, last year severely critical of steam railroad ownership of trolleys, seem now to have paused while Boston appeals to "monopoly" to save it from Mr. Morse. On the other hand, in northern New England, New Hampshire is still in the convulsions of an anti-railroad movement and Vermont has enacted a set of new railroad statutes that makes most of the western anti-railroad legislation seem tame. In the submissive legislatures of southern New England there may be some restrictive law-making hereafter; but, if so, it will be aimed probably not at monopoly or extension but at matters relating to railroad finance and public supervision. Without much effort the assertive New Haven method has secured from the law-making authority all that it has asked, and, if it asks more, will get it.

But the main interest of the New England railroad situation is not so much in the forces external to it as in the situation itself and its contrasts. Within a region of the country thickly settled and of high industrial intensity three railroad systems, two of them large, are placed. Two of them have adopted policies comparatively inactive; the other has been and is, in the language of trade, a "hustler." It has reached out north, south, east and west, has grasped trolleys and steamboat lines, has pushed into rival territory, has expanded capital. Thus far its policy, whether viewed as one of aggression or self-protection, has prospered; but it has yet to be searched by antagonisms—one of which may, perhaps, be descried on the Morse horizon and by the sharper test of hard times. The history of American railroads has supplied somewhat similar cases of bold policies on the one hand and conservative policies on the other, with diverse results. We have had the slow Chicago & Alton policy which for many years was successful, and the radical Gowen policy on the Reading which for so many years failed. The result in such cases is apt to depend on the sagacity and skill of its original projector. But, as compared with other American examples, the New England situation is novel as trying

out the two policies in homogeneous railroad territory, at very close quarters and with their consequences hereafter to be depicted, so to speak, upon the same screen.

LOCOMOTIVE PERFORMANCE DATA DEVELOPED AT PURDUE.

It seems curious in the light of the recent experimental information that has been obtained regarding the action of the several parts of the locomotive, that the world should have waited for it so long. It is not so very long ago that the use even of the indicator upon the locomotive was rare or unknown, and our only means of testing, if it could be called testing, was to ride upon the engine and observe general results. This was followed by road tests that involved so many variables that the real object of the work was sometimes buried beneath a mass of uncertainties. So when it was proposed by Purdue University to build a laboratory plant upon which a full-sized locomotive could be tested under constant conditions it was received with the warmest acclaim by the railroad world and the greatest interest was at once manifested in the probability of obtaining valuable results. Whether the promoters of the scheme had a clear idea of what was to be the outcome, we are not informed, but if they had they must have been endowed with a most remarkable foresight.

The Purdue testing plant has given rise to others, and the results of the investigations that have been made have been so prolific of good that this method of testing has now come to be recognized as the only one upon which reliance can be placed, and the records of Purdue and St. Louis form the most valuable contributions to the literature of the locomotive extant. When it is remembered that in 1890, before the opening of the Purdue laboratory, we had no definite idea of how the draft of a locomotive was produced and that every engine driver was a law unto himself as to the adjustment of the smokebox details; that the action of the fire was almost unknown; the influence of tube length a mystery; the quality of steam supplied to the engine a pure guess, and the economical efficiency of the machine, as a whole, a matter upon which there was a general agreement to the wrong, namely, that it was extravagant in the use of coal and steam, we can see that much was to be learned, much more than was realized at the time.

Seventeen years of constant, painstaking effort has borne fruit a hundredfold, and we have learned so much that we are realizing more and more every day how much there still remains to be done. We have learned that there is a scientific method of adjusting diaphragm and petticoat pipe and stack and netting and front end proportions in order to secure maximum efficiency with a minimum of back pressure, and if this one thing were all that we had to show, it would fully repay for all the trouble and expense. To remove the smokebox from the realm of guesswork and settle definitely the relation of steam jet to entrained air, and size and diameter of stack was a great achievement and deserves all the praise that has been given it.

Then come the clear cut definite statements that have been made regarding the value of high steam pressures. In the early eighties, when 125 lbs. was the standard, it was felt that more would be better and tentative efforts were made that soon raised that standard to 140 lbs. Then as facilities for boiler construction were increased, the pressures advanced by leaps and bounds until now many engines have been built designed for 200 lbs., for use with simple expansion, but here the warning hand from Purdue has been raised and we are given an unmistakeable demonstration, admitting of no criticism, that we are too high and that 185 lbs. is the point at which steam pressure in a single-expansion engine reaches its point of maximum efficiency.

And how about the quality and consumption of that steam? We guessed that it was damp and that much water was entrained into the cylinders, and guessed wrongly, for we are now told definitely that though "the locomotive is often credited with carrying over a great deal of water to the cylinders, the tests show that this does not happen under constant conditions of running." Then comes the greatest surprise of all, in the fact that the engine is not only not wasteful but is exceedingly economical in the use of steam and that it is quite capable of developing a horse-power on less than 25 lbs. per hour, and that good average practice ranges in the neighborhood of 30 lbs. This is probably at least 25 per cent. lower than the average motive power man would have guessed before this scientific research was placed on record.

We learned many years ago that the boiler was the limiting factor in locomotive performance. Wheels of large diameter and cylinders of large capacity availed us nothing for the production of high speeds or great power unless we could get the steam with which to operate them. So we increased the sizes of our boilers and added to our heating surface and raised our pressures until we reached the limits of human endurance for the fireman, and also the clearance limit of permanent structures. Then the testing plant at Purdue came to the front and brought out certain points on boiler performance well worthy of attention. We were shown the intimate relationship existing between all of the elements of the boiler and the fuel, and how a change in any one affects the economical operation of the whole. As the draft rises so does the firebox and smokebox temperature, and with this the amount of fuel burned per hour; facts more or less well known, but we did not know just what this relationship was until these reports were published. We can now see how the rate of evaporation falls off as the intensity of the combustion increases, and we are thus able to form an approximate estimate of the values to be obtained from forcing, and their probable cost.

We have been taught, too, a really scientific method of handling the indicator and interpreting its records, and we are shown how a bad adjustment of piping may tell a falsehood under a guise of truth that is worse than misleading, and how many of the conclusions that have been drawn from indicator cards that looked all right may be misleading and not warranted by the actual conditions that exist within the cylinder. The conclusions reached from a study of the indicator work done in connection with the plant are that piping tends to retard the pencil action and that it should, therefore, be short and direct, and that this piping effect increases with the speed of the engine and inversely with the point of cut-off.

A great deal of valuable information has also been obtained regarding the proportions of valves and the effect of lap, lead, travel and inside clearance. In the days when the valve-setter shrouded his work in mystery lead was usually fixed by the arbitrary decision of some one in charge based upon an opinion that had more or less, usually less, of a foundation to rest upon; and inside clearance never existed except where some careless workman had planed out the D of the valve too much. As for the increasing lead that occurs with the shortening of the cut-off with the Stephenson gear, there were two opposing camps, with diametrically opposite opinions: one holding that the increase was good and an advantage and the other the reverse; each having very good reasons for its belief. Hence the careful analysis of these matters that we now have is welcome as a fair referee's decision of a disputed point. It appears that a reduction of lead effects a reduction in the back-pressure losses, but it also reduces the positive work under the steam and expansion lines; and, judging from the cards alone, it would appear to be a fair question whether any advantage had been gained by reducing the lead; but it must be remembered that a reduction in the size of a card does not necessarily constitute an argument against reduced lead. The advisability of the change is rather to be judged by the amount of steam consumed per unit of power. And then it is shown definitely and "conclusively, that the reduction in lead effects a reduction in the amount of steam consumed." This has led to a strengthening of the position of the Walschaert gear with its constant lead as a valuable improvement to the American locomotive.

As for inside clearance, the blowing-through effect, that was formerly feared, has been shown to be "insignificant as far as its effect upon the form of the card is concerned, even though the amount of clearance is as much as ⅜ in." while the reduction of compression and the freer passage that is given for the exhaust steam to escape to the atmosphere, lowers the back pressure, increases the area of the card and with it the mean effective pressure. This, however, does not mean that there is a saving in steam consumption, for it appears, as would be expected, that "inside clearance results in loss of efficiency at low speeds, but as the speed is increased, the difference in steam consumption for different amounts of inside clearance diminishes" until at high speeds of "50 miles an hour or thereabouts, we have the same steam consumption for all cases. For speeds above 50 miles an hour, the least steam consumption attends the use of the greatest amount of inside clearance, while the steam consumption for the valve having no inside clearance increases rapidly, with increase of speed beyond this limit." All this has been checked off and corroborated by engines in high speed service, upon which it has been found to be necessary to use a liberal amount of inside clearance in order to obtain the required speed and tractive power.

So it runs, through a wide gamut, in the performance of the

locomotive, and we find that the sum of our knowledge has been vastly increased since the first days of the Purdue plant, and the generalizations that have been drawn regarding the action and interaction of the several parts are having their influence along the whole line of American practice. It is quite true that the specific conditions that may have exercised great influence on the engine used for the greater portion of this work, may not exist in others of different types and weights, but this will not necessarily vitiate the results. So that the broad generalizations that have been put forth regarding boiler, cylinder and engine performances, with the resultant drawbar pull and the losses that occur between the indicated and the actual work of the locomotive can be accepted as very nearly accurate.

New York Central & Hudson River.

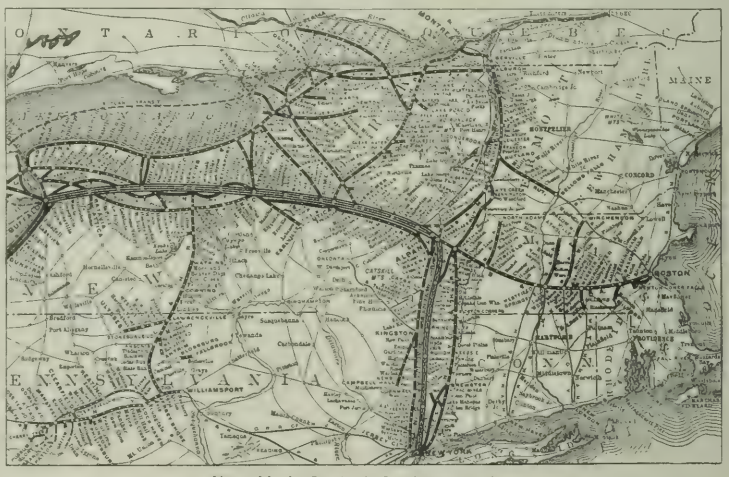
The year 1906 will always stand out in the long history of the New York Central, as the year of the beginning of electric operation. On September 30 the first train operated by electricity ran into the Grand Central station. This was a trial trip, but on December 11 regular service with motor cars of the Yonkers local trains was begun between the Lexington avenue temporary terminal and the present terminal of electric operation on the Hudson division at High Bridge, being hauled thence by steam locomotive to Yonkers. At the same time switching by electric locomotives in the new depressed Lexington avenue yard was begun. Since the close of the year, with the exception of the New Haven trains, almost all trains running in and out of the Grand Central station have been changed over to electric operation either with motor cars or electric locomotives. The use of electric locomotives on the Harlem division began disastrously with the wreck of the Brewster local express on the evening of February 16, but the working of the electrified lines has been, with this exception, satisfactory, and has already caused a great saving in switching movements over the line as far north as Mott Haven Junction and, at the same time, improved the atmosphere in the Park avenue tunnel, which begins to give a hint of what it should be under complete electric operation. It is expected that operation of all regular trains by electricity between the temporary electric terminals at High Bridge and Wakefield will be shortly accomplished. For some months longer, however, it may be expected that the New Haven trains will be operated in and out of the Grand Central station with steam locomotives.

Of the work on the new and improved Grand Central station about one-third is finished. The great task of entirely rebuilding the terminal and station, which involves placing the express tracks on the level of the present depressed Lexington avenue yard and the local tracks on a still lower level, is being done in three sections; the first including the Lexington avenue temporary terminal and depressed yard; the second, the space between this and the eastern edge of the Grand Central station proper, containing the train shed for incoming trains which is now being torn down; and the third, the Grand Central station proper. The excavation on the first section is finished, so far as present conditions will allow, and is now under way on the second or middle section. By moving a large number of trains to the new temporary terminal on the east, it is possible to abandon this middle section while under construction without seriously overcrowding the Grand Central station proper. The cost of the Grand Central terminal improvement up to the end of 1906, as charged for the first time on the balance sheet, is a little more than $7,000,000.

In connection with the electrification there has been another year of changes and improvements to both the Hudson and Harlem divisions in the territory soon to be electrified. At Mott Haven Junction excavation is now under way for the large "Bronx" station there to be built. The four-tracking of the line between Spuyten Duyvil and Yonkers has advanced to the point where its completion awaits only the moving of a few large obstacles such as station buildings and bridges. Through Yonkers, where the four-track line is to run on an elevated viaduct on reinforced concrete abutments, thus doing away with all grade crossings, the work is well under way, $53,000 having been spent during 1906. Some of the most important four-track work in the neighborhood of Ossining is finished; $117,000 was spent during the year for station and yard improvements at this point. The piles are being driven for the foundations of a second double-track bridge over the Croton river. There was a total of $489,000 charged to cost of road and equipment during the year on account of this four-track work between Spuyten Duyvil and Croton. Besides this, $355,000 was charged to the same account for improvements in yard and terminal facilities at Croton where excavation and filling were carried on during almost the whole of the year for the new terminal yard and a large engine house and an inspection building for electric equipment built. This electric terminal is to be just north of the Croton river bridge, about one mile south of Croton.

Considered from the standpoint of earnings the year was a prosperous one, though increases were not as large as in the previous year. Gross earnings were $92,000,000 against $86,000,000 the year before, a gain of $6,000,000 against $7,500,000 in 1905. The increase in freight earnings was $2,500,000, only half that of 1905, but there was a gain in passenger earnings of $2,800,000 against $1,600,000 in 1905. The increase in net earnings was $1,000,000 against $2,100,000 in 1905. There was an increase of $2,400,000 in income from investments, the result of raising the dividend rates on Lake Shore, Michigan Central, and Pittsburg & Lake Erie stocks owned, and a gain of $1,800,000 in net income. Dividend payments were larger by $1,200,000, principally on account of the $45,900,000 new stock issued during the year and also because of the increase in the annual dividend rate from 5 to 6 per cent., which, however, was operative only in the last quarter of the year. The year's surplus after dividends was about $800,000 larger than in 1905. In both years this was used almost entirely in special appropriations. There was deducted for additional betterments made during the year $1,300,000 against $1,500,000 in 1905 and for the special improvement fund $2,800,000 as compared with $1,500,000 in 1905.

The freight earnings, and more particularly tonnage, were affected unfavorably by the heavy decrease in coal carried due to the four months' strike in the bituminous fields and "subsequent inability to concentrate the scattered car supply for coal movement." This loss of tonnage had less effect on earnings than it would otherwise have had because there was the largest movement of merchandise traffic ever known which in a way took the place of the coal and at the same time paid a higher rate. The tendency to make the New York Central more of a high grade and less of a low grade traffic road is hinted at in decreases in the tonnage of grain—once the principal traffic of the road—and lumber. On the other hand there was an increase in miscellaneous manufactured articles of 1,660,000 tons or 43 per cent. The decrease in bituminous coal tonnage was 1,270,000 tons, or 12 per cent. There was an increase of 4,900,000 revenue ton miles and a decrease of 102,000,000 ton miles of company freight, making a net decrease of 97,000,000 ton miles during the year.



New York Central & Hudson River.

Including the Rutland Railroad, results of whose operation are separately reported.

The increase in passenger, mail and express earnings for the year amounted to nearly 11 per cent. One can get an idea of the importance of this department of the New York Central's traffic from the fact that passenger train mileage during the year was 27,000,000 miles against 24,600,000 traveled by freight engines. The gain in passenger earnings is remarkable in view of the poor service which was given in at least parts of the road's territory throughout most of the year. Partly the indirect result of the terminal electrification, but apparently much more due to disorganization of the operating and motive power forces, schedules to and from the Grand Central Station have been rarely lived up to, and frequently have entirely gone by the board. One particular cause of complaint during the past winter has been the condition of the steam locomotive power, which has at times been so run down that a drop of 15 or

20 degrees in the temperature disorganized or tied up the operation of certain suburban divisions. Conditions at present are not as bad as they have been, but since a change of the schedule about a month ago by which the time of almost every train was lengthened from five to 15 minutes there appears to be no closer living up to schedule than before. It is not unheard of for a train never to be exactly on time at a certain station for six months or a year. From frequent observation of the condition of the road it seems obvious that much of the confusion and delay is the result of poor management.

Maintenance expenditures were in general somewhat higher than in the previous year. Maintenance of way cost $3,052 per mile of road as against $2,820 in 1905. Repairs of equipment, not including renewals, cost $2,038 per locomotive against $2,055 in 1905, $723 per passenger car against $617 in 1905 and $60 per freight car against $53 in 1905. Including renewals the figures were per locomotive $2,693 against $2,561 in 1905, per passenger car $788 against $643 in 1905 and per freight car $77 against $80 in 1905.

There were bought during the year $6,000,000 of the $10,000,000 new capital stock of the Mohawk Valley Company, maintaining the New York Central's ownership of 60 per cent. of the stock of this holding company for electric lines between Buffalo and Albany; $241,696 of the $250,000 stock of the Little Falls & Dolgeville, an 11-mile branch from the main line, formerly independent; $12,800 of the stock of the Merchants' Despatch Transportation Company, an incorporated fast freight line which handles much of the highest class traffic over the New York Central lines; and $574,800 Boston & Maine common stock. In regard to the Merchants' Despatch Company information as to the terms under which traffic is handled by it over the New York Central would be much more illuminating to the shareholders of the railroad than the facts in regard to a small purchase of capital stock. The Boston & Maine purchase may or may not be significant. It seems probable that that road cannot always remain permanently independent and must come into possession of either the New York Central or the New York, New Haven & Hartford. Even in the latter event the New York Central, which already through the American Express Company controls a substantial interest in the Boston & Maine, would have an incentive to first make its control as strong as possible in order to demand from the New Haven certain advantages, such as perhaps the surrender by that road of the New York, Ontario & Western in return for its acquiescence in the New Haven absorption of the Boston & Maine.

One great problem which the New York Central more than a great many other roads is facing, which is no doubt responsible for many of its difficulties, particularly the great delays to freight during the past year, is the fact that its traffic has been and still is increasing at an unprecedented rate. The road has a rough measure of work done in the number of cars handled daily. In the first 15 days of April there were 108,000 more cars handled than in the same period of 1905 and of this number 73,000 were loaded cars. The New York Central is better situated than many roads at the present moment to handle so large a traffic, for it has at hand the proceeds of $50,000,000 short term notes sold in January, but at the same time it has the heavy expenses of the improvements in the New York terminal territory.

The principal statistics of operation, rearranged according to our usual classification, were as follows:

	1906.	1905.
Mileage worked	3,784	3,774
Freight earnings	$54,824,282	$52,312,331
Passenger earnings	28,508,578	25,761,586
Gross earnings	92,480,768	86,095,602
Maint. way and structures	10,718,599	9,984,101
Maint. of equipment	14,569,057	13,238,124
Conducting transportation	37,267,589	34,360,220
Operating expenses	64,953,095	59,968,028
Net earnings	27,136,073	26,127,573
Other income	7,707,738	6,523,499
Gross income	34,843,811	32,651,072
Net income	12,275,907	10,258,570
Dividends	7,832,885	6,612,500
Appropriated for betterments	4,108,261	3,622,722
Year's surplus	19,431	18,252

NEW PUBLICATIONS.

Locomotive Performance. By William F. M. Goss, M. S. D. E. New York: John Wiley & Sons; London, Chapman & Hall. 439 pages, 229 illustrations; 6 in. x 9 in. Cloth. Price, $5.00.

With the publication of this book it is the expected that has happened. Those conversant with railroad work, and the development of the locomotive have kept more or less in touch with what has been done in the locomotive experimental laboratory at Purdue University. The work has been going on quietly and effectively for 16 years, and as the results have been established they have been given to the public through papers read before the several railroad associations of the country and the technical press. So gradually have these been brought out, that few have realized what a tremendous mass of valuable information had been gathered until the publication of this book. Each separate item has been received with interest, has been commented upon, at the time of its publication, and then laid aside to be used as the exigencies of service or the requirements of the designer might demand. In this way the information has been scattered through such a wide range of publications and over such a great extent of time that its true total value has escaped notice. This is, however, borne in on one as he turns the leaves of this small book, small in volume to be sure, but it is well within bounds to say that it contains more information regarding locomotive performance than any book or books that have heretofore appeared. In short, it is probably the most valuable treatise on the subject that has ever been written, and it is difficult to find words to describe it at its full worth. Aside from the intrinsic value of the subject matter, the method of its presentation is admirable in the extreme. The style is fluent, easy, clear, definite, absolutely free from diffuseness and is one of the best examples extant of concise and logical treatment of a subject. It is free from mathematical hypotheses and complications. It tells a straight, unvarnished story of what a locomotive did under certain definite conditions. These conditions were repeated often enough so that there could be no doubt that the story was a true one, and then deductions are drawn that no one can question. It puts the reader into close personal touch with and breathes the atmosphere of the Purdue laboratory, and he feels the honesty and integrity with which all of these investigations were pursued.

The book opens with a brief review of the Purdue testing plant, and the method of installing the first and second locomotives. The construction of the testing apparatus is described in such detail that the interested engineer is in a position to judge for himself of the probable value of the records. The methods of conducting the tests are laid bare and every means is given to permit a judgment to be passed upon every step that has been taken. The growth in the value attached to locomotive testing is detailed, and complete specifications are given of the locomotives used. Having thus shown how the work was done the data and results are given in the chapters that follow. The boiler, the firebox, the smokebox, the cylinders, the counterbalance, the valves, the gearing and the wheels are all studied and what they do and what they can be made to do told simply and directly. Nothing is taken for granted, and wherever there is a doubt regarding the conclusions to be drawn, no one can be more conscious of it or more anxious to point it out than the author.

In another column there is given a general review of what the Purdue plant has taught us. Such a review can only show it in the barest and faintest outline, for the only way to do justice to the book is to reprint it entire. It may only be added here that it covers the subjects of boiler performance and the effects of high rates of combustion and the thickness of the fire. It details the well-known smokebox investigations with the radiation and spark losses. It handles in a comprehensive way the use of the indicator and the effects of such valve adjustments as variations of lap, lead and inside clearance. It repeats the counterbalance tests that aroused such wide interest at the time of their publication. It shows the effect on locomotive performance of throttling, high pressures, diameter of drivers and atmospheric resistances, and concludes with a generalization of locomotive performances.

That is what the body of the book tells. In the preface we find a cordial tribute to the president of Purdue, and to those engineers who assisted in the establishment of the plant, and as far as the text is concerned the reader is left to guess at the connection of the author with the enterprise. But those who have kept track of this work as it has progressed know very well who the guiding spirit has been, and it would be difficult to find a railroad man who does not have a full appreciation of what has been done and of the man who has done it, and who will not look forward with eager interest to future revised and enlarged editions of the work, for the whole story has not yet been learned or told; and who will not feel a sense of self-congratulation that Professor Goss has placed this mine of information at his service, a mine unequaled in richness by anything that has thus far been brought to light.

CONTRIBUTIONS

Superelevation.

Detroit, Mich., April 22, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In partial answer to your correspondent in your paper of April 19: The sketches herewith are designed to represent graphically the conditions that seem to exist on an inclined plane.

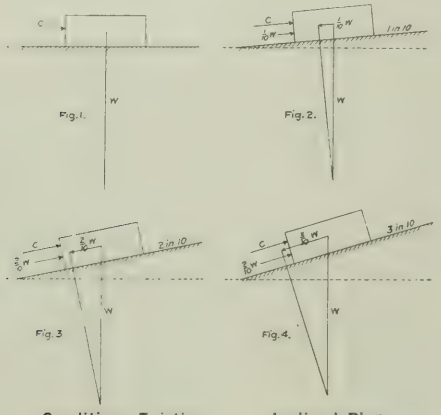
In Fig. 1 the plane is level and the load is vertical; hence there is no horizontal component of the load; and if we apply a horizontal force C it will exert its full value as a shearing force along the horizontal plane of contact.

In Fig. 2 the plane is inclined to a grade of one in ten, substantially the same as 6 in. superelevation on a railroad. In this case a force one-tenth W, parallel with the incline, is generated, and if not opposed by something the weight would move down the

incline. As it does not so move we say that a counterforce (friction) just equal to but no more than one-tenth W is generated. Since these two forces are equal and opposite in direction they neutralize each other, and any other applied force C exerts its full value as in Fig. 1.

In Fig. 3 the plane is inclined to a grade of two in ten. In this case the force two-tenths W is generated, and if the weight still remains immovable, though just about in a condition to start, it is because the friction two-tenths W is generated. Being equal and in opposite direction these forces neutralize each other, and any applied force C exerts its full value as in Fig. 1 and Fig. 2.

In Fig. 4 the plane is inclined to a grade of three in ten. Here we have a force three-tenths W tending to move the weight down the incline, and if the coefficient of friction is only two-tenths, then the friction cannot be greater than two-tenths of W; and we have therefore a surplus and unneutralized force one-tenth W tending to move the weight down the incline; and the net effect of an



Conditions Existing on an Inclined Plane.

outside force C will be diminished by this excess force one-tenth W. These four sketches indicate with sufficient accuracy some of the conditions to be found on a railroad track.

If C be taken to represent the centrifugal force, meaning a radial force generated by a weight moving in the arc of a circle and not complicated with other conditions, we see that its value is not affected by any superelevation of less than 12 in. (an inclination of two in ten); but that if we exceed 12 in. of superelevation then we just begin to get some relief, and if we take a superelevation of 18 in. we shall relieve the centrifugal force by an amount equal to one-tenth W, which is just the amount of relief we have always supposed we were getting from 6 in. of superelevation.

That this rather remarkable difference is due to our neglect to take friction into account will perhaps be evident if we refer again to Fig. 2, where we see that if we leave out the friction we shall have remaining a relief force of one-tenth W (about 200 lbs. per ton) to "balance" by so much the centrifugal force generated.

It seems reasonable therefore to conclude that superelevation within any limits that are practicable to use does not relieve or affect the centrifugal force; and it almost seems evident that it does not materially affect any of the other forces developed on a railroad curve.

JOHN A. FULTON.

Continuous Rails for Uniform Track Structure.

Montreal, April 29, 1907.

To the Editor of the Railroad Gazette:

With reference to the editorial on continuous rails for uniform track structure in your issue of April 12, 1907, you state that it is the lack of stiffness in the upper structure that permits the excessive deflecting of the ties, rather than the lack of bearing under the ties that permits the excessive deflection of the rail. I submit that the primary cause of low joints is the impact upon the rail ends of passing wheels, and that this cause is not eliminated by any practical form of joint.

I agree that present research and ingenuity seems to be exerted upon wrong lines, viz., in an endeavor to design a joint in which it is expected that the joint ties will not become low, instead of accepting primarily the necessity of proper maintenance of track. I concur in your description of an ideal joint, but I maintain that the bolt connection of a joint designed to provide for expansion and contraction is the limiting factor of strength rather than the section of the bars at the rail ends, and believe that the extra material added to the ordinary angle bar in the way of a depending flange is not only wasted but is objectionable. The Canadian Pacific Railway has had six to eight years of experience with about 1,000 miles of track so equipped, and has found that the depending flange causes ice to form between the ballast and the base of the rail, which, near the end of the season, forms a perfect anvil of ice on which the rail ends are battered. These bars were of soft steel, as you recommend, which the harder rail had worn or pounded down at the center, and the rail ends deflected similarly under the passing loads and caused a permanent low joint.

It was this wearing of the angle bar that suggested the increasing of the hardness of the bars equal to that of the rail, and, as this also increased the stiffness, the common angle bar of high carbon steel was finally adopted some five years ago. Our experience to date has been that we made no mistake, wear between rail and bars has been minimized, and, for some 3,000 miles of track so equipped only 48 bars have been reported defective, and these joints are holding up better than those with the depending flange, which I think goes against your conclusion for northern transcontinental railroads. In conclusion, I would point out that the old fish plate joint, properly maintained, is better than any of the modern joints where the maintenance of the surface at the joint is neglected.

F. P. GUTELIUS,
Assistant Chief Engineer, Canadian Pacific Railway.

Higher Pay in Prussia.

In reply to demands for higher pay and other concessions to the railroad employees, the Prussian Minister of Public Works said in the Diet that such questions necessarily engaged his attention, as he is the greatest employer of labor in the country. In 1900 his department paid on the average 68.8 cents per day; in 1907, as estimated, the average will be 73 cents per day. Now every additional cent per day means $866,650 more per year to be paid out. The advances from 1905 to 1907 in the pay and allowances of the regular corps of employees and of laborers absorbed 17 out of 40 millions of marks increase in amount paid for salaries and wages, the other 23 millions being due to an increase in the number of employees. The average pay of a workman, which was $189 in 1897, will be something more than $238 in 1907, an increase of more than one-fourth. The state is compelled to have regard to the condition of agriculture and other industries in advancing wages, and to follow rather than lead, especially as the state employees have advantages of security and privileges such as pensions, greater than private industries offer.

Pennsylvania Report on Motor Cars.

The following extracts are taken from the report to the General Manager by the special Pennsylvania committee appointed to study the operation of foreign road and rail motor cars.

Your committee left New York, Saturday, November 24, 1906, and returned to New York, Saturday, February 2, 1907. During the 10 weeks intervening, we inspected and traveled over the principal railroads of England, Ireland, Scotland, Belgium, Holland, Germany, Switzerland, Italy and France, thereby obtaining valuable experience and collecting voluminous data.

RAIL AND ROAD MOTORS.

The English railroads have operated rail and road motors for the past three years, using them as feeders, and in providing more frequent and satisfactory service on branch lines having light traffic, but principally as a defensive measure from tram or trolley competition. They have no objection to the building of lateral trolley lines, but are seriously opposed to competing tramways which would parallel their lines or affect their local business, as this short haul passenger traffic forms a large proportion of their passenger revenue, and they, therefore, jealously resent any encroachment upon their local territory. There was considerable demand for the introduction of tramways in England several years ago, but since the establishment of rail and road motor service the agitation for tramways has apparently ceased and a number of projected lines abandoned. This has been the experience along the Great Western Railway of England, the largest users of rail and road motors, as well as that of the London & North Western and the London & South Western Railways.

ROAD MOTORS.

The road motor for passenger service is simply an automobile omnibus of various types, the cost varying from $3,000 to $5,000, some of them having double decks, and in many cases a small compartment for the accommodation of luggage and parcels. Machines of this character have been introduced to a greater or less extent by the following railroads: London & North Western, Great Western, London and South Western, Great Eastern, Caledonian.

Frequent road motor service has been established at points where there are villages not located on the railroads, but with sufficient population to warrant the service, also from a station on the main line across country to the terminus of a branch line, as well as from the terminus of one branch line to that of another. These motors are operated, on advertised schedules, at a maximum

speed of 15 miles per hour, the average speed amounting to eight miles per hour. They make connection with the arriving and departing steam trains, preference being given at all times to departing rather than arriving trains, and stops are made at any point except on steep grades to receive or discharge passengers. The routes covered range from three to 20 miles in length, and the tariff rates for passengers, luggage and parcels are published, no distinction being made as to class. A store-keeper in each village is employed as the agent for the company, who receives and delivers parcels on a commission basis, the guard in charge of each motor issuing tickets and collecting fares.

The well-kept and excellent condition of the roads and highways in Great Britain, together with the moderate climate, make it practicable to operate this character of service successfully in country and suburban districts, where it would be absolutely impracticable, except to a very limited degree, in the territory contiguous to our lines.

In many cases where this service has been introduced, it has displaced the expensive, irregular and unsatisfactory facilities formerly provided by horse omnibuses and other conveyances operated by private individuals.

The established schedules are maintained with a fair degree of regularity and the service well patronized and apparently appreciated by those depending upon it. However, your committee failed to find, at any of the places visited, very much enthusiasm expressed in regard to the road motor proposition from a railroad standpoint, some of the railroad officials stating that they did not consider this character of service as a proper function of a steam railroad company, and in some cases negotiations were under way with independent automobile omnibus companies to take over and operate their road motor service; and further, we failed to find any road motors in operation or contemplated in connection with any of the Continental railroads.

We observed the performance of road motors of the London & North Western Railway in operation between Harrow and Watford stations, suburbs 11 and 17 miles from London, covering a distance of seven miles, describing an arc, passing through several towns and villages not located on the railroad; which, in addition to accommodating passengers arriving and departing on the steam trains, are also utilized to a considerable extent locally between the different villages.

The road motor is equipped with a four-cylinder gasolene engine, the wheels being fitted with flat solid rubber tires. There is a small compartment for luggage or parcels, and a passenger compartment accommodating 12 persons inside and seats for 18 persons on top; total capacity of 30 persons.

This line was inaugurated in July, 1906, and we were advised that the total cost of operation, including 20 per cent. depreciation, is one shilling per mile. The London & North Western has also a similar line in North Wales.

The Great Western Railway of England, on account of the numerous small towns and villages adjacent to the line, is the largest user of road motors, owning 84 machines and operating them on 44 established lines. We inspected the service between Slough and Stoke-Poges, a distance of 10 miles the round trip. The car used was equipped with a four-cylinder gasolene engine of the Milnes-Daimler type, and had a capacity of 20 persons, with a rail around the roof to permit the carriage of luggage on the top. The car had been in service for three years and presented a very good appearance. It was lighted with acetylene gas but not heated. There was no objectionable vibration while the car was running, and the average speed was about 10 miles per hour. Steam road motors have been tried on this line, but were unsuccessful on account of boiler troubles and have been abandoned.

The London & South Western has four steam road motors of the Clarkson type which are considered quite unsatisfactory.

The Great Eastern has 18 road motors; four Daimler, two Wolseley, two Thornycraft and 10 built by themselves. We inspected the cars in service at Chelmsford, where the service was established in March, 1905. These cars are equipped with four-cylinder 35 h.p. gasolene engines, chain drive, maximum speed 12 miles per hour, with flat solid rubber tires. The cars have double decks and seat 20 persons inside and 18 on top; total, 38. This car, while built at the company's shops, is of the Milnes-Daimler pattern with slight modifications.

The Caledonian Railway, Scotland, has two road motors in service a few miles from Glasgow, between Clarkston and Eaglesham, a distance of eight miles. They are not enclosed; one using oil fuel with steam generator, of the Serpollet type, and the other a four-cylinder gasolene car of the Durham-Churchill type, having been in service but a short time and being used experimentally.

It was noted that wherever steam has been used for the operation of road motors, they have proven unsatisfactory, and that the gasolene machines are the most successfully operated, those of the Milnes-Daimler type predominating.

From our personal observation and the information obtained as to the conditions existing under which road motor service has been established and operated in Great Britain, and with our knowledge of the general conditions existing in the territory traversed by our line, it is the opinion of your committee that the establishment of this character of service as an adjunct to our railroad passenger business is not worthy of any serious consideration at this time, and it is our judgment that the same cannot be successfully or profitably operated on account of the general bad condition of the roads, severe climate, and the territory not at present covered by trolley lines being so sparsely settled as to make such service unnecessary and unwarranted.

RAIL MOTORS.

Rail motors, costing from $8,000 to $10,000 each, have been introduced to a greater or less extent by all principal railroads of England; also by a number on the Continent, as follows:

Great Western Railway.
London & North Western Railway.
London, Brighton & South Coast Railway.
London & South Western Railway.
Great Central Railway of England.
German Government Railways (Saxony).
Italian State Railways.
Paris, Lyons & Mediterranean Railway.
Paris & Orleans Railway Company.

More frequent and prompt service, economy of operation, and the forestalling of tram competition, also in some cases to lessen the stops of express trains (the motor cars accommodating the travel between intermediate stations), are the reasons given for establishing this character of service.

In some cases these rail motors have entirely displaced the steam passenger service on branch lines, but are generally being used for supplementary service in connection with other trains.

The English railroads, under Board of Trade regulations, are compelled to provide fully equipped stations at all regular stops of their steam trains, consisting of a permanent structure, heated and lighted, with raised platforms, one and generally two booking offices, toilet rooms and waiting rooms, for the separate accommodation of the several classes of travel, together with a complete staff of attendants, which is a proposition involving considerably more expense than is the case on American railroads. In the operation of rail motor service, however, they are excused from these regulations and are permitted to establish regular stops, which are called "Halts," without any accommodations or conveniences for passengers other than a low platform, in some cases with, but in many cases without a shed or shelter, under which permission it has been found desirable to establish a great many more stops for the motor cars than for the regular steam trains, making it more convenient for the patrons of the road and thereby stimulating travel without any additional cost for station maintenance or operation.

Practically the same regulations regarding rates, tickets, etc., governing regular steam trains apply to this service, with the exception that no luggage or parcels are delivered at "Halts" and no class distinction is made as to passengers.

The car is in charge of a guard who issues tickets and collects fares, also performs the necessary duties in connection with the handling of luggage and parcels and keeps the necessary train records, his rate of pay being somewhat higher than that paid the guard on a regular train. Generally a driver and a fireman are also employed in the operation of the car, receiving the same rate as that paid to the driver and fireman on a regular locomotive, making the crew consist of three men. In some cases, however, the fireman is dispensed with, the driver performing his duties, making the crew consist of two men.

The car is equipped with a small compartment on the rear platform in which is placed a throttle connection with the boiler, the necessary brake apparatus and whistle, which permits it to be operated from either end, making it unnecessary at any time to turn the car.

The design and construction of the car is such as to make it unsuitable for shifting purposes, and, therefore, this is not attempted or allowed, such service when necessary being performed by a shifting locomotive or horses, the latter being used to a great extent at all points, even to take cars (capacity 10 tons) to and from the main track. On such lines where motor cars are operated, the freight train service is performed by a regular locomotive.

From our observation the acceleration of these cars was more rapid than on regular trains, the maximum speed not exceeding 50 miles per hour.

From the information given us, it would appear that where rail motor service has been established travel has increased to a considerable extent. Within itself, the service is not remunerative, but the expense would seem to be warranted when its value as a feeder in creating additional long-distance travel for the main line steam trains is taken into consideration. We were, however, unable to obtain any statistics to confirm this statement.

The operating officials of the various roads on which this character of service has been established were rather enthusiastic as to the possibilities of the same. The mechanical people, however, were practically unanimous in expressing themselves as not being favorable to the self-contained rail motor and its ultimate economy.

While it is admitted that there is a slight saving in fuel, it is claimed that this is more than offset by the increased cost of maintenance and the loss of service while undergoing repairs, experience so far demonstrating that the self-contained motor car requires more frequent shopping than the ordinary locomotive and coach, on which account the London & North Western and the London & South Western companies have found it necessary to design and are now building the engine on an independent frame fastened to the frame of the car, which can readily be detached and an extra engine substituted, facilitating repairs and reducing the time in shop.

On the Continent, while this service is in actual operation to a limited extent in Germany, France and Italy, the railroad people still consider it to be in an experimental stage. They, however, are operating this class of service with a crew of two men, namely, driver and guard. It is necessary to turn these cars at terminals on account of their not being equipped to permit of their operation from either end.

We inspected the Great Western Railway motor service from Southall to Ealing, both stations being suburban to London. The car was about 60 ft. long, operated by steam, having outside cylinders, arranged with the boiler and engine compartment in the forward end, a small luggage compartment and a passenger compartment seating 50 persons, partitioned off to provide a section for smoking and the remainder for general travel. The rear platform was an enclosed compartment fitted with lever leading to throttle on boiler, also vacuum brake apparatus and whistle, making it possible to operate the car in either direction without turning.

The crew consisted of engineer or driver, a fireman and a conductor or guard who also handled the parcels and luggage as well as issuing tickets and collecting fares.

The speed ranged from 20 to 45 miles per hour, and the driver stated that the car was capable of 50 miles per hour. The car ran smoothly, without noticeable vibration, and had been in successful operation for three years. The estimated cost of operation was given us as 18 cents per mile.

The London & North Western operates a rail motor line on its Oxford branch from Bicester to Oxford. Upon our arrival at Bicester, where we went to inspect this car, we found that it was in the shop at Oxford undergoing slight repairs and the run was temporarily filled by a steam train, which we used to Oxford, and had the opportunity of inspecting the car in the shed. This car was operated by steam, equipped with upright boiler, inside cylinders and crank axles.

The car was divided into boiler and engine room, luggage compartment, smoking compartment seating 24 persons, and one general compartment seating 24. The crew consisted of three persons, engineer or driver, fireman, and conductor or guard. The car was fitted to be operated from either end without turning.

We were informed that this particular line had been operated 15 months, at a loss of $350, but when the entire rail motor service of the London & North Western was taken together it was $3,500 ahead on the year's business. The cost of operation, including depreciation, was placed at 13 cents per mile.

The London, Brighton & South Coast has two gasolene motors in service at Brighton, which we inspected. Each car is equipped with two 30 h.p. Daimler motors suspended from the frame. Length of car 48 ft., capacity 42 passengers. The service was inaugurated in March, 1945. The longest continuous service for these cars without repairs has been two months. These cars were both in the hands of the mechanics undergoing slight repairs, but were expected to be properly repaired in time for their next scheduled run. The crew consisted of driver and conductor or guard.

There was considerable noise and vibration noticeable while these cars were standing with the motors running, as well as a very disagreeable odor from the gasolene.

The London, Brighton & South Coast has also two small detachable steam locomotives at Brighton which are attached to trailers. These trailers are fitted with shaft extending under or over the car to throttle valve so that the locomotive and trailer may be operated from either end without turning. We were informed by the local officials on the ground that the latter service was more satisfactory than the cars operated by the gasolene engines, although necessitating an additional man (fireman).

The London & South Western has 14 steam rail motors similar to those mentioned above, each car being operated by two men, a driver and guard, who alternate their positions weekly.

The Great Central Railway operates two rail motors from its Marylebone station, London, of a similar type to those in use on the London & South Western.

The German railroads, under Government management, have been experimenting with rail motors for two years, using for purposes of comparison a Serpollet car (steam, with coal fuel), a Milnes-Daimler car (gasolene), and an accumulator car (storage battery), also a small locomotive and coach. We were informed that the experiment so far showed the steam locomotive and coach to be the most economical and successful in operation, and a statement showing the results of the trials was furnished us and is submitted.

In Italy we learned that some experiments had recently been conducted at Milan with steam rail motor cars, but as the tests had been completed and the cars removed, we were unable to inspect them. We wrote for the result of the experiments, but have not yet received the information.

In Berlin, the American Consul, Mr. Thackara, had recently been investigating the subject of rail motor cars, and kindly furnished us with full data and photographs concerning the Ganz rail motor (steam), which accompany our report, these cars we understand being in use on the Austrian State Railways.

In correspondence with the manufacturers as to where these cars could be seen in operation, we learned that they had recently established an American agency with the Railway Auto Car Company, No. 114 Liberty street, New York City, which states that one car is about to be placed in operation on the Florida East Coast Railway and that three cars are now contracted for, one for service on the Erie Railroad, which will be run in about 30 days; one for the Rock Island System, which they expect to have in operation about June 1, 1907, and another for the Delaware, Lackawanna & Western, which will not be completed until next fall.

In France, the Paris, Lyons & Mediterranean Railway has eight steam rail motors, six of them built by Purrey & Company, Bordeaux, and two Serpollet cars.

The service was inaugurated about three years ago, but has only been in full operation about a year. The Paris, Lyons & Mediterranean people are building 12 more of these cars, but state that they are still in an experimental stage; and that the motors are frequently out of order, perhaps 50 per cent. of the time, and that the service thus far cannot be considered satisfactory.

The Paris & Orleans Railway has 10 rail motors, built by Purrey & Company, Bordeaux. The service was first introduced two years ago, but has been in full operation only six months. These people could not furnish ready figures showing the cost of operation and results obtained, the service so far being entirely experimental, but apparently they did not seem to approve of the proposition.

The English railroads, by the introduction and operation of self-contained rail motor cars, have apparently accomplished the purpose intended, by increasing travel, effecting a saving in operation, in that they use in some cases a crew of but two men and never more than three, also a saving in station force and a slight economy in fuel, which results could only be accomplished or brought about with the conditions confronting them, by the substitution of the self-contained motor car for the regular steam service, and have further eliminated to a great extent the several class distinctions of passenger travel which custom requires them to maintain in their regular steam service. In this class of service they evidently have the most effective answer to tram competition.

With the benefit of this experience, your committee is of the opinion that the installation of self-contained motor cars for passenger service on certain branch lines largely depends upon the gradients, the possibilities for increased travel, and the saving which it is possible to obtain in operation by a reduction in the number of men comprising the present train crew. If the latter is possible to the extent of one man, your committee believes that the question is worthy of serious consideration.

A small tank locomotive and car equipped for operation in either direction without turning, commends itself as the most elastic adaptation of the rail motor which came under our observation, and appears to be in the line of future development abroad.

The Railroad Commission of New Jersey.

The Act creating the Board of Railroad Commissioners for the state of New Jersey, which has just become a law, empowers the Governor, with the advice and consent of the Senate, to appoint three citizens of the state, not over 30 years of age, to terms of six years each beginning May 1; but it is arranged that the terms shall expire successively in 1909, 1911 and 1913, etc. The salaries of the commissioners are to be $5,000 each and that of the secretary is to be $3,000. The board is to appoint two inspectors, one of whom shall be a civil engineer, skilled in railroad affairs, and the other a mechanical or electrical expert; also other necessary clerical and expert help; but the total expense of the board, including salaries, must not exceed $30,000 a year. The board is to have general supervision of all railroads, by whatever power operated, which are subject to the general railroad act of 1903. The board may require the attendance of witnesses and the production of papers and may invoke the aid of a Justice of the Supreme Court in these matters. Every railroad must report all accidents immediately to the commission and, if the public interests require it, the commission shall investigate the accident. The board is to hear all complaints touching railroad service, etc., applications for connecting tracks, for changes of stations, for abolition of crossings and all other matters of railroad operation. It is the duty of the board to see that the railroad laws are observed and enforced, and, through the Attorney-General, who is to be its adviser and legal counsel, may cause actions to be brought to recover penalties from railroads. The orders of the board concerning safety of road, etc., and concerning

station facilities, must be complied with by the railroads, or, upon their failure, the board shall report the facts to the Attorney-General; and he must proceed against the offending railroad. An aggrieved railroad may petition the Supreme Court. The commission may enter a suit in equity to enforce its orders.

New Railroad Laws of Indiana.

The Railroad Commission of Indiana has issued to the railroads of the state a circular giving in brief language the requirements of the several new laws affecting railroads which were passed by the legislature of that state, recently adjourned, and which went into effect April 10. This circular is in substance as follows:

Duties and Requirements, Section 3, Commission's Bill.—a. An annual report is required to be filed on or before October first, in the form prescribed by I. C. C. This does not apply to electric roads until 1908.

b. Steam lines required, as between themselves, to afford all reasonable facilities for the interchange of traffic at junction points; electric roads, as between themselves, the same.

c. The construction of sidings, switches, spurs and turnout tracks to industries is required, also connections with industrial tracks.

d. The construction of interchange tracks at all junction points is required, unless the commission orders to the contrary. This applies to crossings at, over or under grade.

e. Transportation must be completed without breaking bulk.

f. Switching must be done for connecting lines on arrival at junction points, and cars made empty must be returned to junction point upon demand.

g. Railroads shall not cross each other in this state without the approval of the commission. This does not apply to an electric road crossing a steam line under the act of 1903.

Tariffs, Section 9, Commission's Bill.—a. Requires all intrastate tariffs to be filed with the commission within 60 days after the act goes into effect.

b. Any interstate tariffs shall be filed within five days after being called for.

c. Tariffs to be in form as prescribed by Interstate Commerce Commission.

d. New tariffs to be filed two days before becoming effective, or the commission may, upon showing, permit new rates to go into effect at once. No change in rates to be made on less than 10 days' notice filed with commission.

e. All switching, transfer and terminal charges to be published and filed as tariffs.

f. All tariffs to be kept on file at all offices where an agent is regularly maintained.

g. No service shall be performed unless a tariff therefor is filed as required.

Passes, Section 13, Commission's Bill.—Free tickets, free passes, or free transportation for passengers, freight or express are forbidden under penalties, except to officers and employees. Does not apply to any pass legally issued for year 1907. This exception was only intended to cover passes issued by the interurban lines which were not subject to the old law.

Accidents, Section 19, Commission's Bill.—a. All accidents resulting in the loss of life or serious injury to passengers or employees to be reported to the commission within five days, with general cause thereof, and within 20 days a full report of the cause shall be filed with the commission.

b. Requires railroads to keep tracks, grades, engines, cars, depots and grounds in good condition and to manage and operate the road with reference to the security and accommodation of the public.

c. Requires that passenger trains be scheduled and operated so as to make reasonable and proper connections at junction points.

d. Provides for the separation of the grade of two crossing lines when both companies agree thereto.

e. Provides for proceedings before the commission to separate the grade of two or more crossing lines when one of the lines desires so to do.

Bribery by Officers, Employees and Patrons.—This act makes it a crime for an officer or employee to accept money or property in addition to regular charges for performing a service, or for patrons to give or offer to give money or property to an officer or employee to obtain service.

Car Movement, etc., Shippers' Bill.—a. Requires traffic to go forward an average of 50 miles every 24 hours. Twenty-four hours allowed for movement through terminals and junctions. Penalty $5 per car per day, or 25 per cent. of freight on L. C. L.

b. C. L. freight to be delivered in 24 hours after arrival, or 24 hours after delivery to connecting line. Penalty $5 per car per day.

c. Car equipment required and equitable distribution among shippers demanded.

d. Car service record required and demand for cars to be noted therein. Cars to be furnished in 48 hours after demand. Penalty $1 per car per day for failure to furnish. The commission will have the form for this record within the next two weeks. It is required to be at each station after 60 days from date the act becomes effective.

e. If coal is confiscated carrier must give immediate notice to consignor and consignee.

f. Lines initiating coal shipments must, on request, publish coal tariffs to any point in the state and furnish cars for shipment. When car of coal is given to connecting line it must go forward to destination and empty car be returned to junction point at an average of 50 miles per day. Penalty for failure $500 to $1,000.

g. Carriers can, only after obtaining permission of the commission so to do, charge less for hauling coal for manufacturing and steaming purposes than they charge for hauling domestic coal.

Safety Appliances.—(a.) Requires all locomotives and 75 per cent. of all cars in train to be properly equipped with brakes, etc. This does not apply to yard service or to a local train while switching. The commission is now of the opinion that the provisions of this act do not apply to work, construction or wreck trains. (b.) Automatic couplers required. (c.) Grab irons and hand holds required. (d.) Standard drawbars required. (e.) Provisions of this act apply to passenger traffic. (f.) Interurban cars used in passenger traffic required to have power air-brake. (g.) Overhead obstructions, less than 21 ft. from top of rail, are forbidden unless allowed by commission. Does not apply in cities or incorporated towns. (h.) No structure to be built, or rebuilt, which is less than 18 in. from the widest part of the widest locomotive or the widest car used on the line unless the commission gives permission so to do. Penalty for violation of paragraphs g and h $500.

Block System.—After July 1, 1909, it will be unlawful to operate trains over a line which is not protected by an approved block system. This applies to lines having a gross annual income of $7,500 or more per mile of line. The commission has authority to relieve carriers of this duty, as to branch or spur lines where traffic is not heavy, or on main lines where no necessity therefor is shown.

Train Rules and Regulations.—a. All companies are required to publish printed rules for the control of trains and to furnish copies thereof to all persons engaged in the operation of trains, and also file a copy with the commission. Employees engaged in the operation of trains shall be instructed in the rules and examined thereon at least once in each six months for 18 months after employment and then annually. Penalty not less than $25 nor more than $200.

b. Any officer, agent or employee of a company engaged in the operation of trains by steam power who is intoxicated while on duty, or who runs trains or gives orders to run trains in violation of the printed rules of the company or in violation of the laws of this state, is subject to a fine of not less than $25 nor more than $500.

c. Copies of this act must be posted in cabooses, depots, etc.

Transportation of Fish.—It is made unlawful to transport beyond the limits of Indiana any pike, pickerel, bass, * * * etc.

Hours of Service.—It is made unlawful to permit, exact, demand or require any engineer, fireman, conductor, brakeman, switchman, telegraph operator, or other employee engaged in the movement of passenger or freight trains or in switching service in yards of railroad stations to remain on duty more than 16 consecutive hours, except when caused by some casualty occurring after the employee has started on the trip, or to require or permit any employee who has been on duty 16 consecutive hours to go on duty without having at least eight hours off duty or to require or permit any such employee who has been on duty 16 hours in the aggregate in any 24 hours' period, to continue on duty or to go on duty without having had at least eight hours off duty within the 24 hour period. Penalty $100 to $500.

Full Crew.—This law requires all companies operating more than four freight trains in 24 hours to have a full crew on every train, consisting of 50 freight cars, excluding caboose and engine, and the full crew must consist of one conductor, one engineer, one fireman, two brakemen and one flagman. Freight trains of less than 50 cars and passenger trains must have the same crew, excepting that only one brakeman is required. Penalty $100 to $500.

Baggage Rates.—(a.) This act requires 150 lbs. of baggage to be carried with each passenger paying full fare, and 75 lbs. with each passenger paying half fare. (b.) The samples, goods, wares, appliances and catalogues of commercial travelers, or their employers, is declared to be baggage and is required to be carried as such. (c.) The charge for carrying baggage, in excess of the weights mentioned, is one cent for each three miles for each 100 lbs. of excess; minimum charge of 25 cents when baggage is less than 500 lbs. and 50 cents when it is over 500 lbs.

Passenger Rates.—By this act passenger rates are fixed at 2 cents per mile for the carriage of an adult. * * * If opportunity is furnished to purchase a ticket and a passenger fails so to do he may be charged 2½ cents per mile, but a check must be given entitling the passenger to receive the overcharge at any station of the company.

Liquor License.—Every company operating a dining or buffet car in which spirituous, vinous, malt or other intoxicating liquors are sold within the state, shall pay annually a license fee of $1,000.

Two laws, not referred to in the circular, are one approved February 21, declaring null and void any contract by which a railroad employee, in joining a relief association, surrenders his right of damage against the railroad company for personal injury or death; and one approved March 9, designed to allow a new railroad to alter the location of its line when necessary, and providing for the protection of land owners in such cases.

Electric Locking.

BY W. H. ARKENBURGH.

The old style interlocking plant, manually operated, with detector bars to prevent switches being thrown while a train was upon them was a great improvement over hand-thrown switches and a safety device of inestimable value. The only check on the manner in which the signalman handles his levers at such a plant is the "dog locking" and the detector bars.

The dog locking is designed and applied to an interlocking machine for the purpose of regulating the order in which levers shall be operated, in such a manner that those for the movements of switches, locks and signals of routes shall require those for the movements of similar functions in conflicting routes to be locked against being cleared. That is, in order to set the switches for a route, lock them and clear the signals for the passage of a train, the use of all opposite or conflicting routes must be prevented. This is all that can be provided for with mechanical locking. With moderate speed of trains and a high intelligence in signalmen, nothing more could be desired.

In late years speeds have been increased to an enormous extent, making it necessary to give distant indications farther and farther away, and power has been introduced to work the switches and signals. Increased speed means more space needed to stop in, and with the old style plant there is nothing to prevent the signalman from changing the route after a train has passed a distant signal at clear. This is a serious defect, for it might lead to running a train off a derail at high speed or through a sharp turnout with disastrous results.

Power used to operate the switches has frequently crumpled up detector bars under trains. Worse yet, with rail larger than the 85-lb. section, detector bars cannot any longer be counted upon to strike the tread of a wheel, but are quite liable to pass up outside. Thus a switch or derail can be thrown under a moving train, with consequences which can well be imagined. Lastly, detector bars are designed on a false principle; if they fail they are inoperative.

To overcome these difficulties electric locking has been introduced. Electric locking is merely an extension of the functions of the track circuit, and is sometimes called track circuit locking.

As applied to mechanical interlocking it is usually quite simple. It involves only the use of electric locks on the latches of certain levers, usually those of the home signals; though if the protection is to be made more complete, they are applied to certain special route levers or to regular levers that can be used as route levers.

The electric locks are electromagnets of such design that they act only when de-energized. When in this condition they hold the lever latch in such a way that the lever cannot be restored or moved either to its full normal or full reverse position, as the case may be.

Fig. 1 shows two views in section of one make of electric lock, applied to a Saxby & Farmer machine. D is the shaft, actuated by the lever latch, which drives the locking bars. On D is mounted a crank arm, which operates a link connection F. F is pinned at its upper end to segment A, which revolves on its center. A is notched to receive dog B, which falls by gravity into the position shown. E is an electromagnet which when energized lifts B out of the notch. When B is in the notch, A is locked and thus prevents the lever latch from being moved.

These locks are controlled by circuits passing through the points of track relays in the various sections involved. This control is usually accomplished through the medium of an indicator; that is, the track relays control the indicator, and the indicator controls the lock. This indicator is made on the principle of a relay, but at the same time actuates a miniature semaphore arm, showing "clear" when the indicator is energized and "danger" when de-energized. This is done in order to give a visible indication of the condition of the track section and not compel the signalman to depend upon watching the train or trying his levers. If he should pursue the latter course, he would be liable to put too much strain on the mechanism, or to catch the lock at the instant of releasing. Repeated trials will in time wear out the dog and slot of the lock and produce a dangerous condition, for it is possible to trip a worn dog and thus throw a lever that should be locked.

An indicator is shown in Fig. 3. Here X is a side elevation, Z a front elevation and Y is the same as Z, with front plate M removed. The magnet coils are shown at A. The armature B is pivoted at C and carries the contact fingers D, held in place by the insulating pins E. These fingers make contact at F, when the magnet is energized, and at G when de-energized. There are four of these fingers, and each will make either a front or a back contact. The bell is used to give an audible indication when the magnet is de-energized. Wires are attached at the binding posts H. I is the semaphore arm, pivoted at J on shaft K. K is actuated by armature B through rocker arm L, which is equipped with an alligator jaw at one end and a pin working in a slotted jaw on shaft K at the other end. M is a metal plate painted white and used as a background for arm J. The whole is mounted on a frame N, and contained in a case with a glass front.

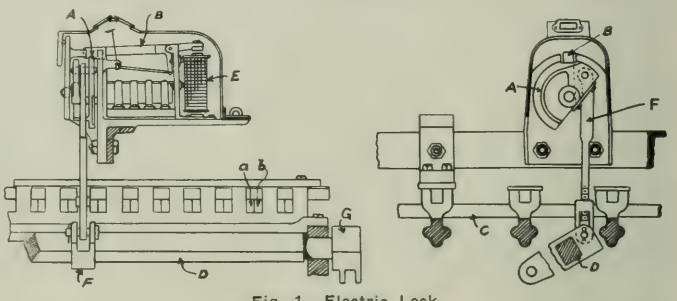


Fig. 1—Electric Lock.

The relative protection afforded by locking signal levers and route levers, respectively, may be understood by reference to Fig. 2, which shows the layout of an interlocking plant having a twenty-lever machine. If the latches of high home signals only are controlled by track circuits, protection only will be given to trains moving in the established direction of traffic on the high-speed routes. Suppose the switches set to make a route from A to B and a train in any part of the route. Then No. 17's latch is locked in the up position, and 17's lever cannot be put fully normal until the train has passed signal 4. No. 17 reversed locks No. 9 reversed, which locks No. 10 reversed. No. 17 reversed also locks No. 7 reversed, which locks No. 8 normal; also Nos. 4 and 20 and 8 are locked normal; therefore, it is safe for the train to proceed, as none of the enumerated functions can be moved. But suppose the signals set for a movement from B to A. Now, No. 4 reversed will lock all the conflicting and opposing functions, but it has no lock on its latch, and track circuit protection is lacking. This could be overcome by putting locks on all the dwarf signal latches, but this would be too expensive. Again, if the signal were out of service and the signalman should flag a train through without reversing his signal lever, there would be no protection.

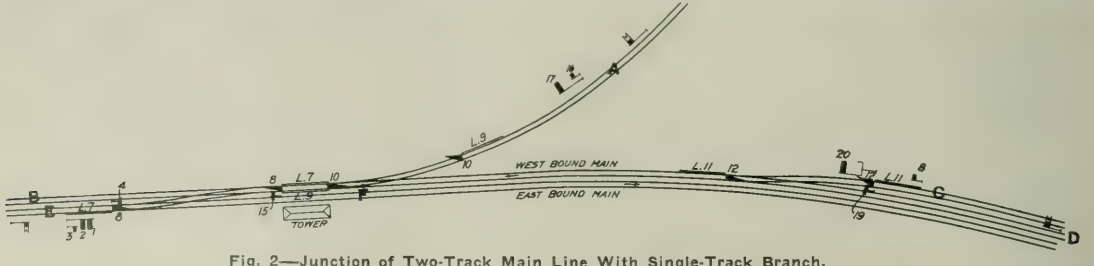


Fig. 2—Junction of Two-Track Main Line With Single-Track Branch.

Full protection can be provided at minimum expense by choosing certain levers as route levers and locking their latches. There are the following possible routes in the present case: A-B, C-B, E-F, D-B, A-E, C-E, D-E, B-A, B-C, B-D, F-E, E-A, E-C, E-D. These may be so grouped together that from A to all possible points can be considered as one route; the same for E and B. Now, suppose

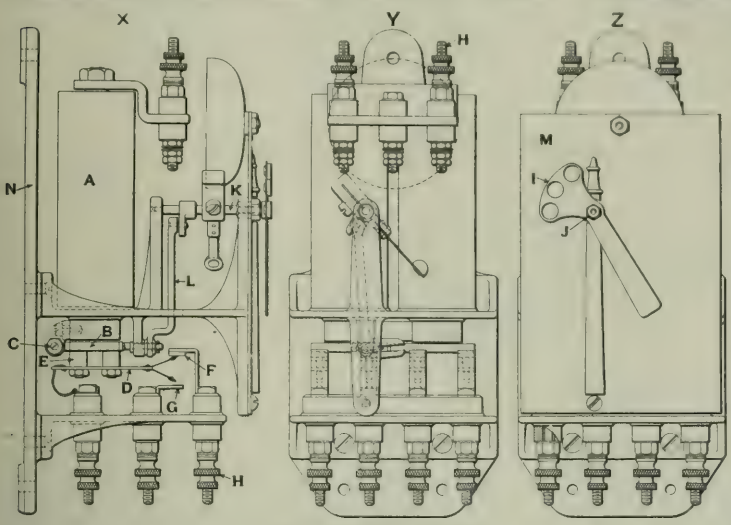


Fig. 3—Electric Indicator.

the dog locking arranged so that in setting up a route to or from A and B, No. 9 must be thrown last before the signal, and to or from E on the main line No. 7 must be thrown last before the signal. Then Nos. 9 or 7 reversed will lock all the functions in the route and will in turn be locked by the signal lever. Therefore, Nos. 9 and 7 are the only levers whose latches need be supplied with locks. These locks must lock the latch down with the lever reversed. This must be done every time a derail or lock lever is used as a route lever. Frequently when a switch lever is used as a route lever the lock must lock the latch down with the lever either normal or reversed. This must be done so as to render movement of the function impossible, while the lock is de-energized. In the case of a home signal lever this should not be done, because it should be always possible to put the signal normal to stop a train in case of emergency. When so supplied, complete protection against wrongful movements of switches and derails is afforded without reference to the home signal levers, no matter what route is being used.

Another method is to have the home signals locked reversed as soon as cleared, and released only when a train has reached a certain point within or beyond the interlocking limits. This will be discussed later in connection with approach locking.

At power plants with electric control the same methods as above described may be used; that is, levers may be locked direct. Usually there are no latches or latch locking at these plants, consequently the lever itself must be locked. Another difference is that there are usually no separately operated facing point locks at power plants. Therefore the locking must act on some derail or switch lever in the case of route locking. Also, these levers must be locked in the full normal or reverse position, as the case may be, for the reason described above in connection with mechanical interlocking. The disadvantage of this system is that there is no physical connection between the function and its lever, so that though the lever may be locked in one position, it is possible for the function to be in the opposite position. Also, control contacts may become detached, maliciously or otherwise, from the lever proper, and by working loose, or being moved through their stroke, cause false throwing of functions, although the lever is locked. It is almost impossible to produce a mischief-proof power interlocking machine.

A better method is to break the control or indication circuits of the various functions through points on the indicators or on relays controlled by them. It is the usual practice to break the indication circuits of the signals and the control circuits of the switches, derails, etc.

If the indication circuits of all signals are broken while a train is occupying the route or section of route governed, the protection will be complete. For, when the indication circuit is broken, the releasing device on the lever cannot act, and the lever is held in an intermediate position, thus locking all opposing and conflicting routes as if it were at full reverse. Usually, however, the indication circuits of the high home signals only and the control circuits of the switches and derails in a route are broken. This is done, because if, with no control on the switches, a signal should be out of order, and it were necessary to flag a train through, there would be no protection; this for the reason that there would be nothing to compel the signalman to reverse his signal lever, and with the signal lever normal the route would not be locked.

The principal disadvantage of using circuit control is this: A signalman may get his lever over and line up a new route by forcing or "plugging" his indication, although with this system functions cannot normally be falsely moved. This can be provided against by breaking the circuits of switches and derails in conflicting routes through the same relays. This is usually impracticable on account of complication, with consequent liability to failure, and also on account of the expense. The best system would seem to be a combination of lever locking and circuit control; that is, break the high home signal indication circuits and the switch and derail control circuits and lock route levers.

There is another system of so-called electric locking. In this, conflicting routes only are locked; that is to say, a train in a certain route locks switches and derails in conflicting routes only. This is no more nor less than dog locking is designed to do, and does with unexcelled efficiency.

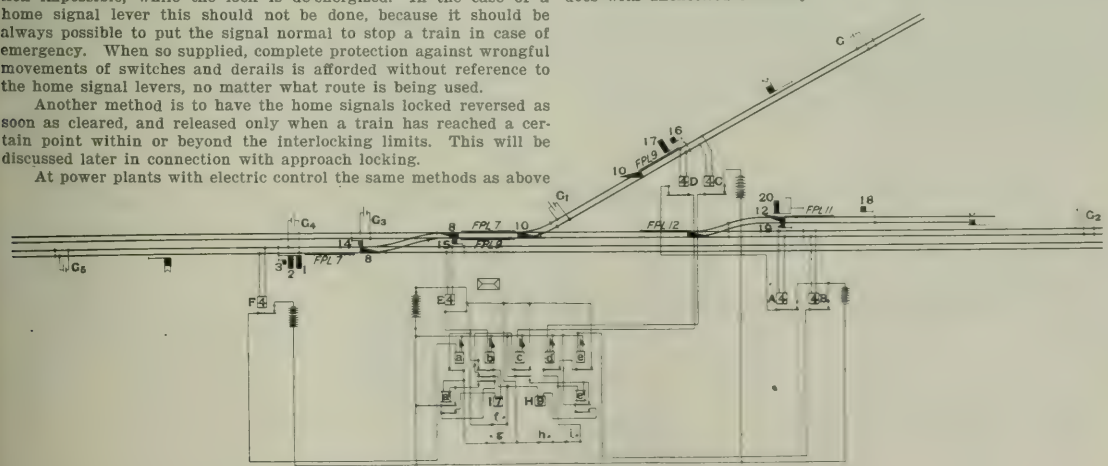


Fig. 4—Electric Locking for Switches and Signals Shown in Fig. 2.

At power plants controlled otherwise than electrically, lever locking is the only variety that can be economically and efficiently applied. Valves and their controlling apparatus are cumbersome and expensive; moreover, in this case, physical connection between the lever and its function is very closely approximated.

Where any one of these systems is applied only to track sections within the home signal limits the use of detector bars can hardly be dispensed with. It takes an appreciable length of time for a track relay to act, and the indicator and the lock consecutively consume equal periods. Therefore, before the lock has acted it may be possible to change at least one of the switches or derails in the route.

Consequently it is advisable to have a detector bar at the entrance to each high-speed route, at least.

To overcome this difficulty and to prevent absolutely any change of route after a train has passed the distant signal at clear, approach locking has been introduced. This is an arrangement of circuits whereby the lock on the home signal, or route lever latch, operates when a train approaches the interlocking plant with the governing signals in a certain position.

Broadly, there are in use two systems: In one the lock acts as above when the train is approaching the distant signal with the home signal clear and holds until the train has reached a point within or beyond the interlocking limits. This may be modified so as to require the distant signals, also to be clear; or it may be made to act when a train has passed the distant signal with the home signal clear. In the other system the route is locked by locks on the route levers or switch levers as in the above, but the home signal is locked reversed with the latch up, as soon as it is cleared, regardless of whether a train is approaching or not. Of course, in dealing with electrically controlled power plants the above may be modified so as to break control and indication circuits as described heretofore.

Fig. 4 shows the approach and other locking circuits for the mechanical interlocking plant shown in Fig. 2. The system is that described for Fig. 2, and the first of the approach locking systems.

A, B, C, D, E, F are 4-ohm track relays controlled by batteries G, etc., through their respective track sections. a, b, c, d, e are indicators. a is controlled by F, b by E, c by A and D, d by C, and e by B. H is a lock on the latch of lever No. 9, and I is a lock on latch of lever No. 7. f, g, h and i are circuit controllers operated by levers Nos. 8, 2, 17 and 20, respectively. Suppose a train approaching on the branch line with the route lined up: Until the first track battery G is passed the route can be changed at will, but as soon as G is passed relay C opens thereby, de-energizing indicator d and the lock H. For, when No. 17 was reversed, circuit controller h was opened and the shunt on the point of d and e removed. Thus No. 9 is locked reversed and the route cannot be changed. No. 9 remains locked until the train has passed beyond signal No. 4, as by its passage relays D and A are successively opened, thereby de-energizing indicator c. This keeps the circuit for lock H open. The signalman is prevented from restoring his lock through putting his signal levers normal while a train is approaching by the special stick wiring of the relays a', e' which control the locks with the "home" indicators. They are controlled by the "distant" indicators a, d, e, and break their own circuits. They can be restored only through the back contacts on their respective "home" indicators when a train is in the home section. Suppose a train approaching without the signals clear; in this case the route would not be locked and the signal man could hold the train at the home signal until ready for it to proceed. At the same time he could allow another train to use any of the routes within the plant.

The necessity for circuit controller f on lever No. 8 is this: Suppose the route through the cross-over set up. Now, to be absolutely safe No. 9 must be controlled by relay E through indicator b; otherwise it would be possible to move any of the switches other than the cross-over while the train is in the eastbound home section. Therefore, f is made to break the shunt around the point of indicator b in the circuit of lock H. It would not do to have lock H controlled by this indicator in every case. If this were done a train in the eastbound home section using the main line route would pre-

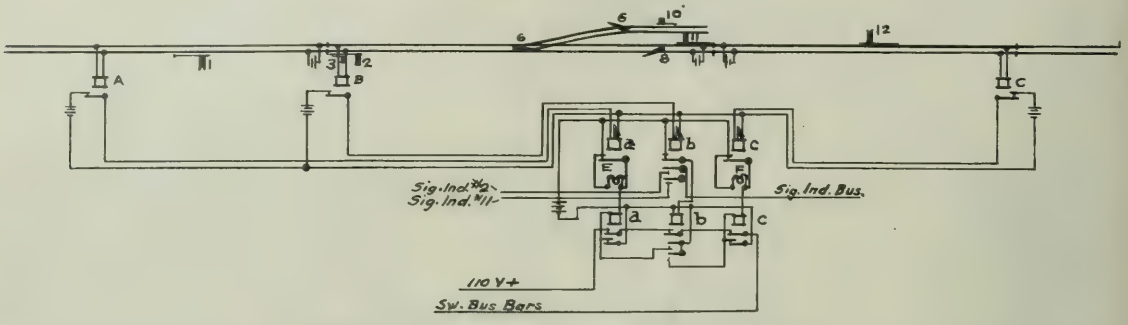


Fig. 5—Approach Locking for Single Switch on a Single Track Main Line.

vent parallel movements in the rest of the plant. These circuits could be used equally well at a power plant.

One modification that is frequently made is to put the circuit controllers on the distant signal levers. When this is done the approach locking takes effect only when the distant signal is clear with a train approaching. In the plant under consideration the distant signals are assumed to be power operated without separate levers. Some advocate breaking the circuit for the "distant" indicators through normally closed circuit controllers on the home and distant signals, so that if either should fail to assume the full horizontal position when the levers are put normal, the route would remain locked. The above applies to all that follows.

Fig. 7 shows the circuits for approach and other locking at a simple single track crossing. Here a separate circuit is run for the lock through a circuit-breaker on the distant signals, so that the locking will not release until the distant signal arm is in full horizontal position. The locks act on the latches of the home signal levers to which are attached the shunt circuit controllers F, G, H, I. These circuit controllers are closed only when the levers are normal and the latches down. Fig. 8 shows the same crossing wired with the indicator circuit through a circuit controller on the distant signal arms. Here the distant indicator drops when the distant signal is cleared, whether a train is approaching or not. The locks act as in Fig. 7, but the circuit controllers need not be attached to the latches. They can work with the home signal levers. The stick relays, X, Y, hold the lock circuits open during the passage of a train, whether the signal levers are restored or not. This circuit is suitable for a power plant in which control and indication circuits are broken and there are no locks on the levers. At such a plant stick relays are necessary, as there is no latch locking, unless the section of lever stroke, after indication has been received, is long enough to operate a circuit controller. At a plant where the home signal lever latches are locked stick relays are not needed, as the shunt circuit controller can be made to close only when the lever is normal with the latch down, and this condition will not occur until the lock is released. At power plants the point at which the lever

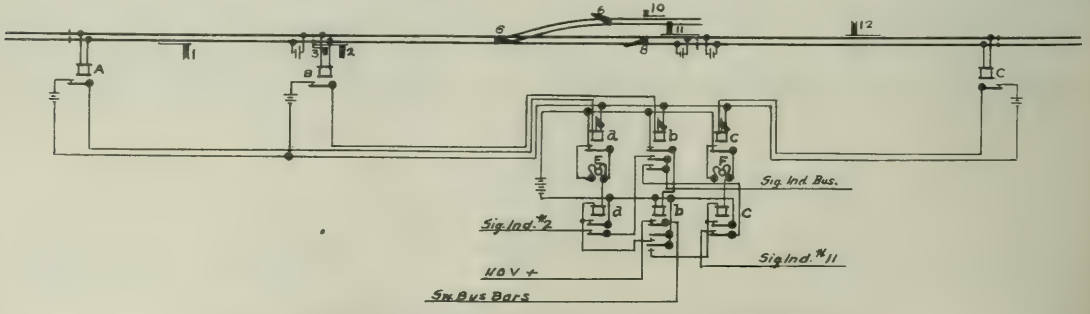


Fig. 6—Approach Locking for Single Switch on a Single-Track Main Line.

is stuck, for the indication can sometimes be used as the latching point as above. But in any case where the shunt circuit controller is operated by a lever other than the one upon which the lock acts, a stick relay must be used.

Next consider a power plant using the first modification described for Fig. 4 but without lever locks. Indicator relays are provided, controlled by track circuits in the usual manner. The indication circuit for each high home signal is broken through a front point of the indicator relay controlled by the track circuit in the

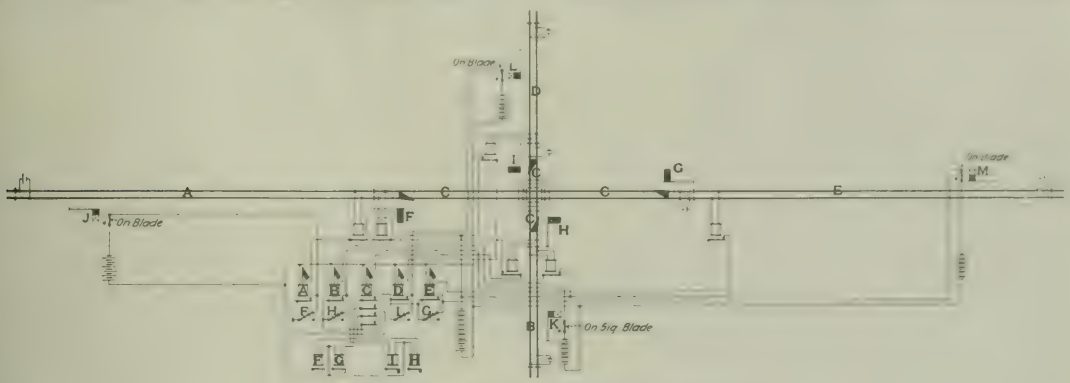


Fig. 7—Approach Locking for Single Track Crossing.

route governed. The approach locking is accomplished by breaking the indicator circuit of the home signal governing a certain route through the front point of a stick relay controlled by a circuit controller on the distant signal lever in parellel with a front point on the distant indicator relay. In this system, unless the distant signal has been cleared, it is possible to put a home signal lever normal at any time, provided a train is not in the section governed. This does away with all delay in case the wrong route has been lined up. It is usual to restore the stick relay in the advance section, when there is one, in order to permit back-up movements. With this system there is no delay due to the locking in case the signalman neglects to put his home signal lever normal promptly. As, when the distant signal is clear with a train approaching, the home signal indication is stuck until the train has passed out of the home section, there is no need to break the control circuits of switches in conflicting routes, as the mechanical locking in the machine will prevent switch levers from being moved. With this system signals can be tested at any time without the necessity of using a hand release.

The second system, wherein the home signal is locked as soon as its lever is reversed, is used most extensively at power plants electrically controlled. In this system the indication circuits of the home

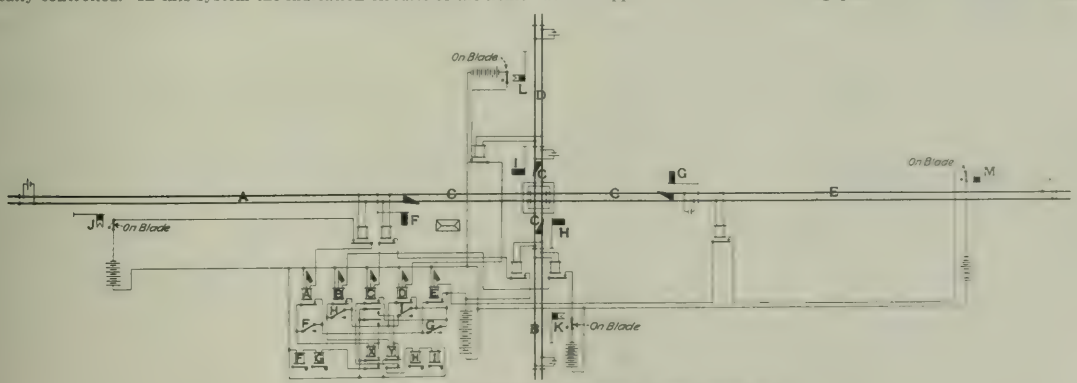


Fig. 8—Approach Locking for Single Track Crossing.

signals are normally broken through open back points of indicator relays, controlled by the home track circuits, so that the signal lever cannot be put normal without forcing the indication or using a hand release unless a train happens to be occupying the track section. In other words, if the signalman clears a home signal he cannot restore his lever in the usual way unless a train is within the interlocking limits on the track governed. Additional approach locking is accomplished by breaking the power circuits of the switches and derails in the route governed through points on a stick relay. The stick relay is controlled by a circuit controller on the distant signal lever in parallel with the front point of an indicator relay controlled by the distant track circuit. At a mechanical plant there would be a lock on the latch of each high home signal. This lock would be controlled by a normally open circuit with a back point on the home indicator. With this arrangement, as soon as the home signal is cleared, the dog of the lock will drop and lock the latch and will release only when a train enters the home section. The disadvantages of this system are as follows:

1. It is impossible to test signals easily. Every time the lever is reversed it locks itself. This is particularly annoying at mechanical plants in winter, when it is necessary to move the signals frequently to keep them from freezing.

2. It interferes with flexibility of operation. If the wrong route is lined up by mistake it locks itself, thereby causing delay.

3. To make a plant absolutely safe it is necessary to break the circuits of switches and derails in conflicting routes through the same relay. This is to prevent lining up conflicting routes by forcing indications. This is expensive and complicated.

4. It leads signalmen into the habit of forcing the indications, as this is easier than any other method of releasing.

It has one great advantage, however. A signalman is not so likely to go to sleep on duty with the route lined up under this system as under another. The chances are that he would not awake until after a train had passed the releasing point. This would mean delay to following trains and consequent awkward explanations. It has been claimed for this system that the wrong route will be lined up less frequently than with other systems, for the reasons given above. Also, it has been said that an engineman seeing the home signal clear should assume that he had authority to proceed at full speed, even though the distant signal were against him. If this were good practice, why go to the expense of erecting distant signals at the approach to an interlocking plant where the view is unobscured and the line straight for a mile or more? Also distant signals govern the approach to the advance signals as well as to the home signals and the consequences of not being able to stop at an advance signal are the same as those involved in not being able to stop at a home signal. Besides, why not accomplish the approach locking by means of a circuit controller on the home signal lever and obtain the same results with a simpler and more flexible system?

Fig. 5 shows the circuits for the system last described. Here an electric power plant is shown. Fig. 6 shows the circuits for the first system as applied to a similar plant. No lever locks are used in either case. In both Fig. 5 and Fig 6, A, B, C, are track relays;

a, b, c, indicators, a', b', c', are secondary relays, controlled by the indicators. These relays are so made as to carry a heavy current through their points. E and F are circuit controllers, normally closed, operated by the distant signal levers. The operation of the various pieces of apparatus is substantially the same as in the mechanical plant described in Fig. 4.

It will be observed that all circuits for the control of routes are so arranged that if any part of the apparatus should fail or become deranged in any way, the locking would act and hold the route, or possibly the whole plant locked, until the trouble was repaired. This is the governing principle in signaling. If anything fails a dangerous condition must not result.

With any of the systems of approach locking above described detector bars can be dispensed with. It is safe to do away with the bars, for, when it is safe for a train to proceed all high-speed routes are locked before the train has reached the home signal. The time consumed by the electrical apparatus in acting does not count, as the approach track circuits are run far enough back to insure early action. If the electric locking device fails, it locks the route; if a detector bar fails it is inoperative. Electric locking covers the whole route, detector bars only portions of the route.

Nothing has been said about methods of releasing the locking should it get out of order. There are many ways of doing this, but the best and safest is to make a repairman attend to the trouble and relieve the signalman of all responsibility. In this connection the only safe course is to put the relays, the indicators and the machine under locked covers and allow only the repairman to have a key. The repairman should be the only one responsible for the safe operation of the plant; the signalman's only business is to operate the functions for the passage of trains.

One important feature of electric locking yet remains unstated. It compels respect for dwarf signals and makes proper handling of switching movements imperative. In an ordinary plant without electric locking, how often does the last car of a string clear the governing signal before making a back-up or switching movement? How often has a detector bar been caught up or a switch split simply because attention was paid only to the movement of the switch points? With electric locking a train must be out of the section involved before the signalman can move a single switch or even unlock it. Therefore, a train to be switched must, in every case, not only clear the switch, but the back-up signal as well.

Now, all that remains is one question: Does electric locking pay? Accident Bulletin No. 17 of the Interstate Commerce Commission contains the record of a collosion (No. 4) and a derailment (No. 3). In the first four persons were injured and the property loss was $4,350. In the second fifteen persons were injured and the property loss was $5,000. Both were caused by defective detector bars and would have been prevented by electric locking. At Marion, N. J., June 2, 1906, a passenger train was derailed at a drawbridge and the engine fell into the water. The bridge was seriously damaged and the property loss was $21,700. The signalman put the signal levers normal and opened the draw after the train had passed the *home signal*. Fortunately, no one was seriously injured. There was no electric locking at the bridge.

Value of Grade Reductions.

BY WILLIAM G. RAYMOND.
Dean, College of Applied Science, State University of Iowa.

Apropos of the recent discussion of economic train speeds, it may be worth while to say that the writer has for some years taught his students that the most economical speed for a freight train is the highest speed that can be safely maintained through a given division with the engine loaded with its maximum load for an assumed minimum speed on the ruling grade, and nothing that he has seen in the discussion mentioned seems to warrant a change in this rule, unless it be to add that the rule holds so long as the locomotive capacity on the ruling grade is not greater than a workable train. This limit will vary on different roads, according to the ruling grade, trackage and traffic.

Nevertheless, it seems to be entirely true, for several reasons, that a heavy train at slow speed costs more per train mile than a lighter train at higher speed, and an effort will be made to show that in determining the value of reductions in ruling grade, allowance should be made for this fact. Considering that the whole estimate of the value of grade reduction is based on a segregation of operating expense that is at best but roughly approximate, the point may seem hardly worth making, but in a problem that recently came to the writer, the inclusion of an allowance for the extra cost per train-mile for heavier trains resulting from the grade reduction lessened the theoretic value of that reduction by about one-fifth, which seems to be too large a fraction to ignore, particularly as the error is systematic and not as likely to be one way as the other.

An approximate statement of the problem will be given and three methods of determining the result compared.

On a division 180 miles long the ruling grade is 1.0 per cent. and the value of the contemplated reduction to 0.8 per cent. is desired. As an average of the year there are 18 daily trains both ways, six passenger trains unaffected by the ruling grade as such, six slow freight trains making 12 miles an hour on the ruling grade, and five fast trains making 15 miles an hour on the ruling grade, with one light way freight unaffected by the ruling grade as such. The maximum trains are drawn by a 10-wheel locomotive having 131,200 lbs. on the drivers, 2,586.8 sq. ft. of heating surface, and a total engine and tender weight of 304,000 lbs. The average train-mile cost is $1.24 and money is worth 5 per cent.

The boiler tractive effort of the locomotive is determined by the formula:

$$T\,b = \frac{146 \times \text{heating surface}}{\text{speed in miles per hour}},$$

With train resistances for 12 and 15 miles an hour respectively for the formula

$$R = 3.5 + 0.0055\ S^2 + \frac{16}{(S+1)^2},$$

And grade resistances of 20 and 16 lbs. per ton respectively on the 1.0 per cent. and 0.8 per cent. grades, the net loads behind the tender, excluding a 15-ton caboose, will be:

	12 miles.	15 miles.
1.0 per cent. grade	1,120 tons.	848 tons.
0.8 per cent. grade	1,373 tons.	1,044 tons.

Following the usual assumption that the trains affected by the ruling grade will be in number inversely as the net hauling power of the locomotive, the six slow trains required by the 1.0 per cent. grade will become 4.86 trains on the 0.8 per cent. grade, and the five fast trains will become 4.05 trains on the 0.8 per cent. grade. The total saving then will be 2.09 daily trains, the fraction being allowable because it represents a yearly average. Without doubt the fast trains cost less per train-mile than the slow trains, but in the problem an average freight train-mile cost will be used. If the average train-mile cost on the road is $1.24, freight train-miles may cost perhaps $1.42 and passenger train-miles $.88. A somewhat careful guess is that the addition to the cost per train-mile for heavier trains is about 1 per cent. for each 10 per cent. increase in the weight of train, and a careful estimate of the items of daily expense affected by a change in the number of trains indicates that about 45 per cent. of the average train-mile cost is saved or added for each train-mile saved or added, the tonnage remaining constant.

These results, then, by the method of Mr. Wellington:

Annual saving 365×2.09 trains over 2×180 miles at 45% of $1.24 = $153,241.31.

If, instead of using the average train-mile cost for this problem the average train-mile cost of the trains affected, namely, the freight trains, be used,

Annual saving $= 365 \times 2.09 \times 2 \times 180 \times .45 \times 1.42 = $175,486.01.

But the hauling capacities of the locomotive on the two grades indicate that the trains on the lighter grade will be roughly about 20 per cent. heavier than those on the 1.0 per cent. grade, and hence their train-mile cost will be increased perhaps 2 per cent. The number of trains so affected is 8.91, and the annual cost of these trains at 2 per cent. of $1.42 is about $33,250, which sum should be deducted from the annual saving by the second method, giving $142,236.

For this particular problem the first method, which is that of Mr. Wellington, gives a result closer to the truth than does the second, which has been used in the more noted discussions of grade reduction. But it is considerably in error on the wrong side, and the second method, which has been so much used, is in error by between one-fifth and one-fourth, assuming the third method correct.

Whatever may be the opinion as to the reasonableness of the figures used, the conclusion seems to be entirely reasonable that the greater train-mile cost of the heavier train should be considered in determining the value of grade reduction, for this item in this particular problem reduces the theoretical reduction values by nearly $3,700 per mile of road.

While it is of much less importance, the same allowance should be made in determining the average train-mile cost to be used on the lower grade line in discussing the values of the reduction of distance, rise and fall and curvature. That is, by the method of Mr. Wellington the new train-mile cost would be

$$\frac{18 \times \$1.24 - 2.09 \times .45 \times 1.24}{18 - 2.09} = \$1.3292+$$

By the second method

$$\frac{18 \times \$1.24 - 2.09 \times .45 \times 1.42}{18 - 2.09} = \$1.319 -$$

When the effect of the greater cost of the heavier trains is introduced the result is

$$\frac{18 - 1.24 - 2.09 \times .45 \times 1.42 + 8.91 \times .02 \times 1.42}{18 - 2.09} = \$1.335 -$$

No serious blunder is likely to result from the use of any one of these train-mile costs for the minor items, and although the last one gives the greatest train-mile cost and will therefore show the greatest values for given rise and fall, distance and curvature reductions, it would seem to be the wiser figure to use, since it is probably nearer the truth than either of the other two.

American Railway Association.

The spring meeting of the American Railway Association was held at Chicago, April 24, over 250 delegates being present. The present membership of the Association is 329 companies, operating 234,321 miles. The Executive Committee reported that the President had appointed a Special Committee on Standard Location for Third Rail Working Conductors and also a Committee on Car Efficiency. The report of this last named committee was printed in the *Railroad Gazette* last week, page 581. As a result of the report and the discussion on it, which was preceded by protracted informal meetings and discussions on the Monday before the meeting, the Association adopted the three recommendations of the committee, the last one of which is an endorsement of the American Railway Clearing House and what it is doing looking toward the establishment of a general freight car pool or its equivalent. It was recognized, however, that the movement for anything in the nature of equal interchange of cars must proceed very slowly and the views of the minority of the car service committee (see below) were recognized to the extent of ordering a letter ballot on the universal adoption of a penalty of $5 a car for diversions. The proposed diversion rule, which, if adopted, will go into effect September 1, is given below. In short, the Association is in favor of a strong effort to pool cars, but in the meantime, believes a penalty necessary and useful—in spite of the committee's conclusion that the roads which have been trying the penalty have not found it very satisfactory.

The statistics of car movement gathered by the Committee on Car Efficiency and by the Clearing House, have thus far been kept confidential and reported only in totals or with names of roads omitted but henceforth roads will be asked to permit their figures to be sent to other companies to be sent to all members.

The Committee on Car Service reported that it had decided adversely on the question, referred to it last autumn, whether a lower per diem rate should be adopted for switching and terminal railroads. The committee holds that the reclaim provided for in the present rule 5 is generally sufficient, and that in many places it is found to be so large that the switching roads receive more than they pay out. The committee seems to have found that the roads which have experimented with the diversion rule have found no marked benefit from it; and the free use of foreign cars without regard to the rights or wishes of the owners is, if anything, more general than ever. Therefore, the committee was not in favor of a diversion rule; moreover, a considerable number of roads are trying to effect reform in exactly the opposite direction, that is to say, by promoting the efforts of a clearing house. The committee reports that the General Superintendents' Association of Chicago is discussing a set of rules to regulate the transfer of cars, which it is hoped will be suitable for general adoption.

Acting on the suggestion of the Association of Transportation and Car Accounting officers the committee recommended the adoption of the following rules for tracing interline carload freight, and they were adopted by the Association:

1. Each tracer for carload freight should be handled through the Car Service Department.

2. No tracer shall be started until the shipment shall have had sufficient time to reach its destination. (Do not confuse with requests to expedite freight. See footnote.)

3. No tracer shall be handled by wire except in case of perishable or highly important freight, or a shipment which has been unreasonably delayed. Such tracer when received by wire should be answered promptly by wire.

4. Each tracer should show the initials and number of car, commodity, point of origin, date of forwarding, route, consignee and destination.

5. (a) When an interline tracer has been properly started as per Rules 1 and 2, it shall be promptly forwarded to the road to which the shipment was delivered, and the originator of the tracer shall be immediately notified of the date, time and place of such delivery; the road making delivery to consignee will promptly advise the originator of the tracer direct, of the date of arrival at destination.

(b) If the shipment has been transferred en route, that information shall also be transmitted, referring to the original car number.

6. When a tracer originates with the consignee, it shall be transmitted from one road to another in reverse order to the route until the shipment is located, when the tracer shall be handled as provided by Rule 5.

NOTE.—These rules do not refer to requests to expedite the movement of freight.

The committee submits two standard forms for interchange and junction reports, one small and brief, the other larger and giving point of shipment, final destination and contents of cars.

The committee proposes to draw up a revised set of rules for car service (demurrage) associations.

Two members of this committee, Messrs. Trump (Penn.) and McKenna (C., M. & St. P.), presented a minority report in which they declared that as anything like a pool or clearing house, in order to be successful, must be agreed to by all roads, it would be better to continue the attempt to cure diversion by a penalty; to adopt a more stringent rule in place of Pier Diem rule 3, for the return of foreign cars, and with a penalty of $10.

The Committee on Safety Appliances reports the number of freight cars in service on the lines of 290 companies reporting on January 1, 1907, as 1,902,582, of which 94.3 per cent. are equipped with air brakes. New freight cars contracted for aggregate 201,239.

The Committee on Transportation of Explosives stated that the Bureau for the Safe Transportation of Explosives and Other Dangerous Articles had been duly organized in New York City on November 21, 1906. The committee also stated that Major B. W. Dunn had been appointed Chief Inspector of the Bureau. Dr. C. B. Dudley, Chemist of the Pennsylvania Railroad at Altoona, Pa., is president of the Bureau; N. D. Maher, General Manager of the Norfolk & Western, Vice-President, and W. F. Allen, New York City, Secretary and Treasurer. Eighty-six companies have joined the bureau.

The Committee on Standard Rail and Wheel Sections reports that the standard wheel section tentatively adopted by the Master Car Builders' Association last June, is proving satisfactory. The committee believes that there is no necessity for a radical change in the A. S. C. E. rail section, so far as it relates to the wheel as a bearing surface. The section has not been criticized, except with a view to strengthening the rail by a better disposition of the metal.

"The committee feels that some consideration should be given to the question of canting the rails, to conform to the coning of the tread, and experiments are now being conducted to determine the effect of this arrangement, especially in the feature of wear.

"The introduction of electric motors of low center of gravity, long, rigid wheel base, and wheels of small diameter, will no doubt have an effect on rail wear in the future. The effect on the rail in the London tubes has already caused comment and has led to a suggestion for the appointment of a Committee of the English engineers to investigate the subject."

The committee has consulted expert chemists and metallurgists and is considering a code of specifications for the manufacture of steel rails. This, when formulated, will be discussed with the rail makers.

The Committee on Standard Location for Third-Rail Working Conductors has appointed a sub-committee to compile a code of terms, and will co-operate with committees of the American Railway Engineering and Maintenance of Way Association and the Master Car Builders' Association, the co-operation of these associations being deemed necessary to the proper treatment of the subjects connected with third rails. The committee recommended that it be empowered to prescribe clearances for overhead equipment, and the Association so ordered.

The Committee on Statistical Inquiry reports the results of its correspondence with Statistician Adams, of the Interstate Commerce Commission, in regard to what the government proposes to require in the way of operating statistics, when the new provision of the law is put into effect. Professor Adams intimates that statistics of physical elements, such as equipment, maintenance and operation, with standard units for the measurements of transportation performance not only will be prescribed by the commission, but are needed to enable the commission to judge of the results of railroad operation, but he assures the committee that nothing will be done to interfere with the liberty of experiment necessary for the development of railroad practice. Professor Adams invites the co-operation of the association in the development of a correct theory of statistics. The committee submits a modified classification of operating statistics. This classification is the result of conferences with Professor Adams and, apparently, is identical with the one which he intends to adopt. It does not differ materially from that heretofore recommended by the committee.

The Committee on Standard Cipher Code reports that 3,050 copies of the code have been printed and sold and a fourth thousand is now being made. A list of the users of the code has been issued, revised to date.

The diversion rule on which members are to be asked to vote between now and May 25, to be put into effect September 1, is as follows:

First Proposed Form of Rule 3 of the Per Diem Rules.

Rule 3. Foreign cars must be handled as follows:

WHEN LOADED.

a. Loaded (via any route) so that the home road will participate in the freight rate.

b. Loaded to the road from which originally received, if such loading is in the direction of the home road, *but not otherwise.*

c. Loaded to an intermediate road in the direction of the home road.

(NOTE.—A road or a combination of roads competing with the road owning the car from point of delivery to destination shall not be considered as an intermediate road or roads.)

d. Loaded in local service in the direction of any junction point with the home road.

e. Cars may be loaded locally in an opposite direction from the home road or home route if to be loaded according to section *a*, *b*, or *c*.

WHEN EMPTY.

Foreign cars must be handled as follows:

f. Empty cars belonging to a system having a direct connection must, unless the owner objects, be returned to such connection regardless of whence they came.

g. The car owner shall have the right to demand the return of his empty cars at the junction point where delivered loaded.

h. Empty cars may be sent in an opposite direction from the home road or home route, if to be loaded according to section *a*, *b*, or *c*.

i. Empty cars may be delivered to connecting road, switching or otherwise, to

be loaded in accordance with section *a*, *b*, or *c*, *but not otherwise*.

j. When necessary to return cars empty belonging to roads other than direct connections, they may be delivered to the road from which received.

WHEN IN SWITCHING SERVICE.

k. Cars received loaded in switching service must be confined to switching territory, and when made empty must be returned to the owner if a direct connection within that territory, or otherwise to the road from which received.

l. For each violation of these rules, actual or constructive, a penalty of five dollars ($5.00) shall apply.

m. The Chairman of the Committee on Car Efficiency of the American Railway Association is hereby authorized to act as sole arbitrator to determine, upon evidence submitted, whether or not there has been a violation of this rule. .

Second Proposed Change of Rule 3 of the Per Diem Rules.

Rule 3.—Sections *a* to *l* the same as in the first form.

m. The Chairman of the Committee on Car Efficiency of the American Railway Association is hereby authorized to act as sole arbitrator, to determine, upon evidence submitted whether or not there has been a violation of this rule; *and will, on request, suspend or modify the operation of this rule in favor of any road that has on its lines less than 95 per cent. of the number of cars it owns.*

The committee on car efficiency laid before the meeting a letter from a Chicago lawyer, Mr. W. J. Calhoun, giving an opinion as to the right of railroads under the Interstate Commerce law to refuse to deliver cars to roads which refuse to enter the Per Diem agreement. The law now requires railroads to establish through routes and through rates; and, even before the law so stipulated, these practices were so common that they should be treated as necessities of commerce. The interchange of cars is also so common that the practice must be considered a necessity in such commerce. In so important and expensive a matter, elaborate and precise rules and regulations are held by the courts to be a reasonable necessity. Numerous decisions of the Supreme Court of the United States are cited to sustain this. In considering the fairness or justice of any rule or regulation the courts will base their opinions on reasonableness, and will justify rules designed to prevent confusion and discrimination by the establishment of uniformity of practice. A railroad that refuses to submit to reasonable rules and regulations or to pay reasonable compensation for the use and detention of cars may, therefore, be refused the use of such cars.

Summarizing his conclusions Mr. Calhoun says:

"1. Can a railroad company legally refuse to furnish a shipper with its own cars to be loaded to another railroad, provided such railroad refuses to abide by the Per Diem Rules?" With the understanding that the Per Diem Rules are reasonable, and the charges fixed are reasonable and just, my answer is in the affirmative. A railroad, under such circumstances, is justified in refusing to furnish a shipper with cars.

"2. Can a railroad company legally refuse to furnish a shipper with cars of a second railroad, for loading to a third railroad company, provided the third railroad company refuses to abide by the Per Diem Rules? Under the Per Diem Rules the first railroad is responsible for per diem and the cars." If the cars of the second railroad are to be delivered to the shipper with the consent or at the request of the owner, then the first railroad cannot refuse to deliver to the shipper. In such case the first railroad is not responsible for the cars or for the per diem when they are finally delivered to the third railroad. If, however, the cars of the second railroad come into the care of the first railroad, in the ordinary course of business, without any such consent or direction as above noted, then the first railroad is responsible to the owner for the per diem, as well as for the safety and return of the cars. In such a case, the first railroad can refuse to deliver the cars of a second railroad to a shipper, for loading and delivery to a third railroad, when the latter refuses to pay the per diem.

"3. Can a railroad company refuse to make through freight rates to points, on another railroad, provided such railroad company refuses to abide by the Per Diem Rules?" This question is substantially of the same import as the first, and the answer to both is the same. Through rates means through routing, and both expressions involve the use of cars; and where reasonable rules and regulations are not recognized, a carrier is not compelled to establish a through rate.

Mr. Hale also read at the meeting the following letter from Hon. Franklin K. Lane, of the Interstate Commerce Commission:

"It is our desire to see everything done that is practicable to stimulate the movement of equipment. . . . We have found throughout the country that railroads have been bidding against each other for business by the granting of free time. Instances of this kind arose at our hearing in Chicago upon the general subject of car shortage, where the shippers confessed that they did not need the time that was granted them, and were willing to have it reduced from five to two days. Every effort put forth by the railroads to stop the using of cars as warehouses and limit their use to purely railroad purposes will have our cordial co-operation. Shippers must have a reasonable and not an excessive time to unload, and I think that most of the shippers realize that it is a part of good citizenship at a time such as this to release equipment speedily in the interest of the general business of the country."

W. C. Brown (New York Central) was re-elected President, and W. A. Gardner (Chicago & North-Western), Second Vice-President. The Association will hold its next meeting in Norfolk, Va., October 23, 1907.

The reason for adopting a diversion rule was voiced by Mr. C. A. Goodnow, General Manager of the Chicago & Alton, after the meeting, as follows:

"It has become apparent to operating officials that the charge of 50 cents a day for the use of interchanged cars does not bring the cars home, and many of the large Chicago roads, in spite of the fact that they have bought or built a very large number of cars, have to-day a smaller number of their own cars on their lines than ever before; and in some instances the difference between their own equipment on foreign lines and foreign cars on their own lines amounts to four or five thousand cars. This has made it clearly apparent that a diversion rule is absolutely necessary. A penalty for diversion does not cover everything, however; and we shall find that a penalty for delay must be added. The use of foreign cars in local service will still be easy [by roads disposed to be unfair], and the 50-cent rate ought to be increased, after 30 days to say, $2."

If a carrier accepts freight from a shipper consigned to a point on another line which refuses to pay a reasonable per diem, and the first line gives through billing therefor, or is a party thereto, such carrier will be responsible to the shipper for any default in the transportation. If the shipment is to Chicago, for instance, the carrier may bring it to that city, but may refuse to deliver it to a connection that refuses to pay the per diem, provided there is nothing in the bill of lading that requires such delivery.

A carrier may refuse to allow its empty cars to go to a connecting line for the use of a shipper located thereon if such road refuses to pay per diem. If a carrier accepts loaded cars from a connection, billed to another connection, and the latter refused to pay per diem, I think the intermediate carrier will be bound to make the delivery. It should give notice to all connections that it will not accept cars billed to such other carrier, for the reason it will not pay per diem charges, and then it may refuse cars subsequently tendered.

Mr. Kruttschnitt, Director of Maintenance and Operation of the Union Pacific and Southern Pacific, speaking after the meeting, said:

"The increased per diem will unquestionably act as a powerful incentive for the return of cars to owners. Small roads not equipped will certainly take steps to provide themselves with cars in lieu of paying twice the rental that they formerly paid. Already the raising of the per diem from 25 to 50 cents by a considerable number of roads, coupled with the strong expectation that the 50 cent rate would be adopted as the standard rate, has impelled many large roads that were short of equipment to order large numbers of cars.

"The proposed diversion rule to be submitted to letter-ballot, will make it much easier to get cars home. The penalty for diversion is sufficiently severe to make the practice decidedly unpopular, and the clause that makes the Chairman of the Committee on Car Efficiency of the American Railway Association sole arbitrator to determine whether there has been a violation of either the letter or spirit of the rules will prevent car-service agents from exercising their ingenuity to divert cars in some new way without violating the letter of the rules.

"I think the action of the Association a distinct step in advance in the line of reform of car service abuses. Its endorsement of the Chicago Clearing House and incorporating its statistical features as part of the Association work will strengthen the Clearing House and no doubt will secure a large number of adherents. The various forward steps affecting car service and distribution of cars all harmonize with the plan of a car pool, and some form of car pool will no doubt ultimately be adopted for all freight cars."

Another Chicago officer said:

"The situation with us is desperate. If we had only our full equipment or its equivalent, we should be well satisfied. The clearing house idea, and the car pool are all right, and we are not opposed to such a scheme, but it will take a long time to get it on a satisfactory working basis. Some plan must be adopted that will remedy the situation quickly, and the $5 diversion penalty seems the most practicable. It ought to be two, three, or even four times this, but $5 will do for a starter. As a sample of our troubles look at this record of the movements on foreign lines of one of our special service cars, which has been absent continuously for a year and three months. This is an exceptional case, though for an ordinary box car it would not be unusual."

MOVEMENTS OF A FREIGHT CAR IN STRANGE LANDS.

To—	1906.
Missouri Pacific	Jan. 28
Denver & Rio Grande	Jan. 30
Missouri Pacific	Feb. 2
Union Pacific	" 13
Missouri Pacific	" 26
Union Pacific	Mar. 3
Colorado Southern	" 6
Union Pacific	" 21
Colorado Southern	" 27
Chic., Burl. & Quincy	" 29
Colorado Southern	Apr. 8
Atch., Topeka & Santa Fe	" 9
Colorado Southern	" 9
Fort Worth & D. C.	" 10
Chic., R. I. & Gulf	" 11
Chic., R. I. & El Paso	" 12
El Paso & N. E.	" 13
Galveston, H. & S. A.	" 16
Texas & N. O.	" 20
El Paso & S. W.	" 23
Nacozari	May 12
El Paso & S. W.	" 26
Southern Pacific	" 31
Gila Valley, G. & N.	Jun. 3
Southern Pacific	" 14
El Paso & S. W.	" 18
Nacozari	" 20

To—	1906.
El Paso & S. W.	July 3
Cananea, Y. R. & Pacific	" 23
El Paso & S. W.	" 31
Chic., R. I. & E. P.	Aug. 9
Chic., R. I. & Gulf	" 14
Chic., R. I. & Pacific	" 15
Cin., Cleve., Chic. & St. Louis	" 19
Chesapeake & Ohio	" 26
Cin., Cleve., Chic. & St. Louis	Sept. 3
Peoria & E.	" 15
Chic., R. I. & Pacific	" 18
Colorado Midland	" 23
Denver & Rio Grande	" 24
Rio Grande Western	" 29
S. Pedro, L. A. & S. L.	Oct. 1
Rio Grande Western	" 28
Denver & Rio Grande	Nov. 5
Chic., Burl. & Quincy	" 25
Union Pacific	Dec. 17
Chic. & North-Western	" 21
	1907.
Chic., St. Paul, Minn. & O.	Jan. 16
Chic., R. I. & Pacific	Feb. 6
Ter. R. R. Association	Mar. 5
Chic., R. I. & Pacific	" 7
Ter. R. R. Association	" 23
Chic., R. I. & Pacific	Apr. 22

(Gone one year and three months.)

Freight Handling at the Port of New York.*

The port of New York occupies a unique position. Situated in latitude 40 deg. 42 min. north and longitude 74 deg. west from Greenwich, it occupies the most central location on the Western Hemisphere, and with the development of its transportation facilities it will soon not only be the commercial emporium of the Western Hemisphere, but of the world.

The few small wharves and docks which existed in the first quarter of the nineteenth century have, in less than 100 years, grown until, at the present day, over 112 miles of wharf room are in use on the New York side alone. The annual income to the city from these properties aggregates over three millions of dollars. Thirty important trans-Atlantic lines operate between New York and European ports, their combined fleets aggregating over 100 first class vessels. Over 120 million bushels of flour and grain are received annually. Of this amount about 110 million is received by rail and the balance by canal and coastwise vessels. Twenty thousand tons of salted beef, 135,000 tons of bacon and hams, 145,000 tons of lard, and 15,000 tons of pork are exported annually. Over 4,000,000 head of live stock are received every year at the port of New York. Over 500,000,000 gallons of petroleum are exported here each year and distributed to the most remote corners of the earth. When to the above items are added the vast quantities of coal, dairy products and every conceivable article of manufactured goods that annually pass through New York, some conception may be gained of the facilities required.

The New York Central is the only railroad having direct rail connection with Manhattan Island, and consequently the only railroad which can make local deliveries direct from its cars to consignees. All other railroads make local deliveries in the Borough of Manhattan and at the steamship piers by an extensive system of lighterage. At the terminals of the great trunk line railroads on the Jersey shore, every facility has been provided for the expeditious handling of freight that human ingenuity can devise and unlimited financial resources provide.

The railroads having extensive terminal facilities at New York are the New York Central, Pennsylvania, New York, New Haven & Hartford, Erie, Lehigh, Lackawanna, Baltimore & Ohio, Central Railroad of New Jersey, New York, Ontario & Western, and Long Island. Each of these railroads maintains on Manhattan Island at least one team delivery yard, to which cars are brought on floats and unloaded directly by teams.

Upon the arrival of freight at the port of New York for export, the foreign freight agent in whose care it is billed, notifies the proper steamship agent, when a permit for its delivery to a specific ship is furnished. Heavy freight for other harbor delivery, such as structural steel and iron, lumber, marble and heavy machinery, is treated in exactly the same way, the consignee furnishing instructions for such domestic delivery on the back of the arrival notice received from the railroad agent. Grain in bulk is either delivered direct from cars or unloaded from cars into an elevator where it is graded in accordance with the rules of the New York Produce Exchange, and put in with other similar grain so that its identity is lost unless the shipper orders its identity preserved. When delivery of grain in an elevator is to be made, the desired quantity of a particular grade and kind to which the consignee is entitled is allowed to run through a chute into the steam lighter and in a similar manner turned into the hold of the ocean carrier.

One of the most modern tipples made by the Brown Hoisting Machine Co. is that in use at Port Morris by the New York Central.

The term lighterage originally meant the carrying of freight from vessel to shore in small boats, where there were no dock facilities or where the water was too shallow to permit of a close approach to the shore. Until recent years piers and dock facilities were unknown in many of the large ports of the world and all kinds of freight was handled in the most primitive manner. This is still noticeably so at Hong Kong, where cargoes are floated in Chinese junks. At Yokohama all freight is lightered. At Bombay and Calcutta "Dhows" are extensively used. At Marseilles all oil is lightered in small boats. At both the Atlantic and Pacific ports of South America all cargoes are lightered, the vessels laying in the open roadsteads, while cattle, horses and swine are dropped overboard and corralled after swimming ashore. At London lighterage is employed in much the same manner as it is at the port of New York. But at this port the lighterage business has been so developed and extended that special classes of vessels have been designed to meet various requirements, and it has extended far beyond the harbor limits. On the east it has been extended to every Sound harbor and the coal barge goes to Boston from the docks at Edgewater, Weehawken, Hoboken, Communipaw and Amboy, and a well-equipped line of tugs and barges supplies the mills on the Kill von Kull with plaster from the Nova Scotia mines. To the north (Hudson river), the immense brick, ice and bluestone traffic is lightered to this port. To the south it may be said to extend to the soft coal wharves at Norfolk and Newport News.

The most general type of lighter employed here is the steam scow, with mast and boom for hoisting freight. Both the hand winch and steam engine are used. Cargo is carried both on the deck and in the hold, the scows varying in capacity from 300 to 800 tons. Freight is taken direct from or delivered to the car, the pier or steamship, and consists especially of heavy freight such as iron, stone, logs, bale cotton, hogsheads of tobacco and molasses. When finer freight is carried it is protected by waterproof canvas covers. Some of these boats are equipped with the steel "A" frame, with steel boom and wire rigging in place of the mast. They lift from 25 to 240 tons. On one of these the largest coast defense gun in the country weighing 116 tons was taken direct from the Watervliet Arsenal to Sandy Hook in 1903.

The covered barge, capacity from 300 to 500 tons, also scow shaped, is used for all classes of package freight, but especially for that which needs protection from heat, cold and wet weather such as packing-house products, cereals, green fruits and vegetables.

The open steam lighter, capacity 200 to 400 tons, with mast and derrick rigged to lift from five to 50 tons, is the express boat of the lighterage fleet. They are assigned for all small orders both east and westbound, export and domestic. They are especially useful in delivering and receiving at piers and warehouses where the slips are congested by other craft.

The covered steam lighter is of the same dimensions as the open, has mast and boom and bears the same relationship to the latter that the covered barge does to the open barge.

The grain barge, capacity 28,000 bushels, is used to float grain from the railroad and private elevator and the car to the steamship's side, whence it is transferred to the ship's hold. They are also used to deliver grain to the milling and brewery plants of Greater New York. The cargo is carried in bulk in the hold. She has a continuous hatch with high combings and is similar to the 7,000-bushel boat of the Erie and Champlain canals. In connection with the grain barge, the floating elevator is an important factor in harbor work. Indeed, it is an absolute necessity in handling export grain.

Barges built on the same lines as the grain boat are used to take coal from the docks and cars to the steamships, power-houses, yards, gas houses and various industrial plants on the water front. The capacity of these barges is from 200 to 1,000 tons each.

The car-float is the factor which makes lighterage play such an important part in the development of domestic commerce at the port of New York. The first car-float was constructed for the Pennsylvania Railroad in 1868. It carried six 12-ton capacity cars. It was 165 ft. long and 34 ft. wide. The float now in general use for pier and bulkhead delivery carries twelve 34-ft. cars, and has two tracks with a platform in the center, making it possible to load or unload all of the cars at the same time, greatly facilitating the work of the crowded freight stations on the North and East rivers. One of the latest design of floats that have been constructed is entirely of steel 318 ft. long, 40 ft. wide, has three tracks and will carry twenty-three 50-ton capacity cars. It is doubtful, however, whether this float, owing to its great weight and the difficulty of handling it in crowded areas will prove an unqualified success.

The largest and most powerful tugs used in towing these floats develop as high as 1,200 h.p. They occupy much the same relation to the handling of the lighterage traffic that the switch engine plays in a large freight yard. In fact, the operation of the lighterage system at the port of New York is analogous to the operation of a union transfer terminal.

New York, with her high rentals for steamship piers, averaging as high as $100,000 per annum, and the extra charge for lighterage, with the inevitable delays, cannot compete in the export trade with Boston, Norfolk, Baltimore, Philadelphia, with their low dock rentals and direct rail connections on the pier. Many movements have been set on foot and thousands of dollars have been expended in planning a great export terminal on the Jersey shore, but as yet nothing has been accomplished, and the wisdom of such a project has even been doubted by leading experts on the transportation facilities of New York.

Some idea may be gained of the magnitude of the lighterage business, when it is considered that, beside the great railroads terminating at this port, each of which maintains its own floating equipment, over 30 independent companies also are engaged in this traffic. The floating equipment of the Erie Railroad comprises 70 covered freight barges, 27 hand-hoist lighters, three steam-hoist lighters, 25 car-floats, three steam lighters, two live-stock boats, 410 harbor canal-boats, nine sound coal boats, 12 coastwise coal barges, 14 tugs, or an aggregate of 575 vessels.

The New York Central had in 1906: Tugs, wood, 2, steel, 19; freight propellers, wood, 3, steel, 3; steam hoisting barges, 10, total capacity, 4,100 tons; hand hoisting barges, 18, total capacity, 3,100 tons; covered barges, 88, total capacity, 22,100 tons; open deck scows, 4, total capacity, 2,200 tons; grain boats, 39, total capacity, 17,130 tons; car floats, 41, total capacity, 486 cars; ferryboats, side wheel, single deck, 5, screw, double deck, 3; total floating equipment, 235; total value of fleet, $2,215,847.

*From an article by William S. Root, in *Rail and Mar.*

Track Deformations and Their Prevention.*†

BY G. CUENOT,
Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway.

VIII.

SHOCK AT THE JOINT (CONTINUED).

The cause of the defective state of the track at the passage of the joint being well shown by the analysis of it by Mr. Freund, it was of interest to verify the manner in which a joint of a track provided with composite ties behaves, in comparison with what habitually takes place. If the theory of Mr. Freund is exact, the fall ought to be very much diminished at the passage of the joint with composite ties.

Care was taken to observe the deformation of the track before any test, and as it was found that this deformation was increased, the profile was corrected by means of hoop iron wedges placed between the splicing and the head of the rail. Fig. 20 displays the condition of the joints before and after placing the wedges; the latter have reduced, at least by one-half, the slope at the extremities of the rails, a slope which could reach about .08 in. in 19.69 in. The permanent deformation of the rails was still more apparent on track provided with composite ties than on that provided with

*Copyright, 1907, by the *Railroad Gazette*.
†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.

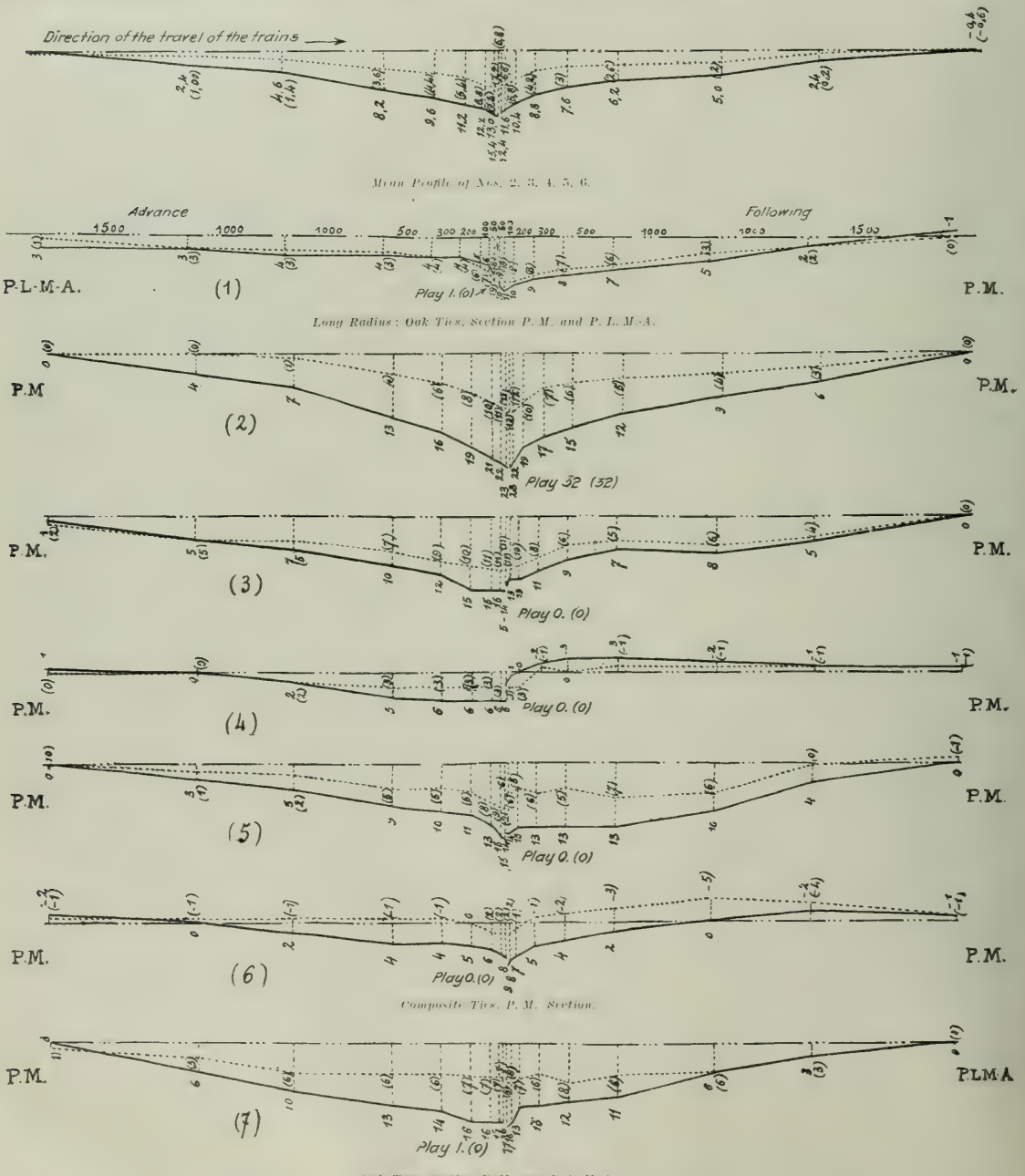


Fig. 20—Condition of the Track at the Joints, Before and After Wedging. (Long Radius.)

Full lines indicate condition of joints immediately after laying composite ties. Dotted lines indicate condition of joints after wedging rails up.

ordinary ties, Fig. 21; that was occasioned by the fact that the P. M. rails, with which the section was provided, were very much worn, after long service.

The experiments were carried on in the following manner: Three cleats were fixed on both sides of the joint, at each of the extremities of the rails, on the upper part of the head. A steel rule placed on rigid supports allowed an estimate of the difference of level between the top of the cleats and the under part of the rule, by means of the wedge gage previously described. The first axle of the engine was brought right at the first cleat, and the profile of the extremities of the rails was observed; then the same operation was repeated by allowing the same axle to advance successively right at each cleat, and the same observation was made.

The result of these experiments is given in Fig. 22, in the left part of which are shown the successive sections of profiles of the P. L. M.-A. rails resting on ordinary cross ties; in the right part, the same profiles of P. M. rails supported on composite ties. The full line represents the original profile of the rails, the dotted line the profile deformed by the passage of the vehicle.

The original profile of the P. L. M.-A. rails is quite defective; there is, from the advance end to the following end of the joint, an unequal level of .064 in. at least; at the passage of the load over the joint there is a fall of .06 in. The successive profile of the two rails becomes quite discontinuous and more undulating.

The original profile of the P. M. rails supported on composite ties is better. At the joint there occurs an ascending step, which

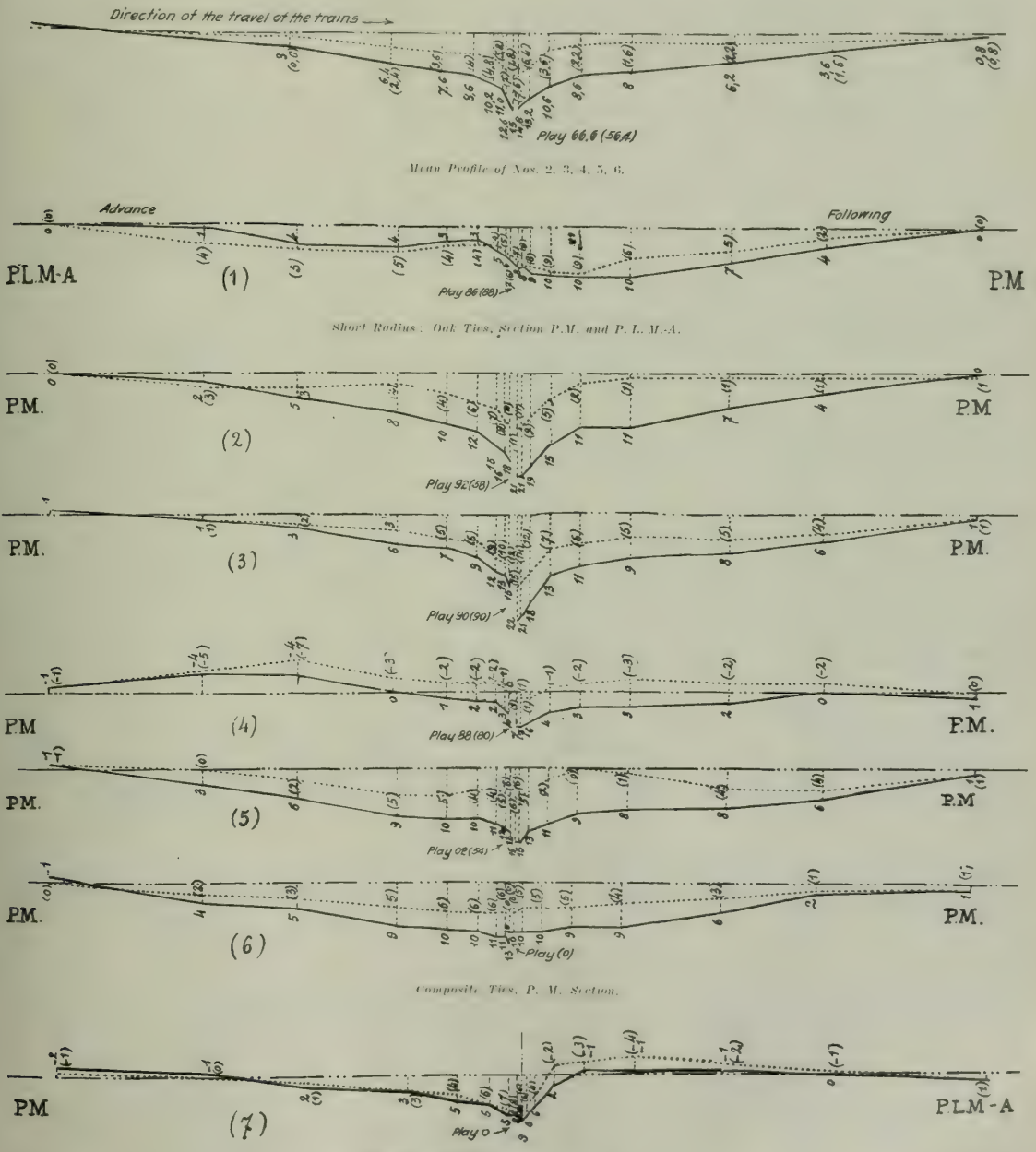


Fig. 20—Condition of the Track at the Joints, Before and After Wedging. (Short Radius.)

Full lines indicate condition of joints immediately after laying composite ties. Dotted lines indicate condition of joints after wedging rails up.

is rather unusual. The passage of the load improves the profile, which becomes almost continuous; there is an inequality of scarcely .012 in. when the load passes over the joint.

This is what is to be expected; it will be recalled, moreover, that the longitudinal movement of the track is much less strong when the latter is provided with composite ties, and that the joint does not undergo any oscillation during the passage of a load over the rail. The splicing is not then injured, as in the ordinary case; the shock which is produced is very much diminished by reason of this fact; the following tie is not unwedged, at least as rapidly. The unequal level of the advance end and following end is increased by this unwedging, but the unwedging is also an effect of the oscillatory movement of the track, and it becomes, in consequence, one of the causes for bad condition of the joint. This unwedging causes the tie of the following end of the even joint to bend more than otherwise, which increases the fall still more, due, for the most part, to the unequal wear of the splice bearing points. The composite tie, which distributes equally over the ballast the pressure which it supports, is not exposed, like the ordinary tie, to being unwedged; the fall at the joint ought then to be reduced.

However, it is difficult to make an exact and complete comparison between the results obtained on the track provided with P. L. M.-A. rails and those which have been found on the track provided with P. M. rails. This latter track is much more rigid than the first, and the movements which can be produced are of less importance. Similarly, the weakness should not reach, from this fact, the proportion of 1 to 3; but it is certain that it will be found, and will be as much greater as the tie is larger, and as the oscillatory movement is reduced.

The experiment performed under the conditions pointed out is therefore of importance. The unequal level which is produced by the passage of vehicles from the advance end to the following

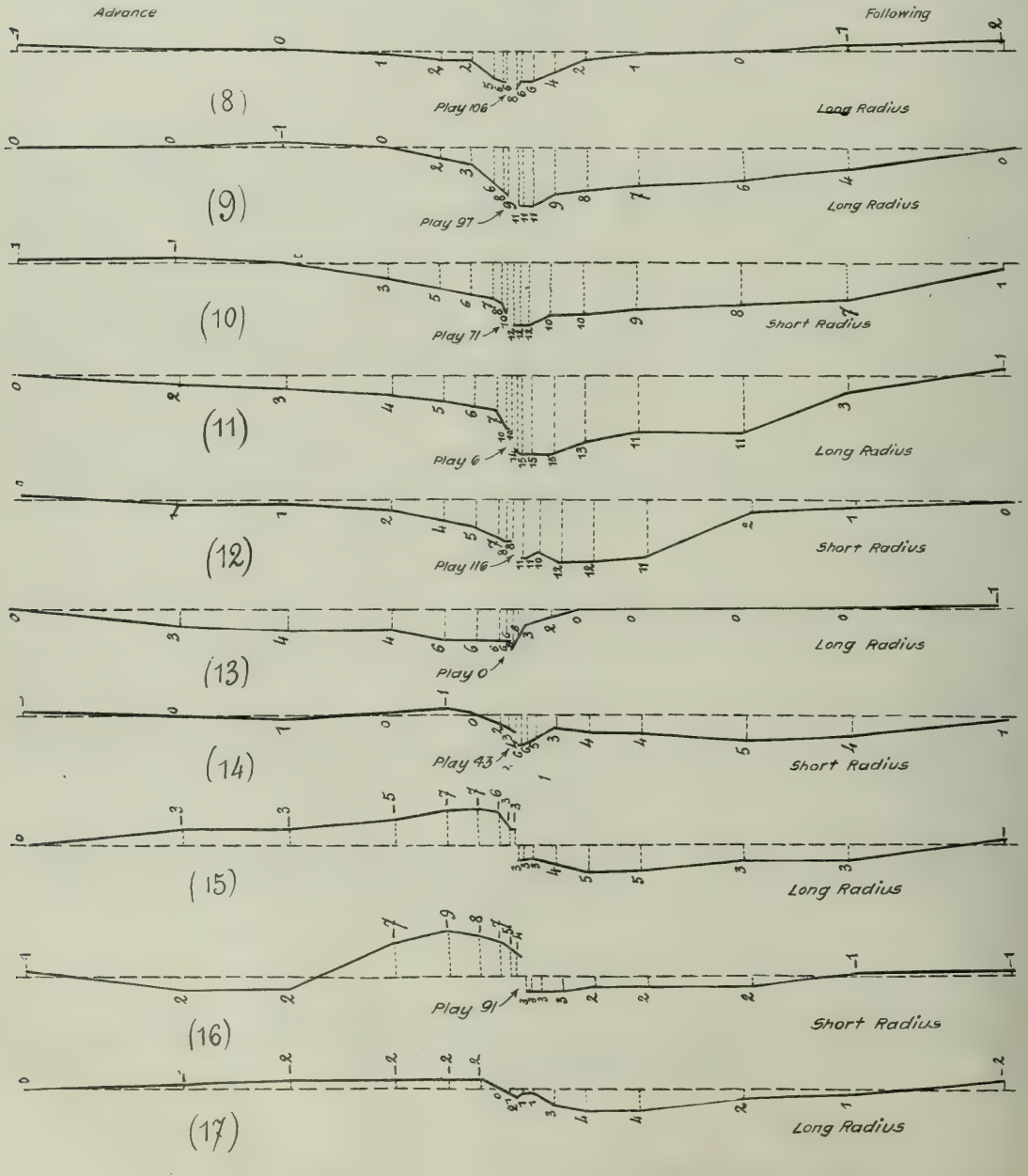


Fig. 21—Condition of the Track at the Joint; Wood Ties.

end has been observed in the static state; it is probable that it is greater in the dynamic state, by reason of the shock which takes place, and which is capable of increasing the movement.

I have not been able to prove it on the experimental track; moreover, the interest of such a measurement would not have been great, for the track conditions on a curve would have vitiated the test, or, at least, rendered it not precise. Nevertheless, I wished to proceed with the measurement of unequal level on track 2 of the line from Lyons to Geneva, particularly stressed and provided with P. M. rails. The ordinary splices, which united the extremities of the rails, presented exactly the aspect pointed out by Mr. Freund; that is to say, the bearing points of the splices were unequally worn, and the notch of the following end, in consequence of the repeated shock, was deeper than the notch of the advance end.

It was necessary, in order to have an exact proof, to photograph results. Mr. Louis Lumière, whose name is well known for his optical studies, established a special apparatus of the most simple kind, which permits registration on a photographic film. This apparatus is composed essentially of two acetylene lanterns at the center of two concave mirrors, each fixed to the extremities of the rails to be tested, and a sensitive film. The housing containing the film and the acetylene lanterns was arranged on a concrete block located about a meter below the track, in such a manner as not to be influenced by the passage of vehicles. The same film registered at the same time the displacement of the advance rail and that of the following rail. The experiment was performed at the passage of a freight train traveling at a maximum speed of 12.4 miles an hour.

Fig. 23 shows the depressions which are manifested at the extremities of the advance rail and following rail at the passage of each of the vehicles; the absolute magnitude of this depression is given by the difference between the position of the horizontal line representing the luminous ray before the passage of the train, and the lower points of the undulating line, determining for each extremity of the rail the oscillatory movement which it assumes at the passage of the train. The influence of each of the axles is clearly noticeable; between two axles the rail tends to raise up. The same effect is produced with more intensity between two vehicles. At the moment when the train is about to cross the joint, the rail is slightly elevated, then it is lowered by a certain quantity, which appears maximum on the passage of the first axle.

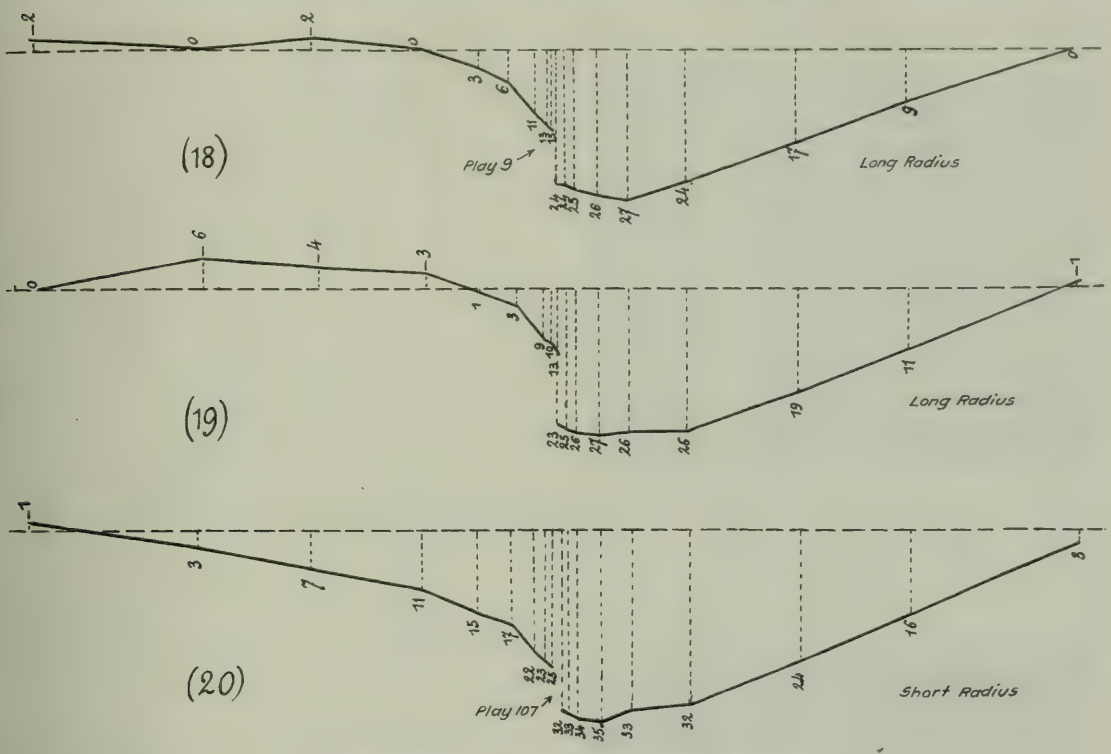


Fig. 21—Condition of the Track at the Joint; Wood Ties.

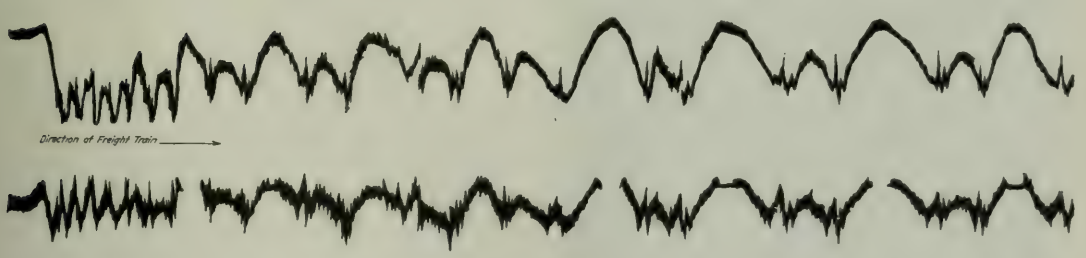


Fig. 23—Photographic Records of Movement at Joint. Upper Record Magnifies Movement 3.79 Times; Lower Record, 3.91 Times.

The magnifying at the advance end is 3.91, the magnifying at the following end is 3.79. It results that, after the photographic trace, the extremity of the following rail vibrated 0.35 in., and that the advance rail had a play of 0.14 in. The fall, when passing from the advance to the following rail, would thus be 0.21 in. It is not necessary to remark that this fall is very great, and that it indicates a joint in bad condition. It was thought desirable, in order to try the apparatus, to take a joint of this kind, allowing an appreciable vibration to be obtained. These results are, besides,

comparable with those which are pointed out by Mr. Coüard in his article of July, 1897, on the vertical deformation of the rails (*Revue des Chemins de Fer*), for he estimates that the variable flexure of the rail at its extremity is 0.12 in., and that the compression of the ballast reaches 0.12 in.; the bending which it can take is, then, 0.24 in.

It matters little whether the flexure does or does not reach this limit; it suffices to prove that it is of real importance, and that it ought to be reduced.

(To be continued.)

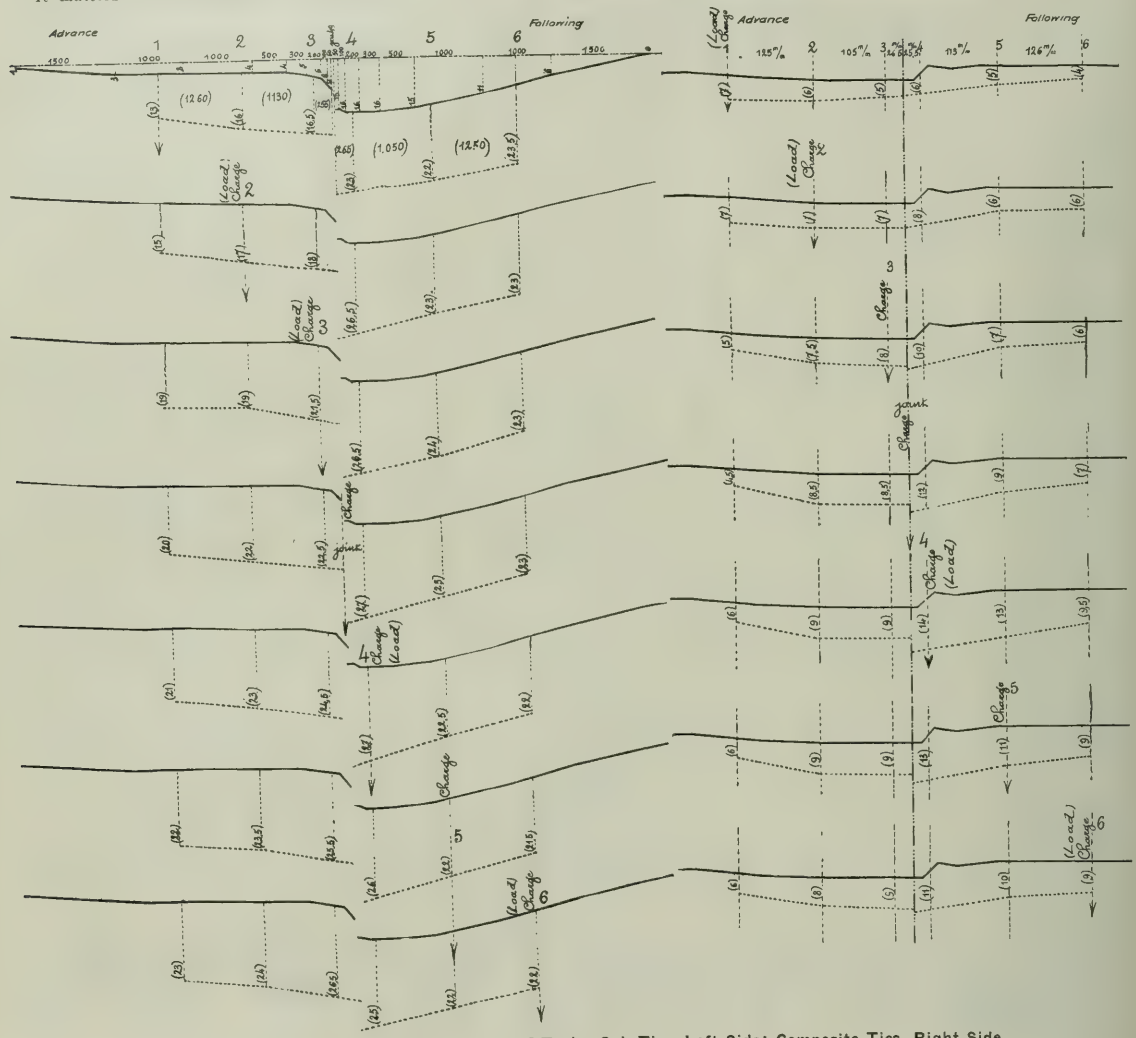


Fig. 22—Depression at the Joint at Passage of Train, Oak Ties, Left Side; Composite Ties, Right Side.

Wisconsin Railroad Commissioners' Report.

The railroad commissioners of the state of Wisconsin, John Barnes, B. H. Meyer and Halford Erickson, have issued the first biennial report of the new commission, which was organized July 11, 1905, under a law which established a new body of three to take the place of the former single commissioner. About half of the present thick volume of 950 pages is filled with statistics of the 50 roads doing business in the state, and most of the remainder is made up of decisions rendered by the commission on complaints of excessive rates and other things. The report proper, which is headed "A General Account of the Work of the Commission," takes only 17 pages.

As far as possible the commission has endeavored to settle complaints by informal conferences, and has encouraged formal complaints only when easier methods failed. The work of these informal conferences is held to be the most important which has been accomplished by the board. The commission has undertaken independent and original investigations of railroad accounts, and of rates and tariffs, both of which involve elaborate studies. Ninety-two formal complaints had been filed up to December 1 last, and 62 of these were disposed of, without a ruling, by informal conferences or correspondence. Important readjustments in rates have been made, and, as the investigation of tariffs proceed more will be made. Information has been gathered (but not yet compiled) concerning railroad sanitation, station facilities, sleeping car and express rates, and the weighing of carload freight. The commission has declined to make a money estimate of the value of the work which it has done, because this would encourage the use of incorrect standards. Important changes have been made in rates on grain, cheese, cattle, coal and lumber, but the direct financial consequences are no more important than the systematic, thorough and continued study of actual conditions which was involved. Moreover, the mere existence of a commission with power to cure wrongs tends strongly to promote fair dealing.

The report recommends that the commission should either have complete jurisdiction over street railways or else have less than now. The line of distinction between city and interurban is not clearly defined. The law concerning the construction of private tracks should be made more definite. The legislature should empower the commission to limit the time in which its orders must be carried out, as, for example, in the construction of station buildings or side tracks. Only one order of the commission, that requiring certain trains to stop at Dwight, Polk County, has been attacked in the courts.

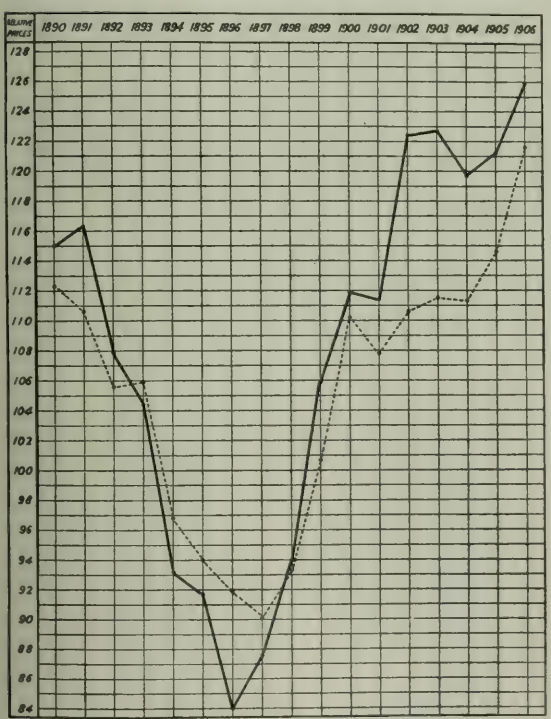
Under the law the railroads have to send to the commission

lists of passes and reduced rate tickets, and in the appendix a statement is given of the newspapers to which the railroads have issued transportation in exchange for advertising, with the value given by each road to each paper. In this statement there are 13 railroads and over 700 papers, and the total sum received by each paper (in the aggregate from all of the roads) varies from $1.05 to $8,444. The Milwaukee *Evening Wisconsin*, which received the latter sum, traveled $3,532 worth on the Milwaukee road, $3,396 worth on the North-Western, $800 on the Wisconsin Central, $664 on the Northern Pacific, and used small amounts on two other roads. The total granted by all of the roads in 12 months and 15 days was $124,390, of which the Milwaukee road contributed $37,266, the North-Western $37,324, and the Illinois Central $2,540.

The commission requires reports of accidents, on blanks which correspond very nearly to those issued by the Interstate Commerce Commission. A representative of the commission visited the scene of two railroad accidents, but it does not appear that any formal report was made. The railroads have filed plans of 12 new interlocking plants since the commission was organized. As the commission had no engineer, these plants were approved subject to future inspection. The former practice in Wisconsin of having these intricate and extensive machines approved by a non-expert is declared to be useless. The commission now has an engineer and has instructed him to correspond with engineers throughout the country to learn what are the best appliances for safety on railroads.

Increased Commodity Costs.

The following diagram, reproduced from the Bulletin of the United States Bureau of Labor for March, 1907, affords perhaps the best single argument for a general increase in freight rates. The curves are compiled painstakingly from the totals of about 260



Relative Prices of Raw and of Manufactured Commodities, 1890-1906.

Average price, 1890-1899, as 100.

articles, including farm products, food, cloths and clothing, fuel and lighting, metals and implements, lumber and building materials, drugs and chemicals, house furnishing goods, and miscellaneous articles. Wholesale prices only are quoted.

A new organization of the Bavarian State Railroads went into effect in April, when some 900 employees were promoted, and a large number were retired, among them Ebermayer, who had been General Manager since 1895, and was the first to reach this position from the engineer department. The railroads now come under a special general manager, Seiler; construction has a separate manager. The railroads are divided among five managements; there are about 4,700 miles of them.

Combination Parlor, Sleeping and Dining Cars for the Canadian Northern.

The Barney & Smith Car Co., Dayton, Ohio, has recently delivered to the Canadian Northern the first of an order for four combination parlor, sleeping and dining cars built under the patents of the American Palace Car Co., New York. The first car has been named "Balmoral" and the other three will be named "Buckingham," "Windsor" and "Warwick." The general arrangement and finish of the cars are shown in the accompanying illustrations.



Car Arranged for Serving Meals.

They are 72 ft. 6 in. long over end sills, 9 ft. 10½ in. wide over side sills and 14 ft. 6½ in. high over all with a height inside of 6 ft. 9 in. from top of sill to bottom of plate.

At one end is a wide observation platform and an observation room 9 ft. 8 in. long containing six wicker chairs and a sofa which can be made up into an upper and lower berth. Next comes the



Making Up a Section.

men's toilet and smoking room, 8 ft. 11 in. long, and then the main room, 32 ft. 9¾ in. long. Beyond that are two ladies toilets, one on each side of the passageway, and the large kitchen in the end of the car. The kitchen end has a Pullman wide vestibule.

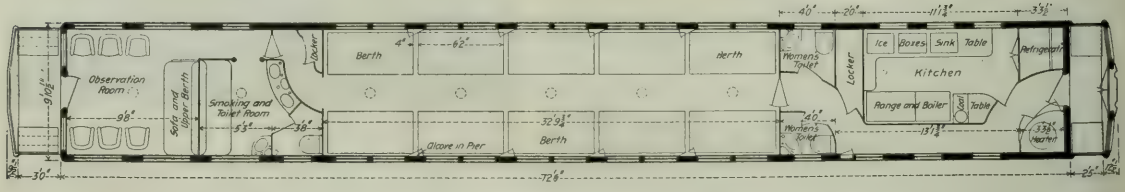
The feature of particular interest in these cars is the arrangement of berths whereby the car can be quickly converted from a parlor car for day travel into a sleeping car for night travel. There are 20 large upholstered chairs for day use and the berths and bedding are stored in ventilated steel pockets built in the framing below the floor and entirely concealed by the flush trap doors which form the body of the floor. To make up a berth the two chairs over a section are moved to one side and the double trap doors 6 ft. 2 in. long are raised to a vertical position forming the partitions

between adjoining sections. The upper and lower berths are then raised out of the pocket to their proper height by means of light wire cables passing over sheaves on the partitions and around a winding drum under the berth pocket. This drum is turned by an extension crank handle passing down to a pinion under the floor, as shown in one of the illustrations. The two berths are raised to their proper height and made up into beds, and the chairs, hand baggage, etc., are stowed away in the pocket under the floor. Berth curtains are hung from a curtain rod carried on hangers which pull out from under the deck. There is 6 in. more headroom in the lower berth than in a Pullman car and the berths are wider. The windows are high and the upper berth is lighted and ventilated from the outside.

The car is finished inside with inlaid polished mahogany except in the kitchen, which is finished in cherry. The ceiling is painted a light olive green with gold decoration and art glass is used in the deck windows and over the side windows. The car is lighted by acetylene gas and heated by steam and in every respect is equipped with the most modern and luxurious fittings. It is understood that this is the first of a large order for these cars which will gradually be put in service on the Mackenzie & Mann system to replace old equipment.



Combination Parlor, Sleeping and Dining Car for the Canadian Northern.



Floor Plan of Combination Parlor, Sleeping and Dining Car for the Canadian Northern.

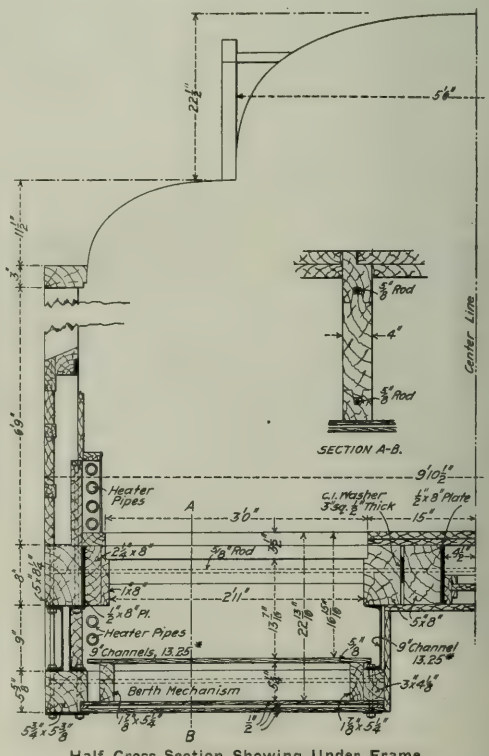
For use as a dining car, 10 double tables are carried in a large locker next to the kitchen and these are put up when required between each pair of chairs as in a cafe parlor car. Paneled lockers are provided in the wide piers between windows in which table silver is stored when not in use.

The peculiar construction of the berth pockets below the floor



Interior View Showing Two Sections Made Up.

requires a special design of heavy composite underframe. Above the side sills the framing is Barney & Smith standard with a few unimportant modifications. The side sills are made up of three timbers 8 in. deep with a total thickness of 8¼ in. and a ½-in. x 8-in. steel flitch plate. For the length of the berth pockets two 9-in. 13.25-lbs. channels are bolted under the main sill and below these is another timber 5¾ in. x 5⅝ in. The four center sills are continuous from end to end of the car and are made up of 5-in. x 8-in. timbers with two ½-in. x 8-in. flitch plates. Under the center sills are two 9-in. channels forming the inside walls of the berth pockets. The reinforcement of the sills makes unnecessary the use of cross-bearers between bolsters which would interfere with the berth pockets.



Half Cross Section Showing Under Frame.

GENERAL NEWS SECTION

NOTES.

The legislature of New York has passed a reciprocal demurrage bill.

The Troy Line has decided to build two new steamboats for its Hudson river passenger traffic.

The lower house of the Florida legislature has passed a bill to limit passenger fares in that state to 2½ cents a mile.

Both houses of the New York legislature have passed a 16-hour labor bill for trainmen, similar to the Federal law on this subject.

The Missouri Pacific has made a reduction of 2 cents per 100 lbs. on grain in carloads from points in Kansas to eastern and southern termini.

Press despatches from Denver say that Chairman Knapp and Commissioner Neill have been asked to come to that city to arbitrate a dispute between the Denver & Rio Grande and its trainmen, who are asking for higher wages.

On April 22 the Governor of Pennsylvania signed the bill authorizing street railroads in that state to carry freight; and 12 hours afterward the Philadelphia & Westchester Traction Company started a car loaded with milk for Philadelphia.

The railroads of Minnesota have decided to discontinue all tourist, charity, clergymen and mileage tickets, and to sell all tickets at the legal rate of 2 cents a mile, which went into effect May 1. "All excursion rates are abolished," the reports say; but for how long?

The State Railroad Commission of Ohio announces that it will no longer allow railroads, in making excursion fares, to include in their estimate of the value of the service, the cost of hauling empty cars from headquarters to the point whence the excursion starts and back to headquarters after the excursion trip has been made.

At a hearing before a committee of the Connecticut legislature in Hartford last week a number of telegraph operators testified that it was common for operators in station offices to work 36 hours continuously. L. H. Dowe, of Danbury, said that within the past three years he had done this probably a dozen times. It was stated that on the Shore line division men worked 24 hours a day once or twice a week.

Chicago papers say that the Chicago, Burlington & Quincy has given notice of withdrawal from the Chicago Car Service (demurrage) Association. It is understood to be the purpose of the Burlington to organize a car service association, publish its car service charges and collect them as rigorously as freight rates are collected. In this way only, it is believed, can demurrage be collected without conflict with the law.

The railroad commissioners of Ohio have decided that where a steam railroad makes reduced fares to meet the competition of electric lines it must give fair treatment to all towns affected. The Hocking Valley issued what it called a twin ticket, good for a round trip for one person, or for rides one way for two persons; and confined the ticket to two or three towns where the competition was particularly felt; but the commissioners say that the reduction must be granted to certain other stations in the same vicinity.

Passenger conductors on the Burlington road are to wear buff vests this summer, as heretofore, but the story that all would be required to have their faces clean shaven appears to have been invented by a reporter who was dreaming, or was making an unusual effort to fill up the space allotted to him for that day. The company does not object to whiskers, but the superintendents will insist that each conductor be "either one thing or the other." If he wears a beard, all right; but if he does not wear one, he must not be seen with "near whiskers."

The South Manchuria Railway.

The plans for the South Manchuria Railway were briefly mentioned in the *Railroad Gazette* of February 1. The extension of the Seoul-Fusan to Wiji on the Yalu river—which separates Corea from Manchuria—is to be built on to Mukden, about 700 miles from Wiji. Work on the first 100 miles has already begun. The rails have been ordered from the United States Steel Products Export Company, which is the foreign-trade branch of the United States Steel Corporation. The contract, which was secured through the New York offices of the Japanese contracting firm of Okura & Company, calls for about 13,000 tons of 75-lb. rails. Deliveries will extend from May to September. From Mukden the line will run north to Harbin, where it will join the Chinese Eastern Railroad, thus getting connection with the Trans-Siberian. South from Mukden, the South Manchuria will be built to Dalny, on the seaboard near Port Arthur. From Harbin to Dalny is 800 miles, so that, including the Wiji-Mukden line, fully 1,500 miles of new standard gage road will be built. Nearly all the rails, bridge material, locomotives and cars will be bought in the United States. Some particulars of the contracts so far placed have been printed from time to time in the *Railroad Gazette*. The entire system will cost, it is estimated, nearly $100,000,000 gold, and by the terms of the Japanese-Chinese treaty it must be finished inside of two years.

Two-Cent Fares in Virginia.

The State Corporation Commission of Virginia, on April 27, issued an order requiring that from July 1 the principal roads of the state limit all passenger fares to 2 cents a mile. The Norfolk, Franklin and Claremont divisions of the Southern are allowed to charge 2½ cents; the Norfolk & Southern and 10 other roads doing a light business are allowed to charge 3 cents, and 12 other small companies 3½ cents.

Loading 150,000 Cars a Day.

At the second annual dinner of the Transportation Association of Milwaukee May 2, Mr. Arthur Hale made a brief address, in which he said: When the newspaper men discovered the freight car last fall they were very much surprised to find that, on an average, it made little more than 24 miles a day. The discussion of this question has done a good deal of good, but there would have been a better understanding of the subject if a little more consideration were given to the exact meaning of an average. I am glad to be able to say that in the first half of 1906 the railroads of the country showed marked improvement. The best figure that I know for 1905 is 24.8. For the first six months of 1906 this rate was raised to 25.7. Probably it would have been better to have said that our freight cars made 9,000 or 9,500 miles a year. If you can personify a fine young freight car, just out from the shops near Chicago, you can imagine his scorn of the 25-mile-a-day record held by some of the old cars which he first associates with, and if the new car makes its first trip, say from Chicago to New York on a 60-hour freight train, it will make a record of well over 300 miles a day for its first three days of existence. It may be loaded back to Chicago on another fast train, but it is much more probable that it will be loaded in local service, where its rate per day would be very much lower. If, for instance, the car is loaded back from New York to Newark, New Jersey, it can only make 8 miles that day, and if the consignee is not in a hurry for his freight and if a Sunday and holiday intervene, even the rate of 8 miles a day may be reduced to 3 or possibly 2 miles a day. An error in a shipper's invoice or an error by a bill clerk may keep the car standing for days or weeks, when its record will be nothing a day, and it will not take many weeks of such ordinary handling to reduce our new car's first record to the average.

Much can be done to improve matters, much is being done, and much more will be done. The Interstate Commission is leading the way by pressing the railroads and the public to do their best in the matter. The railroads have doubled their per diem rate of car hire as between themselves; they are following up their own delays better than ever before, and they are buying more cars than ever before. On the other hand, the public is handling cars quicker and is accepting with more favor the various plans devised to penalize delays. An increase of one mile a day means an increase of 80,000 or 100,000 cars in this country, and that number of new cars would cost the railroads nearly $100,000,000, or, putting it in another way, an increase of one mile a day means an increase of 4 or 5 per cent. in the cars available for loading every day. My estimate is that the country loads about 150,000 cars a day, and this meagre increase of one mile means, therefore, an increase in the country of 6,000 or 7,000 carloads a day. The railroads are adding to their equipment this year nearly 200,000 cars.

Guatemalan Railroad.

Sir William Van Horne, who recently returned from Guatemala, made an inspection of the railroad being built from Porto Barrios, on the Atlantic coast, to Guatemala City. He stated that less than 30 miles of rail out of a total length of 194 miles remains to be laid. It is expected to have the line in operation within four months. The new line will bring Guatemala City within two and a half days of New Orleans and five days of New York. The United Fruit Company is building three steamships to ply between Porto Barrios and New Orleans in connection with this line, and the Hamburg-American company also intends to establish a line between Porto Barrios, New York and Europe. Work on the road was

begun about 15 years ago under President Barrios, but after 135 miles of the line had been built was abandoned, leaving the difficult work of crossing the Cordilleras unfinished. The successful execution of this work was brought about by private capital, the funds being furnished by a syndicate, the leading members of which were Sir William Van Horne, General Thomas H. Hubbard, President of the Pacific Improvement Company, and Minor C. Keith, of the United Fruit Company. The road is held by a New Jersey corporation, called the Guatemala Railway Company, and so far about $12,000,000 has been spent on construction.

Export Rates Must be Published and Adhered To.

In the United States Circuit Court of Appeals at St. Paul April 29, Judge Sanborn affirmed the judgments of the United States District Court for the Western District of Missouri against the Armour Packing Company, Swift & Co., Morris & Co. and the Cudahy Packing Company for accepting concessions of 12 cents per 100 lbs. on provisions from Kansas City to Christiania and other points in foreign countries. Judges Hook and Adams concurred in the opinion. The lower court (Judge McPherson at Kansas City June 22) imposed a penalty of $15,000 on each of the indicted firms, and these fines are affirmed. The substance of the conclusions reached by the court are:

The giving or receiving of a rebate or concession whereby property in interstate or foreign commerce is transported at a less rate than that legally filed and published is a violation of the law of 1903, and is a continuous crime, adjudicable in any court of the United States having jurisdiction of any district through which transportation is conducted. Rates from places in the United States to ports of transshipment, and from ports of entry to places in the United States, of property in foreign commerce carried under through bills of lading are required to be filed and published. If carried under an aggregate through rate, which is the sum of the ocean rate and the rate from or to a place in the United States to or from the port of transshipment or of entry, the latter rate is required to be filed and published.

If carried under a joint through rate the joint rate is required to be filed and published. The "device" by which the concession is brought about is not an essential element of the crime, and it is unnecessary to plead it in the indictment.

A contract by a carrier and a shipper to transport the latter's goods in interstate or foreign commerce at the then established rate for a definite time is ineffective after a higher rate has been filed and published, as required by law. The time during which a rate different from the agreed rate is established by filing and publishing is excepted from the term of such contract by virtue of the national acts to regulate commerce which are a part thereof. Such a contract constitutes no defense to a charge of giving or receiving a rebate or concession from the filed and published rate.

The only criminal intent requisite to a conviction of an offense created by statute which is not *malum in se* is the purpose to do the act in violation of the statute. No moral turpitude or wicked intent is essential to a conviction of such a crime.

The defendants in this case were indicted by the Federal Grand Jury in Kansas on December 15, 1905. The Grand Jury also indicted three railroads and several officers. The officers were charged with conspiracy and the railroads with giving rebates. These cases are pending before the United States Circuit Court of Appeals.

Good Advice from the Erie Employees' Magazine.

Hook up the handles of your station trucks and keep them out of the way of passengers when the trucks are not in use. Passengers have an awkward habit of tumbling over trucks when these are left about unloaded.

Station agents should remember that it helps rather than hurts to have bulletin boards accurate when trains are late.

If United States mail pouches are short be sure to issue a shortage slip to cover. Make reports of handling on forms 909 and 910 complete in every detail. If not, the company is fined by the Post Office Department.

If a shipper cannot load a car in 24 hours or 48 hours at the extreme limit, give it to the next shipper, or, if there are no other shippers ready, promptly report it as not wanted. Don't hold it for loading on the "bad roads" excuse.

It cost this company about $1,000 in three months because agents loading cars for points on the C. N. E. via Campbell Hall did not bear in mind the fact that some of the cars exceeded the clearances of that road. A trifling effort to insure loading for such transfer points of only such cars as will clear would have obviated delay and the expense of transferring.

Remember that a car with drawbar out should never be hauled with chains beyond the sidetrack nearest the point of accident, care being taken never to block passing sidings. If the car contains live stock or perishable freight it should be repaired very promptly or the freight transferred at once.

The Cook Improved Track Drill.

Several improvements have recently been made in the mechanism of the Cook standard track drill shown herewith. The ball-bearings of this tool, as it is now made, are encased in highly tempered tool steel "racers." They are self contained so that the balls cannot be lost out of the racers when the bearings are put on or taken off; the bearings are held in place by a set screw. Using these bearings to absorb the thrust eliminates the cutting of the thrust bearing, which is a common drill trouble, the friction at the thrust point being greatly lessened as the power exerted on the handles of the drill can be used at the bit point in cutting through the rail, and not lost in the drill mechanism. To further absorb the bit thrust and reduce friction to a minimum, a square nut, internally threaded to fit the feed screw, is adapted to take the thrust. The ratchet wheel (heretofore held as if in a vise) being thus relieved of carrying the thrust, revolves easily and prolongs the life of the pawls, cam, the forks at the end of the "walking beam" or arm, the gears, and all other wearing parts. Another feature of the improved form is the "quick return" of the drill bit. This is accomplished

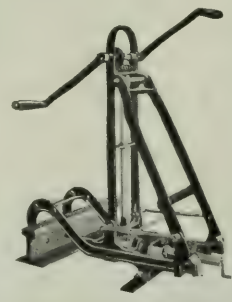


Fig. 1—Cook Improved Track Drill in Working Position.

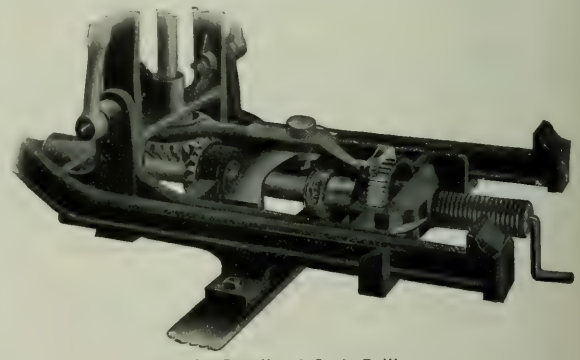


Fig. 2—Details of Cook Drill.

by means of a crank at the end of the feeding screw whereby the drill bit may be quickly screwed up to the work, or returned, as desired. The rapidity with which the spindle can be moved forward or back renders it unnecessary to collapse the drill, except when trains are actually passing on the track. The Cook

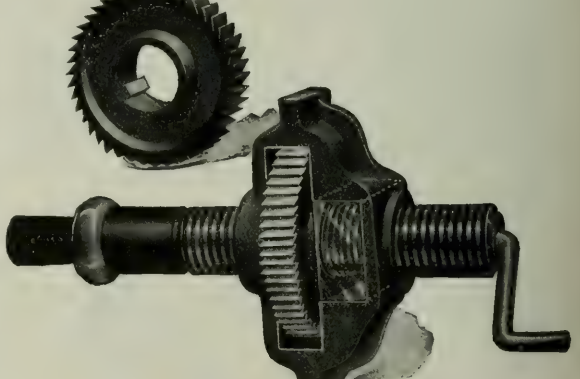


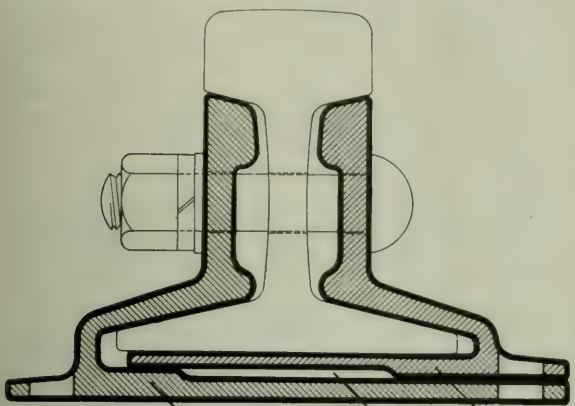
Fig. 3—Quick Return Device.

standard track drill is made by Cook's Standard Tool Co., Kalamazoo, Mich. The H. A. Rogers Company, dealers in railroad and machinists supplies, 19 John street, New York City, are the exclusive selling agents in the eastern and southern states.

The Stanford Rail Joint.

A new form of rail joint has been devised by Arthur L. Stanford, Chicago. The inventor describes it substantially as follows:

By means of recess 3 the rail brace and splice-bar flange 1 are deprived of direct support, and their elasticity is developed by bending nearly to, but not exceeding, the elastic limit, thus in a measure protecting the rail tread from injury by the hammering of the car wheels. Also, due to this same recess, there is no bearing between the two splice bars, 1 and 2, at the central part, likewise developing the elasticity of bar 2 and further protecting the tread



The Stanford Rail Joint.

from battering. The attainment of this object yields longer life to the rail and lessens breakage, noise, damage to rolling stock, cost of maintenance, etc.

The base flanges 1 and 2 overlap, each therefore carrying the entire weight and being thereby interlocked by friction. This produces in effect a one-piece joint. The splice-bar flanges are given equal offsets, making each stronger near the web. The location of the recess 3 is such that when the two bars are unified by friction a desirable structural shape is provided. It is, therefore, claimed that for equal weights of metal this form of rail joint is the strongest made. Other advantages are: The wide thin base flanges, being more or less flexible, will accommodate themselves to each other and to the rail, and slight variations in thickness are minimized in effect. The holding power of the spikes on both sides of the joint is utilized to resist flange pressure, without adding to the tensile stresses in the track bolts. Unification by friction of base flanges 1 and 2 tends mutually to lower the neutral axes of the two bars. The lower base flange provides a satisfactory form of tie plate. The design is considered to possess the advantages of three-piece joints without their complexity. Mr. Stanford's office is in the Railway Exchange, Chicago.

Must Run Trains at a Loss.

The Supreme Court of the United States has decided in effect that the railroad commissioners of North Carolina can compel a railroad company so to adjust its time tables as to accommodate passengers on other lines even if the service is unprofitable. The opinion was delivered by Justice White in the case of the Atlantic Coast Line vs. the Corporation Commission. An order was issued by the commissioners directing the railroad to make connection at Selma at 2:25 p. m. with a train on another line running from the eastern part of the state, with the object of accommodating passengers whose destination was Raleigh. The railroad company resisted the order as it necessitated a special train. This, it was contended, amounted to taking property without due process of law. The Supreme Court of North Carolina held against the railroad company, and its decision is now affirmed. Justice White discussed the contention of the road that the case involved rates and said:

In a case involving the validity of an order enforcing a scheme of maximum rates of course the finding that the enforcement of such scheme will not produce an adequate return from the operation of the railroad, in and of itself, demonstrates the unreasonableness of the order, even if the rules applicable to an entire rate scheme were to be here applied; but as the findings made below as to the net earnings constrain us to conclude that adequate remuneration would result from the general operation of the rates in force even allowing for any loss occasioned by the running of the extra train in question, it follows that the order would not be unreasonable. The distinction between an order directing a carrier to furnish a facility and an order fixing rates as the primal duty of a carrier is to furnish adequate facilities to the public, that duty may well be compelled although by doing so as an incident some pecuniary loss from rendering such service may result. Of course, the fact that the furnishing of a necessary facility ordered may occasion an incidental pecuniary loss is an important criterion to be taken into view in determining the reasonableness of the order, but it is not the only one.

Mexican Street Car Conductors.

In the waiting room of the electric lines in the City of Mexico was one of these two-bit porcelain cuspidors chained to a staple in the floor and padlocked. I saw the necessity of such precaution when I inspected the car service. As a car leaves the barn a fellow called the "caredor," or something like that, takes a receipt from the conductor for everything in the car. Any parts missing when the car comes back into the barn are charged to the conductor. I saw a fellow docked for a missing brass rod from a curtain. The conductor on the shift before him got away with it. Another conductor had unscrewed a brass handle off a door to sell somewhere. The company was losing 2,500 electric globes a month; conductors sell them and report them as broken. Now all globe sockets are etched with acid and must be returned to prove breakage.

They have no such thing as a cash register on a street car in Mexico. Each conductor carries a small book, from which he tears a little ticket and hands it to a passenger as a sort of receipt for his fare. To encourage the public to ask for these coupons they are good as lottery tickets at the monthly drawing, when $2,500 is distributed in prizes. So most of the passengers save their tickets. The conductors, however, have a way of telling the peons, "Six cents with a lottery ticket, 4 cents without," and then they pocket the 4 cents. They have also issued counterfeit tickets and pocketed the fares.

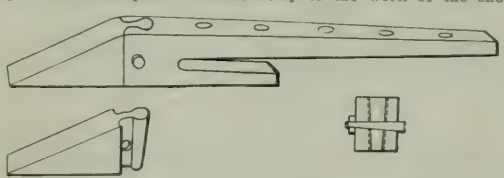
Mexican conductors are paid 10 cents an hour (Mexican money); the motormen 22 cents an hour from the fifth year on. The conductor, however, is never paid any more than 10 cents an hour, because his job is full of good chances. One reason that the motorman gets so much more pay is that he spends about half his time in jail. Every time there is an accident the motorman is arrested and jailed until the case is settled, but the company never has to pay any damages.—*Electric Traction Weekly.*

Consolidation of Morse Lines.

Four of the Morse steamship lines are to be consolidated under the name Consolidated Steamship Co., which was recently incorporated. The Ward Line and the New York & Porto Rico Steamship Co. will be merged later. For each 100 shares of stock of the old companies, 100 shares of stock and 10 collateral trust 4 per cent. bonds of the new company will be exchanged. The four companies are: The Eastern Steamship Co., which has $3,000,000 capital stock; the Metropolitan Steamship Co., $3,000,000 stock; the Clyde Steamship Co., $14,000,000 stock, and the Mallory Line, $14,000,000 stock.

Treacy Detachable-Point Dipper Tooth for Steam Shovels.

The Treacy detachable-point, steam-shovel dipper tooth is illustrated herewith. These points are made of solid steel, and may be re-sharpened or pointed when worn. Points can be changed quickly, new or re-sharpened points being substituted for dull ones, which may thus be sharpened without delay to the work of the shovel.



Treacy Detachable-Point Dipper Tooth for Steam Shovels.

The point is self-locking, there being no bolts. A taper pin is driven through the joint to prevent accidental separation. The joint is claimed to be perfectly rigid and as strong as if solid. The teeth are made of open-hearth cast steel, and are furnished with points of manganese or crucible cast steel for hard rock digging.

A chief advantage claimed for the detachable points is lessened cost of repairs. It is unnecessary to remove the base of the tooth from the dipper, and where an extra set of points is kept ready the shovel can be kept constantly in service. The teeth are made in any size for all makes of shovels. Benjamin C. Bradford, St. Paul, Minn., is General Sales Agent.

Passengers Versus Grain.

One passenger going through Boston is worth more to the community than the transmission of 100,000 bushels of grain. The passenger spends some money in the city, and is, therefore, of some benefit. During the past five years the passenger traffic has increased wonderfully. In 1900, 15,328 first class passengers, and 40,905 steerage passengers passed through Boston. In 1905 there were 25,850 and 101,706 respectively.—*E. Van Etten.*

Automatic Block Signals on the N. O. & N. E.

President Harvey, of the New Orleans & North-eastern, says that the lines of that road and of its affiliated companies, the Alabama & Vicksburg, and the Vicksburg, Shreveport & Pacific, are to be equipped with automatic block signals. It is the intention to erect signals on about 30 miles a year until the work is finished.

Iron Fencing for Railroads.

A substantial design of iron fence for retaining walls is shown in Fig. 1 herewith. It is made of a special three-rib steel channel rail, the third rib being placed to give additional strength where most needed. Fig. 2 is a design of inter-track and park fencing, in which the same channel rail is used. The picket heads are made of malleable iron to prevent possibility of breakage. Both designs are products of The Stewart Iron Works Co., Cincinnati, Ohio, which has a patent on the three-rib steel channel rail. Users of this fencing include the New York Central Lines, the Pennsylvania, the Chicago & North-Western, the Southern, the Illinois Central, the Lehigh Valley, the Mexican Central and the Louisville & Nashville. In addition to iron fencing the company makes wire and iron wickets, grilles, window guards, office and depot railings, folding gates, lamp standards and similar railroad equipment.



Fig. 1—Fence for Retaining Wall.



Fig. 2—Inter-Track Fence; Stewart Iron Works.

Sleeping Franchises in New York.

Governor Hughes, of New York, has vetoed a bill which would have extended the time in which the Davenport, Middleburg & Durham Railroad Company might begin the construction of its road. The Governor is opposed to the extension of so-called "sleeping" railroad franchises except for strong reasons. The road was incorporated in 1892. It was required to begin construction and expend thereon 10 per cent. of its capital within five years and to complete the road within 10 years. It has had two extensions, but construction has not yet been commenced. The Governor says: "The franchise to be a railroad corporation and to construct and operate a railroad is not to be regarded as a bounty conferred without reciprocal obligations, but is permitted in view of a supposed public interest and upon the condition that the railroad shall be begun and completed within the prescribed time. This is an important policy, and it should not be nullified by the grant of extensions unless exceptional circumstances demand them. No such circumstances are shown in this case."

TRADE CATALOGUES.

The Obermayer Bulletin.—The latest number of the bi-monthly magazine of The S. Obermayer Co., Cincinnati, Ohio, contains as special articles, a continuation of the series on "The Right Way to Run a Foundry"; "Shrinkage and Contraction"; "Where Should the Blame Rest?" having reference to the trouble known as "seaming" or "rat-tailing"; and "Foundry Practice." There are also other articles and notes of interest in the line of foundry information.

Manufacturing and Business.

The Russell Car & Snow Plow Co., Ridgway, Pa., has arranged to be represented in the east by Wendell & MacDuffie, 26 Cortlandt street, New York City.

The Lehigh Valley Railroad has moved its western passenger office from 218 South Clark street to 203 South Clark street, Chicago. The new office is in the new building of the Commercial National Trust Company, northeast corner of Adams and Clark streets, the center of the railroad and business district of the city.

The Lock Joint Pipe Co., 346 Broadway, New York, has received the following orders from railroads for the protection of tidewater piling: Charlotte Harbor & Northern, all bridges and docks between Hull and Gasparilla, Florida; Pennsylvania, Barnegat Bay bridge; Norfolk & Southern, the two transfer bridges at Winthrop and Oriental, N. C.

W. M. Vandersluis has been appointed Signal Engineer and Superintendent of Construction of the Western district of the Union Switch & Signal Co., with office at 1535 Monadnock block, Chicago, succeeding W. E. Foster, appointed Engineer Assistant to the General Manager at the general office at Swissvale, Pa. Mr. Vandersluis is a graduate of the University of Michigan. He was signal inspector on the Pennsylvania Lines West of Pittsburg for four years, and on the Harriman lines for about a year, and was Signal Engineer of the Big Four before going to the Union Switch & Signal Company. He is 27 years old.

Iron and Steel.

There is a demand for about 250,000 tons of pig iron, and the price has been advanced $2 a ton during the past week. The indications are that pig iron will be scarce, and the price further advanced.

The Carnegie Steel Company, it is said, has given an order to the American Bridge Co. for 6,500 tons of structural steel for a new open hearth mill. During April the orders received by the American Bridge Co. will aggregate probably more than 50,000 tons, and it is expected that May will be still heavier.

The Japanese Government, through Okura & Co., 11 Broadway, New York, its representatives in this country, has ordered from the United States Steel Corporation 75-lb. rails for 100 miles of the South Manchuria Railway, with fastenings, a total of about 13,000 tons. The price was $29 a ton at the mills, which is the highest paid by foreign buyers in a number of years. The contract requires delivery to begin in May.

A number of rail contracts have closed here this week on foreign account. They comprise orders from China, Mexico, Cuba, etc., aggregating 13,400 tons.

The United States Steel Products Export Company—the foreign branch of the United States Steel Corporation—secured a contract for 3,000 tons for use in the construction of the Yekkan Railway, China. Another requisition is for 5,000 tons for the Mexican Central, while 4,000 tons have been ordered for Pamana. The Pennsylvania Steel Company has an order for 1,400 tons, to be shipped to Cuba for a railroad to be built on the Stewart Sugar Company's plantation, formerly the property of the Silveira Sugar Co., in which J. M. Ceballos & Co. and associates were the dominant factors.

OBITUARY NOTICES.

N. T. Smith, Treasurer of the Southern Pacific, died on April 23 at his home at San Carlos, Cal. Mr. Smith was born in 1829 at Schodack, N. Y. He was made cashier and paymaster of the Southern Pacific Railroad in 1871, and five years later was appointed Treasurer. In 1885 he was appointed also Assistant Treasurer of the Southern Pacific Company, and since 1892 he has been Treasurer of both companies.

E. G. Russell, Executive Agent of the Grand Trunk Pacific in British Columbia, shot himself on April 25 at Prince Rupert, B. C. Mr. Russell was born in 1858 at St. George, N. B., and began railroad work in 1874 as a telegraph operator on the Minnesota & Northwestern, now part of the Chicago, Milwaukee & St. Paul. After serving as train despatcher and assistant to the Superin-

tendent, he was, in 1882, made Superintendent of Telegraph. In 1886 he was appointed Assistant General Superintendent, and in 1888 went to the Illinois Central as Assistant Superintendent of the Chicago division. Later in that year he was made Superintendent at Rockford, Ill., of the Chicago, Madison & Northern, now part of the Illinois Central. After serving as Superintendent of different divisions of the Illinois Central, he was appointed Superintendent of Transportation in 1891, and the next year was made Superintendent at Dubuque, Iowa. In 1893 he went to the Rome, Watertown & Ogdensburg as Superintendent. In 1899 he was made Superintendent of the Morris & Essex division of the Delaware, Lackawanna & Western, and in a few months was promoted to be General Superintendent of that road. In 1901 he was made Manager of the Intercolonial, from which position he resigned in the fall of 1902 to go into private business until he was appointed Executive Agent of the Grand Trunk Pacific.

David Willcox, who recently resigned as President of the Delaware & Hudson, shot himself on April 24 while at sea on the North German Lloyd steamship "Barbarossa." Mr. Willcox, who went abroad in ill health and had not recovered, was returning from Naples. He was born on December 12, 1849, at Flatbush, L. I. He graduated from Yale College in 1872, being valedictorian of his class. He studied law at Columbia Law School for two years, and was admitted to the bar in 1874, after which he began to practice law in New York City. He was a member of the firm of Opdyke, Willcox & Bristow, which was the General Counsel for the Delaware & Hudson from 1883 to 1898. In 1898 Mr. Willcox was made General Counsel of the Delaware & Hudson and in 1900 was made Vice-President. He was elected President in the spring of 1903. While President of the Delaware & Hudson, Mr. Willcox had a prominent part in directing the policy of the anthracite roads, particularly during the strike in 1902, when he took the stand that the miners, led by John Mitchell, were acting in restraint of trade and therefore violating the Sherman anti-trust law.



David Willcox.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Railway Signal Association.

The May meeting of this Association will be held in the building of the American Society Civil Engineers, 220 West Fifty-seventh street, New York City, on Tuesday, the 14th, beginning at 10 a.m. The subjects for discussion are as follows: 10 to 12—Preliminary report of Committee No. 15. This report treats on Specifications for Mechanical Interlocking for Drawbridges, and changes in certain paragraphs in Mechanical Specifications adopted October 16. 12 to 1—A paper on "How to Reclaim Storage Batteries After Being Improperly Used." 2.30 to 4—Paper on "Copper Clad Steel Wire for Electric Purposes," by Byron E. Eldred. 4 to 4.30—The following questions:

1. When track relays are shunted, current is not entirely absent, with train in block. What current does the relay receive under such conditions?

2. Would a relay, able to pick up at .030 and release at 50 to 75 per cent. of the pick up, be desirable; also, with such relay could longer blocks be used?

3. What would the ideal pick up and release points be for a 4-ohm relay?

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Erie.—See Delaware & Hudson under Operating Officers.

Operating Officers.

Ann Arbor.—See Mississippi Central.

Canadian Pacific.—V. A. Harshaw, Trainmaster at London, Ont., has been appointed Superintendent of Terminals at Toronto. A. Swinnerton succeeds Mr. Harshaw.

Delaware & Hudson.—C. S. Sims, Assistant to the President of the Erie, has been appointed General Manager of the Delaware & Hudson.

Grand Trunk.—W. G. Brownlee, Superintendent of the Middle division, has been appointed to the new office of General Transportation Manager, in charge of maintenance and operation, with office at Montreal. A. A. Tisdale, Assistant to the Fourth Vice-President, has been appointed Assistant to the General Transportation Manager.

Gulf, Opelousas & Northeastern.—H. Flanders, Superintendent of the Avoyelles division of the Texas & Pacific, has been appointed General Manager of the Gulf, Opelousas & Northeastern, which has just been opened for traffic between Melville, La., and Opelousas.

Mississippi Central.—M. D. Fohey, Trainmaster of the Ann Arbor, has been appointed Superintendent of the Mississippi Central, succeeding M. H. McCabe, resigned.

New York Central & Hudson River.—David Hanna has been appointed Trainmaster of the Harlem division, with office at White Plains, N. Y., succeeding Gerard Van Tassell, promoted.

Pennsylvania.—S. C. Long, who was recently appointed General Superintendent of the Western Pennsylvania grand division, graduated from Lafayette College with a C.E. degree and began railroad work in 1881 as a rodman on construction work on the Pennsylvania. He was transferred to the Maintenance of Way department at Altoona in 1882, and in a few months was made assistant supervisor of the Pittsburg yard. The next year he was transferred to the Pitcairn yard, and in 1881 to the Philadelphia yard. In 1885 he was appointed supervisor of the Pittsburg, Virginia & Charleston, running from Pittsburg to Brownsville and Uniontown, and now the Redstone branch of the Pennsylvania. Later in that year he was transferred to Lancaster, Pa., on the main line, and in 1889 was appointed Assistant Engineer of the Delaware Railroad, now part of the Philadelphia, Baltimore & Washington. Four years later he was appointed Assistant Engineer of the Maryland division, and in 1900 was appointed Superintendent of the Bedford division. He was made Superintendent of the Allegheny Valley in 1902, and in 1903 was appointed Superintendent of the Pittsburg division, from which position he was recently promoted.



S. C. Long.

R. T. Morrow, who succeeded Mr. Long as Superintendent of the Pittsburg division, was born at Oswego, N. Y., in 1859. After a public school education and a two-year course in the New York State Normal School at Oswego, he began railroad work in 1876 in the Elmira shops of the Northern Central. In the summer of 1877 he began to prepare for Lehigh University, which he entered in the fall of 1878. He graduated with a C.E. degree in 1882 and at once re-entered railroad work in the Assistant Engineer's office at Williamsport on the Philadelphia & Erie division of the Pennsylvania. After being in charge of a location survey, he was made assistant supervisor of the Eastern division of the Philadelphia & Erie division. In 1884 he was made assistant trainmaster of the Lewisburg & Tyrone branch, and in 1891 was made supervisor at Altoona. He was appointed Assistant Engineer of the Middle division in 1893, and in 1894 was transferred to the Elmira & Canandaigua division of the Northern Central. In 1899 he was appointed Assistant Engineer of the Pittsburg division, and three years later was made Assistant Superintendent of that division. In 1904 he was appointed Superintendent of the Western Pennsylvania division, which is now a division of the Western Pennsylvania grand division, where he remained until his recent promotion.

Southern Pacific.—E. S. Luty has been appointed Trainmaster of the Salt Lake division, with jurisdiction over the First and Second districts, and office at Ogden, Utah, succeeding A. W. Wright, transferred. B. A. Campbell has been appointed Trainmaster of the Fourth district of the Salt Lake division, extending from Lovelock to Sparks, including Lovelock, Hazen and

Sparks yards, with office at Sparks, Nev. The authority of W. J. Stinson, Trainmaster of the Third and Fourth districts of the Salt Lake division, now extends over the line from Carlin to Lovelock, including the Carlin and Winnemucca yards, with office at Winnemucca, Nev.

Texas & Pacific.—See Gulf, Opelousas & Northeastern.

Traffic Officers.

Gulf, Opelousas & Northeastern.—J. W. Jordan has been appointed General Freight and Ticket Agent of the Gulf, Opelousas & Northeastern, which has just been opened for traffic between Melville, La., and Opelousas.

Michigan Central.—C. J. Hupp, Assistant General Freight Agent, has been appointed to the new office of Industrial Commissioner.

New York Central & Hudson River.—George H. Daniels, Manager of the General Advertising Department, has retired.

Northern Pacific.—G. A. Mitchell, General Agent at Spokane, Wash., has been appointed Assistant General Passenger Agent, with office at St. Paul, succeeding A. B. Smith, who resigned several months ago to go to the New York, New Haven & Hartford.

San Pedro, Los Angeles & Salt Lake.—Allen Waldbauer, commercial agent at Pittsburg, has been appointed to the new office of General Agent at that place.

Southern Pacific.—H. N. Gibson has been appointed General Agent at Monterey, Mex., succeeding E. F. O'Brien, resigned.

Wisconsin Central.—E. G. Clark, Assistant General Freight Agent, has been appointed General Freight Agent, succeeding H. F. Stohr. D. L. Freeland, General Agent at Chicago, succeeds Mr. Clark. F. B. Montgomery, General Agent at Pittsburg, succeeds Mr. Freeland. W. S. Campbell succeeds Mr. Montgomery.

Engineering and Rolling Stock Officers.

Buffalo & Susquehanna.—E. P. Lupfer, Division Engineer of the Northern division, has resigned to go into private business.

Missouri, Kansas & Texas.—William O'Herin, Superintendent of Machinery and Equipment, has been given indefinite leave of absence to recover from injuries sustained some months ago. W. H. Maddocks has been appointed Assistant Superintendent of Machinery and Equipment, with office at Parsons, Kan.

Wisconsin Central.—R. W. Cattermole, Division Engineer at Abbottsford, Wis., has been appointed to the new office of Engineer of Maintenance of Way.

LOCOMOTIVE BUILDING.

The Tampa Northern is said to have ordered four locomotives.

The New Orleans Terminal is about to buy two switching locomotives.

The Mississippi Central will shortly be in the market for several locomotives.

The New South Wales Government Railways will shortly be in the market for several locomotives.

George H. Carey, 1 Broadway, New York, is figuring on two lots of locomotives for Mexican plantations.

The Krajewski-Pesant Company, 32 Broadway, New York, is figuring on some heavy locomotives for Cuba.

The Tabasco Plantation Co., Onxaguena, Isthmus of Tehuantepec, Mexico, has ordered a locomotive from the H. K. Porter Co.

The Canadian Northern denies having ordered two eight-wheel, 50-ton locomotives from the Hicks Locomotive & Car Works, as reported in the *Railroad Gazette* of April 19.

The Philippine Railway is in the market for more locomotives. The contract will be placed through J. G. White & Co., New York. The combined locomotive and car contracts now pending will amount to about $400,000.

The Ann Arbor has ordered four simple Atlantic (4-4-2) locomotives from the American Locomotive Co., for August delivery. The specifications are as follows:

General Dimensions.

Type of locomotive	Atlantic
Weight, total	162,000 lbs.
Weight on drivers	94,000 "
Diameter of drivers	69 in.
Cylinders	19 in. x 26 in.
Boiler, type	Straight top
" working steam pressure	200 lbs.
" number of tubes	256
" material of tubes	Detroit steel
" diameter of tubes	2 in.
" length of tubes	16 ft.
Firebox, length	90½ in.
" width	62¾ "
" grate area	39.1 sq. ft.
Heating surface, total	2,292 sq. ft.
Tank capacity	6,500 gals.
Coal capacity	11 tons

Special Equipment.

Air brakes	Westinghouse-American
Axles	Midvale
Bell ringer	Gollmar
Brake-beams	Chicago
Brake-shoes	American
Couplers	Buckeye
Journal bearings	Ajax
Piston rod packings	U. S. Metallic
Valve rod packings	American Locomotive Co.
Safety valve	Crosby
Sanding devices	Leach
Sight-feed lubricators	Detroit
Springs	Ann Arbor R. R.
Steam gages	Consolidated
Steam heat equipment	Consolidated
Tires, driving wheel	Latrobe
" truck wheel	Latrobe
" tender wheel	Latrobe

The Northern of Costa Rica is in the market for eight 20-ton locomotives (narrow gage). The contract will be placed by R. B. Hubbell, Purchasing Agent of the United Fruit Co., which controls the road. Mr. Hubbell's office is room 1,612 Whitehall Building, Battery place, New York.

CAR BUILDING.

The Union Railway, it is understood, has ordered 2,300 gondola cars.

The Morgantown & Kingwood is about to buy several hundred steel coal cars.

The Starks Heater Car Company, Chicago, is in the market for 25 special freight cars.

The Chicago Union Traction Company contemplates buying from 400 to 600 city electric cars.

O. R. Whitney, Taylor Building, Cortlandt street, New York, is in the market for some flat cars.

The Southern is in the market for 150 box cars, and is reported to be in the market for 150 cabooses.

The Tabasco Plantation Co., Oaxaguena, Isthmus of Tehuantepec, Mexico, has ordered 70 cane cars.

The Duluth, Missabe & Northern, it is reported, is considering the purchase of various kinds of freight equipment.

The Milwaukee Refrigerator Transit Company, Milwaukee, as reported in the *Railroad Gazette* of February 8, is building 100 refrigerator cars at its own shops.

The Elgin, Joliet & Eastern, as reported in the *Railroad Gazette* of April 19, is asking bids on 3,000 freight cars of various kinds, and is considering the purchase of 50 steel box cars.

The Union Railroad, as reported in the *Railroad Gazette* of April 19, is in the market for 2,300 gondola cars of 100,000 lbs. capacity, and 400 wooden box cars; also is considering the purchase of 100 steel box cars.

The Philippine Railway is in the market for more cars, both freight and passenger. The contract will be placed through J. G. White & Co., New York. The combined car and locomotive contracts now pending will amount to about $400,000.

The Intercolonial, as reported in the *Railroad Gazette* of April 19, has ordered, from Rhodes, Curry & Co., five Bohn refrigerator cars of 60,000 lbs. capacity, 70 Hart convertible cars of 80,000 lbs. capacity, 100 box cars of 60,000 lbs. capacity, and 130 15-ton hopper cars of 30,000 lbs. capacity. The refrigerator cars will weigh 39,700 lbs. and will measure 28 ft. 9½ in. long, 8 ft. 1¼ in. wide and 7 ft. 6¾ in. high, inside measurements, and 36 ft. long, 9 ft. wide and 12 ft. 11⅝ in. high, over all. The Hart convertible cars will weigh 36,900 lbs., and will measure 32 ft. 2 in. long, 8 ft. 8 in. wide and 3 ft. ¼ in. high, inside measurements, and 34 ft. long, 9 ft. wide and 7 ft. 7½ in. high, over all. The box cars will weigh 34,800 lbs., and will measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements, and 36 ft. 9⅝ in. long, 9 ft. 2¼ in. wide and 13 ft. $3^{3}/_{16}$ in. high, over all. The hopper cars will weigh 20,700 lbs., and will measure 15 ft. 10½ in. long, 8 ft. 3 in. wide and 6 ft. 9 in. high, inside measurements, and 16 ft. 10 in. long, 8 ft. 6½ in. wide and 9 ft. 5 in. high, over all. Bodies and underframes of all cars will be of wood. The special equipment for all includes:

Bolsters	Simplex
Brake-beams	Simplex
Brake-shoes, for all except Hart Convertible	Christy
Brakes	Westinghouse
Door fastenings Refrigerator cars	Malleable
Door fastenings—Box cars	National Lock Washer Co.
Doors—Box and refrigerator cars	Intercolonial standard
Draft rigging	Miner tandem
Dust guards	Harrison
Paint—Refrigerator cars	White lead
Paint—All others	Red oxial
Roofs—Box cars	Chicago Galvanized Corrugated Iron Car Rfg. Co.
Roofs—Refrigerator cars	Wood
Springs	Intercolonial standard, hopper only
Trucks, for all except hopper cars	Simplex

The Northern of Costa Rica is in the market for 100 gondola

and 100 box cars (narrow gage). The contract will be placed by R. B. Hubbell, Purchasing Agent of the United Fruit Co., which controls the road. Mr. Hubbell's office is room 1,612, Whitehall Building, Battery place, New York.

RAILROAD STRUCTURES.

ALBANY, N. Y.—The New York Central & Hudson River, local reports state, will make improvements at its West Albany shops, to include new buildings and extensions to existing structures.

ALLENTOWN, PA.—Extensive improvements, it is said, are to be made at this place by the Central of New Jersey and the Lehigh Valley Railroads. These two companies agree to pay $18,400 towards the bridge at Tilghman street.

Negotiations are under way for rebuilding the bridge at Glendon over the Lehigh Valley tracks and the canal. When completed the structure is to be maintained by the railroad company.

AMES, IOWA.—The Fort Dodge, Des Moines & Southern, it is said, will put up a new station, also a car barn here.

CLINTON, IOWA.—According to local reports, the Chicago & North-Western is to make improvements, including a steel bridge to carry two tracks over the Mississippi river, a new station, improvements to freight terminals, a large roundhouse and new shops.

COLUMBUS, OHIO.—The Pennsylvania, it is said, will make additions and improvements to its freight house here at a cost of about $50,000.

HAVRE DE GRACE, MD.—The Baltimore & Ohio, it is said, is to replace the present single-track bridge over the Susquehanna river with a new structure to carry two tracks. The cost of the improvements will be about $2,000,000.

JOHNSTOWN, PA.—The Pennsylvania, the Cambria Steel Company and the city authorities are to build an overhead bridge from the central part of the city to the Twelfth ward.

LONDON, ONT.—The Pere Marquette, it is thought, will build two steel bridges in this city at a cost of $50,000.

MACKEY FERRY, N. C.—The Norfolk & Southern, it is said, has given a contract for building a trestle across Albemarle Sound, 5½ miles long, to cost $379,000, to the McLean Construction Company, of Baltimore. According to the terms of the contract the work must be finished by March 1, 1908.

NEW FLORENCE, PA.—The Pennsylvania, it is said, has submitted plans to the Borough Council for a subway 17 ft. high and 40 ft. wide at Legonier street under its tracks, which are to be raised 7 ft. at that place.

PHOENIXVILLE, PA.—The electric railroads have submitted to the County Commissioners a proposition to pay $25,000 towards the cost of the new steel bridge to replace the present Gay street bridge. The companies are to be allowed to operate street cars over the new structure.

PONTIAC, MICH.—The Grand Trunk is planning to put up a new station here to cost $25,000.

STRATHCONA, ALB.—Plans are being made for a new station to be built here at a cost of $65,000.

TORONTO, ONT.—The Grand Trunk, it is said, will build 20 new stations in Ontario this year.

WILLIAMSPORT, PA.—Work is about to be started by Rogers Bros., of Albion, who have the contract for the Campbell street undergrade crossing, and expect to have the work finished in about four months. The Pennsylvania is to pay $18,700 of the $39,000 which the proposed subway is to cost.

WINNIPEG, MAN.—The city council has decided that the Midland of Manitoba must build six concrete subways in connection with its entrance into Winnipeg.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ASTORIA & COLUMBIA RIVER.—According to local reports, on the extension which this company is building from Cartwright, Ore., south to Tillamook, 45 miles, there will be 17 tunnels aggregating 19,000 feet in length. (March 15, p. 379.)

BESSEMER & LAKE ERIE.—Surveys are about finished for building an extension of the Western Allegheny from Kaylor, Pa., northeast to Reidsburg, where connection is to be made with the Franklin & Clearfield, now being built by the Lake Shore & Michigan Southern. The work includes a steel bridge over the Allegheny river near East Brady.

Officials of this road have authorized the expenditure of $100,000 for additional tracks near Greenville, Pa. This, it is said, brings the total appropriations for track and shop improvements on this road for the present year up to $1,000,000.

BLANEY & SOUTHERN. See Minneapolis, St. Paul and Sault Ste. Marie.

BUFFALO, ROCHESTER & EASTERN.—Incorporated in New York with a capital of $3,500,000 and office at Rochester. This company, composed of men interested in street railroads in Massachusetts, proposes to build a line to parallel the New York Central from Buffalo east to Rochester and thence to Troy, 300 miles. The directors are: R. D. Gillett, H. W. Ely and A. D. Robinson, Westfield, Mass.; A. W. Eaton, Pittsfield; F. Weston, Dalton; H. W. Bowman, F. T. Ley, Springfield; J. O. Skinner, Holyoke; J. H. Caldwell, Troy; J. J. Whipple, Brockton, and J. F. Shaw, Manchester.

CHICAGO, OTTAWA & PEORIA.—Incorporated in Illinois with $50,000 capital to build a line from Chicago southwest to Peoria, 150 miles, with a branch from Ottawa west to Princeton, 35 miles. The incorporators include: H. E. Chubbock, of Ottawa, and W. A. Carnahan, C. Zilly, C. A. Wright and G. Mattis, of Champaign.

CIMARRON & NORTH WESTERN.—See St. Louis, Rocky Mountain & Pacific.

COLORADO ROADS (ELECTRIC).—Plans are being made to incorporate a company with $2,000,000 capital, in which Greeley and Denver capitalists are interested. The company is being formed to build an electric line from Greeley, Colo., south to Denver, about 58 miles. The proposed line is to run between the Colorado & Southern and Union Pacific, paralleling the latter into Denver.

COLUMBIA, KENTON & LIMA (ELECTRIC).—This company is to be incorporated in Ohio, as a consolidation of the Columbus, Urbano & Western, the Lima, Kenton & Marion, and the Delaware, Megantic Springs & Northern Traction.

COLUMBUS, URBANO & WESTERN.—See Columbia, Kenton & Lima Electric.

DELAWARE, MEGANTIC SPRINGS & NORTHERN.—See Columbia, Kenton & Lima Electric.

LIMA, KENTON & MARION.—See Columbia, Kenton & Lima Electric.

MEXICAN CENTRAL.—According to Vice-President H. R. Nickerson, this company has made surveys for an extension from Balsas, south via Chilpancingo to Acapulco, on the Pacific coast, about 100 miles, to complete the through line from the City of Mexico to Acapulco.

This company, it is reported, has given a contract to the Atlantic Construction Company, of Boston, for building the proposed extension to Tampico. Some of the work has been sublet to Belle & Somers, of Mexico City.

MEXICAN ROADS.—A concession has been granted to Inigo N. Noriega to build a line from Mexico City southeast to Chalco, in the state of Mexico, about 20 miles. By the terms of the concession, surveys must be begun within one month, six miles built the first year, and the entire line finished by the end of the second year.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—This company, it is said, has bought the Blaney & Southern, a logging railroad eight miles long, operating from Blaney Junction, Mich., north to Bear Creek, and proposes to build an extension north about 10 miles to Germfask, where a connection is to be made with the Manistique Railway.

MONTEREY, FRESNO & EASTERN.—Work has been started on the construction of a 1,500-ft. wharf at Monterey, Cal., the ocean terminus of this proposed line. The company has been incorporated with a capital of $5,000,000 to build a line from Fresno, Cal., west to Monterey, about 140 miles. The new line is being built as a steam road, but it is probable that it will be converted into an electric line within a few years. It is the intention of the San Francisco capitalists who are interested in the company to extend the road at some future time. In locating the final surveys, a route was selected with such grades as will obviate the danger of flooding the tracks along the Salinas river valley and at other points where the existing railroads suffered much interruption of traffic during the spring freshets this year. The distance from Monterey to Salinas by the new road will be 16½ miles. Although the heavy freight shipments that are expected from the fruit and raisin districts surrounding Fresno and the diversified farming products of the intervening territory will furnish the greater portion of the new road's revenue, a large passenger traffic is expected also, especially in summer. The 400-ft. wooden truss bridge across the Salinas river is the only important bridge. There are no difficult engineering features, but there is to be a loop at the Rocks at San Juan, where the road will follow the contour of the hill. In entering Monterey the line nearly parallels the Southern Pacific and runs through the streets near the business center. Rails have been ordered and grading will be commenced at Hollister in May. Gangs of graders will work both ways. A. D.

Bowen is President, and E. W. Wilson, the Vice-President of the American National Bank of San Francisco, is Treasurer. The cost of construction and equipment of the line is estimated at $2,500,000. Cars and locomotives have already been ordered sufficient for the first year's requirements. It is announced by the management of the company that the Watsonville Transportation Company's six-mile electric road has been bought. This extends west from Watsonville to Port Watsonville, on the Pacific ocean. The freight and passenger steamer "F. A. Kilbourne" is included in the purchase. This vessel will make regular trips between San Francisco and Port Watsonville and Monterey, connecting with the trains of the Watsonville branch road, which will be connected with the main line at San Juan.

NEW YORK SUBWAYS.—Bids are wanted by the Board of Rapid Transit Commissioners May 14 for building a section of route No. 9, in Centre street, between Canal street and Broome street, in the Borough of Manhattan. The general plan of construction calls for a sub-surface railroad. There are to be four tracks in Centre street and provisions for a spur turning west into Grand street. Separate bids are asked for the construction of pipe galleries in the same section. Bion L. Burrows, Secretary, 320 Broadway.

No bids were received April 25, on which date the Board of Rapid Transit Commissioners was to open bids for the construction of rapid transit railroads (subways) for the Lexington avenue line, and for the Seventh and Eighth avenue lines. (April 12, p. 531.)

OKLAHOMA & TEXAS.—President G. V. Stone, of Oklahoma City, is quoted as saying that arrangements are to be made to start work on this proposed line. Surveys were made about two years ago from Oklahoma City to Wichita Falls, Tex., 200 miles. It is the intention of the company to finish the section from Oklahoma City to Lindsay, Ind. T., as soon as financial arrangements have been made.

PACIFIC RAILWAY & NAVIGATION.—A contract has been let by this company for the construction of a tunnel 1,400 ft. long, five miles west of Buxton, Ore., to which point the road has been completed, on the extension building north to Veronia. (March 15, p. 388.)

PENNSYLVANIA.—The new line under construction from a point on the Buffalo division, running parallel to the Terminal Railway of Buffalo from Gardenville to a point just west of the crossing by the Buffalo, Rochester & Pittsburg, across that road, thence northwest crossing the Nickel Plate, the Buffalo & Southwestern branch of the Erie and the Lake Shore overhead, and coming down to grade near the Ridge road, where a delivery yard and regular freight station will be established, is nearing completion. North of this point, connection is to be made with the South Buffalo Railroad, running into the steel plant, and the Buffalo & Susquehanna Iron Co.'s furnace, and to the railroad's large ore-dock property and lake terminal facilities just north of the city. This line is slightly in excess of seven miles long and is being built to facilitate the movement of freight to and from the South Buffalo industries and the railroad company's canal, ore-dock and coal handling facilities.

ST. LOUIS, ROCKY MOUNTAIN & PACIFIC.—This company has built a standard gage railroad from Des Moines, on the Colorado & Southern, 80 miles south of Trinidad, Colo., to Ute Park, at the foot of Baldy Mountain, adjoining the Elizabethtown mining district. Including a branch of seven miles from Clifton House to Raton, and one of three miles from Koehler Junction to Koehler, the line is 106 miles long. From Des Moines to Cimarron is prairie. Above Cimarron the road threads the winding Cimarron Canon, not unlike the Grand Canon of the Arkansas in Colorado, and the grades run up to 2.1 per cent. maximum compensated for curvature. On the main line 80-lb. rails have been laid. At Clifton House the road spans the Canadian river and crosses the Santa Fe overhead with three deck plate girder spans, two of 60 ft. each and one of 30 ft. The supporting masonry is concrete. The other bridges on the road are timber trestles. The road connects with the Santa Fe at Raton and Preston, and, with the Dawson branch of the El Paso & Southwestern at Vermejo. The Raton branch crosses the Santa Fe overhead between Clifton House and Raton. At Vermejo the intersection of the El Paso & Southwestern is at grade, with interlocker. Suitable shops have been located at Cimarron. The road has a much better water supply than that of southern New Mexico. Operation of the entire line began in February. An extension westward 40 miles to Taos is projected. The Rocky Mountain Company's most important mining operation is at Koehler. The company will have 200 coke ovens in operation by July 1, to supplement 186 already in operation at Gardiner, near Raton. The full complement of ovens should produce about 175,000 tons of coke per annum. The Raton field yields high grade bituminous steam and coking coal, low in sulphur and well adapted to transportation. The principal market for the coal of the Raton field is in the El Paso district, and the copper mining and smelting regions of Arizona and Mexico. To reach the timber on the eastern slope of the Rocky Mountains the Cimarron & North Western Railway is under construction from Cimarron northwest 22 miles up the Ponil river. This line is designed as a feeder to the St. Louis, Rocky Mountain & Pacific.

ST. LOUIS, TERRE HAUTE & QUINCY TRACTION.—Incorporated in Illinois with a capital of $25,000 and office at Springfield. The company proposes to build an electric line from a point in Illinois opposite Terre Haute, Ind., west to Quincy, Ill., about 225 miles, and eventually south to St. Louis, Mo. The incorporators include: E. Yates, of Pittsfield; H. T. Wilson and H. C. Simmons, of Virden; P. Chase, of Decatur, and E. E. Barclay, of Springfield.

SOUTHERN.—The new line which this company is building from Jasper, Ind., northeast to French Lick Springs, will be finished about December 1. Landslides have caused considerable damage to the work in the neighborhood of French Lick Springs. This extension has been under construction for almost two years. It has been delayed by high water, by landslides, and by the difficulty experienced in boring a tunnel about four miles from French Lick Springs. The tunnel is to be 2,200 ft. long, 21½ ft. high and 16 ft. wide. It is to be lined throughout with reinforced concrete, and will cost when finished about $325,000. Four miles of track have been laid from French Lick Springs and six miles from Jasper. The roadbed is ready for the ties on the remaining 15 miles.

VANCOUVER RAILROAD.—C. H. Cobb, C. H. Healy and associates, of Seattle, Wash., it is said, will build a 25-mile line through timber lands on Vancouver Island.

WESTERN ALLEGHENY.—See Bessemer & Lake Erie.

RAILROAD CORPORATION NEWS.

ATCHISON, TOPEKA & SANTA FE.—Holders of the $103,001,000 common and the $114,173,730 preferred stock are given the right, until May 10, to subscribe to an issue of 10-year, 5 per cent. convertible bonds, at par and accrued interest, to the extent of 12 per cent. of their holdings in stock. The bonds are convertible into common stock until June 1, 1913.

CHATTANOOGA SOUTHERN.—W. W. Kent and E. C. Osborne have been appointed receivers of this road, which runs from Gadsden, Ala., to a point near Chattanooga, Tenn., about 100 miles, including branches. The receivers were appointed on application of the Pacific Construction Company, which owns bonds on which interest has been defaulted. The sale of the Chattanooga Southern to the Louisville & Nashville has been pending since October, 1906.

CHESAPEAKE & OHIO.—This company has arranged to sell to Moffat & White and Proctor & Borden $600,000 4 per cent. 40-year Potts Creek branch bonds. They are secured on the line being built from Covington, Va., southwest 25 miles, which, it is expected, will be in operation by July 1.

CONSOLIDATED RAILWAY (NEW YORK, NEW HAVEN & HARTFORD ELECTRIC LINES).—See New York, New Haven & Hartford.

DENVER & RIO GRANDE.—The United States Supreme Court has given a judgment for $1,808,272 in favor of R. S. Raphael against the Wasatch & Jordan Valley, which runs from Bingham, Utah, to Alta, 44 miles, and is now a part of the Rio Grande Western. When the road was built, 30 years ago, $884,000 7 per cent. mortgage bonds were issued, of which Nathan Raphael bought $680,000, but interest was defaulted in 1882 and the present owners bought the property under foreclosure. The suits terminating with the above decision were started by Nathan Raphael and continued after his death by his son. The above judgment represents principal and accrued interest.

LOUISVILLE & NASHVILLE.—See Chattanooga Southern.

MOBILE & OHIO.—This company has sold to the Mississippi Valley Trust Company and Francis Bros. & Co., St. Louis, $1,291,000 5 per cent. equipment trust notes maturing serially up to October 1, 1914. The notes, which are guaranteed by the American Car & Foundry Company, cover 1,000 box cars and 750 gondolas.

NEW ENGLAND INVESTMENT & SECURITY.—The $10,000,000 4 per cent. preferred stock of this company is being offered to the public at 92½ and accrued dividends. It is stated that about $7,000,000 has been sold. The company is the holding company for the New York, New Haven & Hartford electric lines in Massachusetts; it was formed last year, and the dividends on the preferred stock are guaranteed by the Consolidated Railway, which owns all of the $10,000,000 common stock.

NEW YORK, NEW HAVEN & HARTFORD.—A meeting of the stockholders of this company has been called for May 31 to ratify the merger of the Consolidated Railway with the New York, New Haven & Hartford.

See New England Investment & Security.

WASATCH & JORDAN VALLEY.—See Denver & Rio Grande.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Results with Two-Cent Fares in Ohio.... 633
- Proposed Freight Car Diversion Penalty. 633
- The New York Commission and the New York Central Wreck 634
- The Rate of Return on Railroad Securities 634
- The Rehabilitation of the Brooklyn Rapid Transit Company 635
- Proposed Advisory Board for Cape Colony 636
- Dissatisfaction with the Italian Railroads 636
- Judicial Business by Telegraph..... 636
- New Publications 637

ILLUSTRATED:
- The 16th Street Track Elevation of the Burlington, at Chicago..... 641
- The Rehabilitation of the Brooklyn Rapid Transit Company 644
- The Union Pacific Gasolene Weed Burner 648
- Tractive Power of Electric Locomotives 650
- Ten-Wheel Locomotive for the Central Railway of Peru 652
- Track Deformations and Their Prevention 654

CONTRIBUTIONS:
- Superelevation 639
- The Profitable Weight and Speed of Freight Trains. 639
- Continuous Rails for Uniform Track Structure 640
- Inside Valve Clearances 640

MISCELLANEOUS:
- A British View of Stock Watering 643
- Report of Florida Railroad Commission . 644
- Economy in Power 649
- Central Railroad Office at Berlin 650
- Objects and Effects of State Regulation.. 651
- Signaling, New England Railway Club... 653
- Effects of Steaming and Preserving on the Strength of Ties 656
- Russian Petroleum 656

GENERAL NEWS SECTION:
- Notes 657
- Trade Catalogues 658
- Meetings and Announcements 659
- Elections and Appointments 659
- Locomotive Building 660
- Car Building 661
- Railroad Structures 662
- Railroad Construction 662
- Railroad Corporation News 664

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The Cleveland & Marietta is a branch in Ohio of the Pennsylvania Lines West extending from Marietta on the Ohio river north 103 miles to a connection with a branch line of the Cleveland & Pittsburg, of which it is in reality an extension. As its mileage is all within the state of Ohio and it makes a separate annual report, which has just been issued, its passenger results for the year ended December 31, 1906, must reflect to a considerable extent the effect of the Ohio two-cent-fare law which went into operation in March of that year. More than this, these figures, though not conclusive for all the railroads in Ohio, should be typical of the effect of the reduction of passenger fares on the passenger earnings of short local lines in that state. During 1906 the number of passengers carried increased 13.5 per cent., and the number of passenger miles traveled, 12.4 per cent. over 1905. The passenger train mileage increased 1.3 per cent. Instead of an increase in gross earnings as a result of the 751,536 more passenger miles traveled, gross earnings from passenger traffic decreased 3 per cent. This was the result of a fall in the average passenger mile rate, as a result of the two-cent-fare law, of 2.9 mills or 12.2 per cent. The companies in the Pennsylvania system make a practice of reporting passenger expenses separately, these figures being obtained by assigning to the passenger service all expenses directly connected with its operation, and pro-rating expenses common to both freight and passenger service on the basis of car mileage. A slight reduction from the figure of the preceding year was made in the cost of operation but, even in spite of this, there was a loss per passenger per mile of 5.3 mills, about 50 per cent. more than in 1905. Translated to train-mile figures this means a loss of over 22 cents for each mile run by passenger trains during the year. The increased business resulting from the lower passenger fares did not make up for the loss in passenger earnings. Where population is dense the gain in business normally makes up for the loss in earnings due to reduced fares, but it is difficult to accomplish this result in any but thickly populated regions. Without a large amount of new business, there is a decrease in gross earnings with no corresponding decrease in operating expenses. On the contrary, there is likely to be an increase in operating expenses to care for what new business there is. The result of this one year's operation on the Cleveland & Marietta cannot be held to be conclusive, but if railroads in Ohio continue to find that the passenger business is being conducted at a loss, their natural action will be to reduce operating expenses by reducing the passenger service.

One large road, we hear, purposes to vote against the proposed universal penalty for wrongful diversion of freight cars, because the rule, as drawn, allows the arbitrator to be lenient with roads which, while innocent of wrongdoing, are suffering from an exceptional scarcity of cars. If a road has lent so many cars, and has received in return so few, that it has in use five per cent. less than it owns, it may be excused from paying penalty for using borrowed cars in local service. A road which has not suffered this five per cent. loss must settle in full for using anybody's cars in disregard of the owner's wishes. It is difficult to see the equity of this 95 per cent. provision, and it is easy to sympathize with those who are disposed to vote against it. But the rule, we think, ought to be adopted in spite of this apparent injustice in a detail. Even if the injustice be real, the rule is so important and so necessary that failure to adopt it would be a misfortune. This is a case where half a loaf is very much better than no bread at all. Even the attempt to cure the diversion disease, however poor the results, will be a useful educational process. Diversion is wrong, and always has been wrong, whether a penalty is assessed or not. If road *A* diverts and has to pay, while road *B* does the same and goes free, the fact is, indeed, irritating to *A*, but it will not be the first time that Justice has been a trifle inaccurate in aiming her arrows. The freight car problem is so big and unwieldly that only by the imposition of technical injustice on some roads can progress be made at all. The change from mileage to per diem has been accomplished only by the meek acceptance of unfair results in many places. In urging the adoption of a penalty rule we do not forget the committee's conclusion that penalties have thus far accomplished but little; neither do we despair of a pool. For ourselves, we must confess that the task of securing agreement on a pool seems mountainous, and the prospective task of managing one so that it would be worth its cost, still more difficult; but every well-considered effort in the direction of freight car economy by the present committee deserves the moral support of all railroads, because, as Commissioner Lane observes, such support is a duty of good citizenship. The penalty rule

is to be supported, therefore, because first, the Association has strongly recommended it and, second, because diversion of cars without their owners' consent is inherently and flagrantly wrong.

THE NEW YORK COMMISSION AND THE NEW YORK CENTRAL WRECK.

Concerning the derailment of the electric train on the Harlem division of the New York Central on February 16, the New York State Board of Railroad Commissioners has this week made public its report. Its length, between 5,000 and 6,000 words, and its having no facts or, indeed, opinions which have not heretofore been fully developed and published in these columns, prevents us from publishing it in full. It is quite within the bounds to say that this report has no value of any kind whatever, either in enabling the public to know more of the cause of railroad accidents, or as suggesting anything to a railroad officer. The significant parts are as follows: "No evidence was produced or discovered which would justify the board in charging the wreck either to obstacles on track, broken parts of equipment, or defects inherent in engines." The two remaining possible causes of the wreck considered by the board are "character of the track" and "high speed." As to "character of the track," the only positive statement in the report is as follows: "The testimony given tended to show that the track and roadbed were laid in accordance with the official standards of the New York Central Railroad both as to quality and super-elevation of the outer rail, and that that was in accordance with the standard recognized in American railroad construction; although the records of the company show that at one time the super-elevation at the point of derailment has been five inches. There is no evidence that the rough spot in the track, discovered the next morning, was experienced by any other engineer during the day and prior to the accident, although the morning engineer rode the same track during the day, but at a less rate of speed."

Concerning "high speed," the commissioners say that in compliance with their own suggestion the New York Central caused as nearly as possible a duplicate of the wrecked train to be made up and run over this section under what was believed to be the same application of power and brakes made by the motorman of the wrecked train. The commissioners report the result of this test as follows: "The train was running at 48.5 miles per hour at the point of the wreck."

The commission's finding, in view of its above quoted statements as to the quality of the track, of the testimony of the motorman and the man in the cab as to speed, of the commissioners' own experimental examination to indicate the probable speed, is a shocking example of the *non sequitur*. It is as follows:

"The Board finds that the accident was caused by a condition of weak track, which was discovered and reported by the engineer of train 5X, which left the Grand Central Station on the morning of Feb. 16 at 9:03 a. m. Also that this bad spot became worse by reason of the pounding it received from numerous passing engines; holding, however, until subjected to the unusual and abnormal pressure exerted by the impact of the two powerful electric locomotives running at a very high rate of speed striking it in quick succession, shearing the spikes and causing the rail to spread. The accident, therefore, was the result of a track condition, plus speed; plus again the neglect to locate and remedy conditions that had been reported on the morning of the accident."

The recommendations are ten in number. Some are specific, some vague and others partaking rather of the nature of a sermon than of an official report. The recommendations are as follows, stars indicating omitted words of discussion or reaffirmation, which would have no interest to readers of the *Railroad Gazette:*

1. That the New York Central & Hudson River Railroad Company cause all tangent and curves on the main line tracks in the "electric zone" to be equipped with what is known as the "shoulder tie-plate," constructed with a shoulder on the outside of each rail with four spikes, two on either side of each rail, on each tie. * * *

2. That the company cause all curves in the "electric zone" to be maintained at a super-elevation not less than the present standard requirements.

3. The Board recommends that a careful, persistent and comprehensive observation of all conditions—track, roadbed, cars and engines—be made wherever electricity is being used, and that a record of such observations be kept in the office of the company, and that at stated periods, not less than four times a year, the result of these observations be filed with the Board of Railroad Commissioners. * * *

4. The Board recommends that there should be the same degree of intelligence in track maintenance as in track construction, and that it should somewhere appear, always affirmatively, in the records of the company and the responsibility located upon some particular officer, that the track and roadbed are fit for given trains of given weight and speed. The present system under examination is in accord, the Board believes, with the best standards of maintenance and direction for such maintenance given out from the office of the General Manager to the track walker. * * *

5. The Board recommends that some method should be devised whereby the line of responsibility between the construction and operating departments shall be kept clear and distinct. * * *

6. The Board recommends that it would be to the best interest of the public and the railroad company if the rules of the company required a consultation between the persons charged with maintenance of way of a particular division for instance, and the person charged with making up the train schedule, before such schedule were put in effect. * * *

7. The Board recommends that no one should be charged with the responsibility of construction of maintenance, where the non-performance of a duty may jeopardize human life, who is unable to express the result of his observations intelligently.

8. The Board recommends that rules should be so made in the carrying out of administrative duties as to make it impossible for the shifting of a responsibility from one person charged with it to another. * * *

9. That the company employ track walkers on each section in the "electric zone," at all hours of the day and night.

10. That each electric locomotive and each electric motor-car operated in the "electric zone" be equipped with fire extinguishers.

THE RATE OF RETURN ON RAILROAD SECURITIES.

As late as the years 1904 and 1905, and especially during the year 1901, the subject of the interest return to the conservative investor, as a question of the future, aroused much discussion and surmise. Under the influence of a prosperity not seriously marred by "high finance" on the one hand or corporation baiting on the other, the interest rate on high class investment had shown a distinct tendency downward. Municipal bonds, especially if locally non-taxable, had fallen to a 3.50 basis or even below. The best guaranteed railroad stocks were quoted regularly almost down to the same figure. Long bonds of high class dividend paying railroads ranged from 3.70 to 3.90; and some independent railroad stocks were forced up by the wave of speculation to a point which left even their own bond interest return behind. As a sequel there were a host of prophets who forecast a steadily declining interest return. Some of them even prefigured as a probability of a future decade or two an interest rate not exceeding 3 per cent. or even below that return. Vast accumulations of conservative capital, much of it hereditary, would, they said, bring about that result, if nothing else did.

Those prophets are not much in evidence now. They, and non-prophets as well, have during the last twelvemonth had opportunity for revisions of opinion and theories relating to the interest return. We have seen some of the financial laws that were supposed to be bed-rocked in experience seemingly reversed. "Prosperity" has been attended with immense shrinkage of the securities predicated upon it. We have had semi-panic without failures. Great railroad earnings have, on the face of things, forced down stocks; and increased dividends and new stock "melons" have done likewise. And, with it all, the interest return has soared upward. The financial seers of two years ago are 30 per cent. behind existent facts, let alone the future. But the fact of misguided forecast does not abate interest in the general problem of the future interest rate return. It rather intensifies it when, under the present anomalous conditions, we see over how large a field the question sweeps and how many and varied are its forces. No eye can look ahead far or very clearly. Yet some elements in a prognosis are discernible so far as they relate to railroads.

Change is the inflexible law of the financial world which, like the tides of the sea ebb and flow in shallows and depths and with countless waves on the surface. The fiscal market grows better or it grows worse, and its tendencies—what we may call its wave-lengths—are apt to reach over considerable periods though, of course, broken by temporary ups and downs. The railroads are, of course, to a degree creatures of the market and have even been overmuch the victims of high finance. But certain of their credentials of intrinsic value are to be noted. One is their institutional character founded on three-quarters of a century of steady development. A second is their great cost and the impossibility of replacement. A third is their close relation to public necessity and convenience. A fourth is their intimate relationship to labor on an immense scale. A fifth is their character as a great fraction in the material and vested wealth of the country; and a sixth is their immunity from any destructive power of new invention—for even the revolutionary forces of electricity have simply adapted themselves to the old steam road. All the foregoing qualities of stability in values the railroads possess and—with the single exception of real estate—they are almost alone among the interests of the country in possessing them. If we may liken the railroad system to a ship it

is singularly well built and equipped to ride out and through financial storm. The system may encounter certain reverses. But if it does, it means that other great interests must encounter reverses that are worse. It is at least rational to infer, therefore, that whether railroads pay the investor a high or low return, the basis of return will be lower than the large majority of other investments simply because the security will be higher—even allowing for a certain insecurity resting on the quasi-public character of the railroad and resulting peril of legislative attack; and investors must put their money somewhere.

The railroad system of the country will, of course, have its revolving wheels within wheels in the mechanism of investment. We shall see periods of panic and semi-panic when both shares and bonds go down. We shall see speculative times when shares render a return lower than bonds; and we shall, very likely, see such a phenomenon as during the "long drag" from 1873 to 1878, when the bond interest return goes down while the stock return goes up—a psychological phase of investment due to the stock losses which focussed the investor's mind on security as contracted with speculative gain. There may also be times when the craze for some fresh form of investment temporarily depresses the railroad stock or bond. But for the reasons cited and in the long run the railroad investment must rank as a "preferred" one with relatively low interest return; and those who cry calamity and ruin based on popular and legislative assault forget what serious material hurt railroad calamity inflicts on communities and how quickly the sentiment in such communities reacts.

In all financial storms and rough weather the railroad must necessarily share in the general stress. When money rates are high, when business projects and demands outrun free capital, when securities of all kinds remain undigested the railroad security must fall in price too and its investment return be high; and, when the general fiscal conditions are reversed, the railroad investment return will be low. But through all such perturbations one may look confidently to the average railroad security for quicker recovery and more assured, if lower, return than any other group of investment in material plants.

But, turning from the relative to the more absolute question, will railroad returns on conservative investments revert to the low interest basis of the years that immediately preceded the present shrinkage of values? Under normal conditions of American finance and industry probably not in a generation, certainly not for many years. The proposition seems negatived by the material development of the country as great as it is persistent and stretching out, with its cry for new capital, in so many industrial directions. That broad and pervasive fact seems more potential on the future investment return than any spectres of harmful government regulation or socialism. On the other hand federal acquirement of the railroads would obviously reduce the interest return by enhancing the average security; and an experience like that of the middle seventies might repeat the era of lower return on railroad bonds. But both these contingencies we class as too abnormal and remote for sober consideration. Barring them, the investment return on the gilded or silver-gilt railroad investment, while almost sure to be lower than now, must wait long before returning to the old basis. Investors in long term bonds antecedent to the short term note period must console themselves now with the security rather than with the rate. They have, besides, the sentimental consolation of being victims of the unforseeable.

THE REHABILITATION OF THE BROOKLYN RAPID TRANSIT COMPANY.

Every public service corporation gets condemnation by its patrons, but in Brooklyn the intensity of bitter animosity toward the great transportation company which holds the borough in its grip of monopoly is of its own kind. It has no parallel. As an example of this public sentiment, the editor of one of the daily papers did not hesitate to say a few years ago that no paper in Brooklyn could financially afford to frankly commend the Brooklyn Rapid Transit Company for anything it had done or intended to do in that city. At every public meeting, in every political campaign the company had been the object of ridicule and abuse. This spirit of hostility is not roused in a community without just cause, and its abatement when the cause is removed, is even slower than its growth. Elsewhere in this issue we print the first of two articles which outline the reasons for this hostility and consider in detail the efforts of the company in recent years to regain favor by giving the city real rapid transit under conditions as difficult in many respects as can be found in any city in the world.

Brooklyn is essentially a city of homes, spread over a wide area. A large proportion of its citizens do business during the day on Manhattan Island, crossing the natural barrier, the East river, every night and morning. Let a single cog in the complicated machinery of transportation slip, a car be derailed, a power house break down, or an accident of any kind block the line, and immediately there is great inconvenience and much indignation. Let the cars stop moving for a day and business halts. It is no wonder then that the people of Brooklyn after having suffered for years from too frequent failures of a much overloaded and badly patched up transit system, became no longer satisfied with excuses and showed in every possible way their hatred of the corporation on which they must needs depend, but which could not or would not provide them with what, short of food and lodging, was their most important daily necessity.

From the time the surface lines were electrified in 1893 there began in the borough of Brooklyn an unprecedented growth of population. The only physical connection between Brooklyn and Manhattan up to 1905 was the Brooklyn Bridge. In 1897, when surface cars were first operated over the Brooklyn Bridge the yearly traffic was 50,000,000; in 1906, nine years later, the estimated traffic over the Brooklyn Bridge alone, not counting pedestrians, was 150,000,000 passengers, and, in addition, the Williamsburgh Bridge carried 45,000,000 and the ferries 100,000,000. The increase in travel between 1893 and 1902 far exceeded the increase in facilities for handling the traffic. The power houses were overloaded, the partly completed electrification of the elevated lines involved the care and operation of machinery which was relatively new and untried, the number of cars on both the surface and elevated lines was inadequate, and the equipment could not be spared from service long enough for proper inspection and repairs. Breakdowns and failures of all kinds were the natural result, and although not the company's fault, the disgraceful crowding in the rush hours at the Brooklyn Bridge was (as it still is) an insult to the decency of the citizens, who were obliged to fight their way on and off the cars every day. The company was blamed for this as well as for its own faults and failures. The property had been patched up from time to time, and the expenditures, even if well applied, which they were not, were wholly inadequate to provide the increased facilities needed. The service was undeniably bad.

In 1902, when Mr. Winter undertook the rehabilitation of the property, he faced a trying and complex situation. The citizens were hostile, the municipal government was antagonistic, and the property was a wreck. The first undertaking was to provide money for the extensive improvements which were absolutely and immediately necessary. This was done through a new refunding mortgage for $150,000,000, the proceeds to be used in retiring the securities of some of the constituent companies, and the remainder as required for improvements. The next work was to effect a complete reorganization and consolidation of the personnel and duties of the subordinate officers. Having the money and the men to carry out his plans, Mr. Winter began the far-reaching reconstruction whose progress thus far is outlined in these two articles.

Perhaps the hardest fight has been to free the company from the influences of political graft and to steer clear of the entanglements of city politics. The effort has been reasonably successful. For years the ward politicians and their favorite contractors, insurance agents and other henchmen reaped large profits from the company in return for immunity from the petty annoyances so easily applied. A volume might be written about the political intrigues which Mr. Winter has had to face in dealing with the bridge terminal problem, franchise grants, tax legislation and many other less important questions affecting the relations between the company and the city.

Depending on results rather than on promises and smooth words, Mr. Winter has been content for the most part to let the people of Brooklyn form their own conclusions as to whether or not the company was making a conscientious effort to remedy the evils so long suffered by the community and to provide a modern and efficient transit system. Shortly after he was made President a contract was made with the city for disposing of ashes in Brooklyn, and over $600,000 was invested in plant and equipment for removing the refuse. At that time the company was openly accused in some quarters of using unfair means in obtaining the contract. There have since been complaints that the collecting stations and incinerator plants constituted a public nuisance, and that the

ash cars caused delays to cars carrying passengers. The contract is soon to expire, and, more because it has aroused public hostility than because it has not been profitable, the company has notified the city that it will not again bid on the job. It will give up the business and write off on its books the investment of $692,000. There is some question as to when the contract expires. The company claims that it expires in 1907, but in spite of all the clamor about its having obtained the contract on unduly favorable terms, the company has been threatened with mandamus proceedings if it does not continue the collection of refuse until November, 1908.

Results of the improvement policy were not apparent at first, and the new administration came in for quite as much condemnation as the old, but the attitude of the public has been gradually changing. The innumerable civic organizations in Brooklyn no longer hold frequent meetings to denounce the company; only occasionally is an attempt made to make political capital out of it; the newspapers are ready and willing to give praise where praise is due. From a financial and operating standpoint the results of the improvements have been even more clearly marked. For the year ended June 30, 1902, the gross earnings were $12,510,622, net earnings $4,301,225, and net income after fixed charges $103,321. For the year ended June 30, 1906, gross earnings were $18,473,328, net earnings $8,031,951, and net income $2,742,952. With an increase of 48 per cent. in gross earnings, net earnings increased 86 per cent. and net income 2,450 per cent. The 1902 surplus, after deducting $84,428 for improvements, was only $18,893. In 1906, after deducting $1,652,113 for betterments and special appropriations, the surplus was $2,075,563. The operating ratio in 1902 was 65.5 per cent., and in 1906 had been reduced to 56.5 per cent.

The value of these improvements to the company is perhaps more strikingly illustrated in other ways, less important in the aggregate but more vital as really typifying the changes which have been wrought. Five years ago the insurance rate on the property of the Brooklyn Rapid Transit Company, including shops, stations, car barns, power houses and rolling stock, averaged $1.65 per $1,000. To-day it is $0.85, and this in spite of the fact that three years ago an arbitrary advance of 20 per cent. was made in the basis rate on all Brooklyn risks. The saving in yearly premiums, large as it is, is nowhere nearly so important as the reduction in the risk of destruction by fire of some important element of the transportation machine, which it indicates. Perhaps no better proof of the general toning up of the entire system can be had than the reduction of the amounts paid annually in settlement of damages for personal injuries. In the year ended June 30, 1901, 8.28 per cent. of the gross earnings was paid out in settlement of such claims. This percentage has been steadily lowered until for the year ended June 30, 1906, it was 3.71 per cent.; this notwithstanding the big increase in number of passengers carried. In 1906 the damages paid were over $300,000 less than in 1901, and less than in any year in the history of the Brooklyn Rapid Transit Company since it took over the lines which it now operates.

Proposed Advisory Board for Cape Colony.

In 1905 a resolution was adopted by the House of Assembly of Cape Colony calling on the government to consider the question of making some change in the management of railroads. A commission of seven members, with the Commissioner of Public Works, under whose authority are the railroads of the colony, as chairman, was appointed on February 4, 1907, and on March 1, after extended investigation, presented its report. With unimportant exceptions, the railroads of Cape Colony are owned and operated by the government, the government system including 2,865 miles. The roads are managed by the system usual in British colonial possessions, with a Commissioner, a government cabinet officer, at the head, and under him a General Manager, the active officer in control. The investigating commission in this instance reports that it is impressed with the necessity of removing as far as possible the railroad management from the influence of party politics without at the same time lessening the legitimate control which must be exercised by Parliament, as the representatives of the taxpayers. With this object in view, it submits certain recommendations, the first of which is that a railroad advisory board, not unlike the commission itself, be established, with the Commissioner of Public Works as chairman, four members of Parliament representing the legislature, two members appointed by the Governor from a list of names to be submitted by the various chambers of commerce of the colony, and two members representing the farming interest, a total of nine members. The functions proposed for this board are very broad, though they are all advisory. They include the general policy of railroad management in the colony and the relations of the Cape of Good Hope roads to other railroads in South Africa; fixing rates and fares for all classes of traffic; estimates of capital and other expenditures; the expenditure of any sum or placing of any contract of a value exceeding $25,000; all emergency expenditures; changes in the general organization, or those involving the abolition or creation of an office with salary of $2,000 or over; alterations in salaries, wages or hours of employment; changes in the train service, and measures of retrenchment. Besides these duties no proposal for new construction is to be presented to Parliament unless accompanied by a full report by the board, setting forth the capital expenditure to be incurred, estimates of the cost of working, the probable volume of traffic, revenue and effect on the traffic and earnings of existing lines. As an offset to these extensive fields of investigation it is expressly recommended that the board confine its attention mainly to large questions of policy, leaving the carrying out of all details of management to the executive officers of the railroad department. The interesting thing about this proposal is that it plans to give representation on the advisory board to the commercial and farming classes of the community who are most directly interested in the details of railroad management. In Prussia and other German states the local trade bodies have representation on a similar advisory board which must be consulted in regard to any proposed change in rates or service, and the system is said to work there with great success. There would seem to be no reason why such a body as that indicated by these proposals should not be successful in bringing about that co-operation between the railroads and the people which is to-day being found so necessary by our American railroad managers. The obvious drawback to this result in this case is that the four members of Parliament on the committee hold office only as long as they are members of Parliament, the same being true of the minister, who is chairman of the advisory board only during his term of office. This is contrary to the well established experience in this country that an able railroad commission is successful largely in proportion to its length of service. Railroad problems are at once so complicated and so vital that a body of men which is changing every few years fails of necessity to get the broad and experienced grasp of the subject which is above all else demanded in a body of this character. The success or failure of this advisory body in Cape Colony, if it shall be established, will be watched with interest, particularly as sooner or later some such formal recognition of the value of the advice of shippers and producers in railroad management is likely to be put in force in this country.

Dissatisfaction with the Italian railroads is becoming more serious than ever. It has received a further impetus from an incident by which the King of Italy himself was made to suffer. It is said that on a recent occasion, when His Majesty was about to make a journey from Rome, it was impossible to find a spare engineman on the spur of the moment, and the intended trip had to be abandoned. Whether this be true or not, there is no doubt that the general public, and especially the commercial community, has been suffering seriously. The mayors of three important cities, Genoa, Milan and Turin, recently met for the special purpose of protesting against the continued paralysis of the railroad service. The difficulty of making good the deficiencies in rolling stock, which existed when the roads were taken over by the state, have been recently emphasized, while one of the most authoritative deputies, formerly a Cabinet Minister, has just published a strong article on the subject. So important does he consider the industrial aspect of the matter that he calls upon the government, regardless of expense, to provide at once 1,000 more engines, 2,500 passenger cars, 400 baggage cars and 20,000 freight cars, and to appoint a Minister of Railroads, who will be directly responsible to Parliament, with a technical director under him. Even the employees seem to have derived little or no advantage from nationalization, which, as in Belgium, has benefited only the deputies and their friends. For, according to the well-known review, the *Nuova Antologia*, the rate of wages paid is miserable, and is in itself sufficient to explain the incompetence of the staff.

The Interstate Commerce Commission has advised California fruit shippers that it will take testimony in Los Angeles next Wednesday, May 15, on their complaint that the railroads are not furnishing a fair supply of cars for the shipment of oranges and lemons to the east. This complaint, which the fruit growers sent to Washington May 1 by telegraph, at an expense of $80, declares that the railroads are inflicting great hardship on the fruit trade by refusing to furnish cars until the fruit is actually packed and ready for shipment. According to the reports the action of the Commission on this complaint was unusually prompt and direct, which, no doubt, is the fact; but to a shipper with oranges rotting for lack of cars a response which takes fourteen days to get there must seem anything but prompt. Perhaps, however, the telegram promising to be there on the fifteenth is expected to do the business.

NEW PUBLICATIONS.

Allgemeine Eisenbahnkunde. Herausgegeben von L. Troske, Professor an der Techn. Hochschule, Hannover. Four parts—of these published Parts I. and II. 422 pp. Price, $3.00. Remainder in preparation. Royal octavo. Otto Spamer, Leipsig.

The important position occupied by railroads in modern industrial and economic life gives sufficient reason for this work. Its aim is to present in co-related form the various engineering activities that enter into building and equipping a railroad and the equally important subjects of management, administration and economics. While much of the subject matter has appeared in print, it was scattered through many books and pamphlets, or was to be found only in the files of the technical press. The author has done a signal service in gathering this information, systematizing it and presenting it as a whole. In this way he has not only furnished a text book for the student, but also a reference book for all who are interested in railroads. Written for an European, perhaps more especially for a German, audience, particular attention has been paid to European conditions, practice and requirements. While this is the case, the work is not less valuable on that account. Good practice on either side of the ocean is an incentive to good work, and it is knowing what has been done and what is being done that is of importance and makes for improvement. It is not the intention to convey the impression that American achievement and practice is neglected. Far from it, the many references to, and illustrations of what has been done here are abundant evidence to the contrary.

The subject is treated under four heads:

1. Location and Construction, pp. 112, 3 pl., 112 illust.
2. Equipment and Operation, pp. 310, 5 pl., 366 illust.
3. Cog Roads, Cable Roads and Street Railways (in preparation.)
4. Management and Railway Economics (in preparation).

Throughout footnotes refer the reader to original sources for fuller information. Only the most important formulas in connection with locomotive and train performance, as well as grade requirements are given, an elaborate discussion being beyond the scope of the work.

The growth and present condition of the railroad mileage and equipment of the different countries of the world is set forth in a series of tables. A condensation of some of these applying to conditions on January 1, 1905, is here given:

	Area, sq. miles.	Population.	Miles of railroad.	Miles of railroad per 100 sq. miles of area.	Miles of railroad per 10,000 of population.
Europe:					
Germany	208,710	56,367,000	34,505	16.5	6.1
Aus.-Hungary	261,130	47,118,000	24,323	9.3	5.2
Great Britain	121,200	41,450,000	22,540	18.8	5.4
France	207,050	38,962,000	28,425	13.7	7.3
Russia (Europe)	2,080,540	105,542,000	33,974	1.6	3.2
Bal. Europe	889,230	102,068,000	45,890	5.2	4.5
Total	3,767,860	391,507,000	189,657	5.0	4.8
N. & S. America:					
United States	2,992,580	78,595,000	213,730	7.1	27.2
Br. Possessions	3,427,220	5,553,000	20,250	0.6	36.5
Mexico	778,180	14,545,000	12,070	1.6	8.3
Central Am.	.....	.....	1,010	...	...
South America	6,956,400	40,225,000	32,750	0.5	8.1
Total	14,154,380	138,918,000	279,810	1.9	20.0
Asia:					
Br. Possessions	1,956,370	298,592,000	27,930	1.4	0.9
Rest of Asia	.....	.....	20,010	...	...
Africa	.....	.....	16,190	...	...
Australia, New Zealand, etc.	3,082,010	4,942,000	16,800	0.5	34.0

Comparison of Equipment, Jan. 1, 1905.

	Total No. of locomotives.	Average equipment for 10 miles of road: Locomotives.	Passenger cars.	Fr't & baggage cars.
Germany	22,000	6.33	12.83	134.08
Austria-Hungary	9,140	3.75	7.66	84.15
Great Britain	22,180	9.80	22.14	333.18
France	12,130	4.27	11.19	112.37
Russia, in Europe	13,130	3.86	4.30	89.24
All Europe	93,500	4.93	.....	.....
United States	45,500	2.13	1.40	78.63
All other countries	29,000	1.98	.....	.....
Total	168,000	3.08	.....	.....

From this it appears that Europe, including Great Britain, with a somewhat smaller mileage than the United States, has in use two locomotives for every one in use in this country. In this tabulation only numbers of locomotives and cars are given, not capacities, and greater numbers do not necessarily mean greater capacity for transportation.

The part devoted to location and construction is as concise as a proper regard for the ground to be covered permits. The "development of the line" to overcome or to reduce grades is liberally illustrated by diagrams and topographical maps of the achievements of the engineer in different parts of the world. The various devices for lengthening the line—utilizing lateral valleys, loops, switchbacks, spirals, tunnels and combinations of these to suit particular case are all represented. In contrast to this careful presentation, the closely related subject of tunnels and bridges seems rather neglected, and a fuller treatment of them would have been welcome.

In Europe there is a persistent endeavor to utilize iron ties, and a large number are in use on different roads; but there, as here, the wooden tie is still regarded as the more satisfactory. To increase the life of the wooden tie, in addition to treating with preservatives, a number of methods are in use that have not found introduction in the United States. Experience goes to show that the wooden tie is destroyed by mechanical wear rather than by rot. To lengthen its life, it is now the rule on all new work of the Prussian State Railways to fasten the rail to the tie by screws instead of spikes. In line with this is also the procedure of screwing hardwood dowels soaked in tar oil into soft wood ties; the screws that hold down the rail screwing into central holes in the dowels. This method is followed to quite an extent in Germany and in Austria as well as in France, where it originated.

While thoroughness within the limits of the scheme of the work is evident throughout, the subject of the development of the locomotive has been treated with particular care, and in the section treating of signals, the system of interlocking signals is gone into with considerable detail.

In the development of the locomotive three important periods are recognized and serve as sub-heads:

1. Constructions to enable the locomotive to adapt itself readily to sharp curves (1851 to 1900).
2. Development of the two, three and four-cylinder compounds (1876 to 1900).
3. Development of the superheated steam locomotive (1902 to 1906).

The suggestion for an improvement is often made or its prototype tested years before the successful construction appears. The Fairlie locomotive of 1864 and the Gunther-Meyer of 1868 had their prototypes in trial engines built for the Lemering Railway in 1851. In 1848-50 the Great Western of England built a couple of two-cylinder compounds, but their performance was unsatisfactory. Various designs were subsequently proposed in England, France and the United States, but the first successful compound locomotives were built by Schneider & Co. at Creuzot in 1876. A few years later saw the introduction of the three and four-cylinder construction.

As early as 1863 Petiet took up superheating steam, and in 1870 the Burlington made experiments in this direction, but the results were unsatisfactory. The first successful superheater applied to locomotives was designed by Schmidt in 1898 and soon after introduced on the Prussian State Railways. This was followed in 1903 by the remarkably simple design of Pielock. The use of superheated steam has made rapid progress in Germany. Towards the end of 1906 more than 1,000 locomotives in operation and 600 in course of construction were using or being fitted out for its use.

Cars on both sides of the Atlantic have developed along lines acceptable to the public using them, and while in matters affecting the comfort and safety of travelers, they have many features in common; differences due to local conditions and tradition will always exist. The section on car construction and equipment gives excellent descriptions of the salient points.

The safeguarding of trains by automatic and interlocking signal devices is described at considerable length. The German practice is illustrated by diagrams and drawings. While probably not better than the best in use here, it is controlled by stricter legal requirements. In many ways this book will be a valuable addition to the library of the student and the engineer, and it is to be hoped that the two remaining parts will soon be published.

Combustion and Smokeless Furnaces. By Jos. W. Hays. New York: Hill Publishing Co. 101 pages, 6 in. by 9 in.; 15 illustrations. Price, $1.50.

It is a pity that the contents of this book cannot be driven home to the inner consciousness of all who have to do with smoke prevention and production, from the man at the shovel in the fireroom up through the several grades of responsibility, through the owner, the smoke inspector and the board of aldermen, guilty of passing so many and such absurd ordinances forbidding the production of smoke as though black soot were the one thing above all others that is to be prevented from passing out at the chimney's top. The book is not what would be called optimistic. It shows that, in the combustion of soft coal, for that is the only fuel considered, we have a problem of such magnitude that its complete solution upon a commercial basis is well-nigh impossible. Starting out with the definitions and theories of heat and combustion it discusses very thoroughly the principles that operate and the conditions that are necessary to fulfill in order to effect a perfect union of the combustible elements of the coal and the oxygen of the air; and while the conclusion reached is that smoke can be prevented such adverse criticisms are offered to all proposed plans of accomplishing this result that the reader is apt to be staggered by the prospect of being obliged to make an effort to succeed. All through the book the author draws a sharp line between what is theoretically and what is practically possible, and the difficulties of the latter are set forth with no unsparing hand. The first requirement of a good boiler and furnace, as seen by Prof. Thurston, is that it should "secure complete combustion of the fuel without permitting dilution of the products of combustion by excess of air." Then the utter futility of expecting to attain this acme of perfection in the fireroom is shown.

In the chapter on the Chimney Evil, the absurdity of the average run of smoke ordinances is clearly shown. The relative hygienic effects of soot and the products of smokeless chimneys are set forth very vigorously and one wonders, when these things are called to mind, how it is possible that city fathers can be so hoodwinked or so careless as to do what they do, until their average technical intelligence is brought to mind. The conclusions drawn from this chapter are that a chimney is a dangerous thing and that when it appears least offensive to the eye it may be pouring forth such volumes of poisonous gases as to make it a menace to the health of the whole community.

Then follows a discussion of the several methods that are used for promoting combustion and preventing smoke. Some receive a few words of commendation and all are criticised severely. Of all these the steam jet fares the worst. For this the author has not a single good word except that it is cheap to apply. It is shown to be wasteful and inefficient and is given such an arraignment that its condemnation must necessarily follow any intelligent reading of the counts that are made against it, and at the conclusion the "writer dismisses the steam jet with the feeling that a disagreeable duty has been honestly performed in the interests of good engineering."

In reviewing the various types of furnaces their good and bad points are set forth and the owner is urged to purchase according to his own requirements and not allow himself to be guided by the assurances of an insinuating salesman—above all, not to be led astray by a test. He declares that an evaporation test for furnace efficiency is a delusion and a snare, and that an analysis of flue gases should be the basis of the opinion to be formed.

It is evident that the author has no axe to grind nor any pet scheme to exploit for he puts things with unvarnished sincerity and an evident belief in his own truthfulness, and is necessarily pessimistic because he is in the same position that is occupied by others who have thought deeply on the subject; he sees no practical way to secure that complete combustion without an intermingling with the products that surplus of air which is more detrimental and uneconomical than incomplete combustion, and do it in a way that is practicable under ordinary working conditions. Thus the book becomes an earnest protest against those who, not knowing what they do, seek and ask for more than the present state of the art can supply.

Valve Gears for Steam Engines. By Cecil H. Peabody, Professor of Naval Architecture, Massachusetts Institute of Technology. New York: John Wiley & Sons. 142 pages, 6 in. by 9 in.; 33 folding plates. Cloth. $2.50.

In his preface the author states that "the book is intended to give engineering students instruction in the theory and practice of designing valve-gears for steam engines," and yet a certain rather extensive degree of familiarity with valve operation would be necessary in order to enable anyone to use the instructions intelligently and to advantage. Graphical methods are used throughout in the body of the book, and that is well, yet there are some places where a geometrical demonstration could have been introduced to advantage to have fixed the principle as well as the fact. For example, in speaking of the Zeuner diagram, which is used throughout, the author gives a geometrical demonstration of the accuracy of the line of valve displacement for any crank angle and then adds an algebraic expression for it, leaving the reader to work out the reason why, when a half dozen words would have made it quite clear.

When the voluminous mass of matter that has been written upon valves and their gears is considered, it is not to be expected that the whole subject can be treated exhaustively in a single volume of the size of the one under consideration. A general and brief review of the subject is therefore given, taking up the types of valve gears in most common use. Indications are given as to the main points to be considered in designing each of them, and warnings are sounded as to the pitfalls that are to be avoided, though the means to be followed in securing this avoidance are not always given with sufficient detail. But with this the reader is cautioned that "facility in design is to be obtained through experience only."

Especial attention is paid to the plain slide valve and the Stephenson link motion, to which 83 pages are devoted; but the Walschaert gear is dismissed with a scant two pages that, of course, merely skim over the subject and indicate in the most general way its construction, so that as far as the actual assistance rendered to the designer is concerned, the student will have to work out his own salvation by a personal analysis of the problem. The same brevity characterizes the treatment of the other radial gears, known as the Marshall, Hackworth and Joy. As an appendix, there is a mathematical analysis of the relative movements of the crank and connecting rod, the Stephenson motion and the Zeuner diagram which is well worked out, and serves as a demonstration and a guide to those engaged in important work where such an analysis will be valuable as a check. As the author states, "so much of the material used is the accumulation of common practice," that there is little that is new. The book may therefore be regarded as a rather valuable collection of guiding marks to indicate the general course to be pursued in the designing of a valve gear, and calling for previous training in order that these marks may be fully identified and used for the worth that they possess, but for the beginner and the novice it would probably prove a difficult morsel to absorb.

Universal Dictionary of Mechanical Drawing. By George H. Fellour. New York: The *Engineering News* Publishing Co. 60 pages; 8 in. by 11 in.; 45 illustrations; cloth. Price, $1.00.

As will be seen from the announcement paragraph, this book is not as large as its title would lead one to expect, but this does not prevent the contents from being up to those expectations. The author, who is now associate professor of machine design and mechanical drawing at the Carnegie Technical Schools, brings to his work the practical experience in large manufacturing establishments and so presents his subject with the brevity and clearness that drawings themselves should possess. It is not a book of instruction in mechanical drawing, but rather a series of brief essays on the way in which work should be executed in order to be most readily understood in the shop. He treats of mechanical drawing as a language, as truly as English is a language in which lines are analogous to letters; views to words; projected views to sentences; drawings to chapters, and sets of drawings to books. So this language is one "of lines, views, dimensions, signs and abreviations, notes and explanatory matter, all for the positive conveying of exact information." In setting forth the character of this language, he gives the various kinds of lines, letters and symbols that should be used, and places especial emphasis on the proper dimensioning of drawings. Those dimensions should be given that the shop will need and in the way that it will need them, and for this the draftsmen should be familiar with practice to an extent to enable him to determine the sequence in which the work will be done. If the book succeeds in driving this one principle home to the consciousness and practice of its readers it will have fulfilled a mission that should earn it the gratitude of every man who has to work from drawings that are too often faulty in this particular.

Then, too, he attacks "first angle," projection, and shows the absurdity of this method of representation, by which one is supposed to be looking through the piece to get at the face drawn, and it is to be hoped that what he says will have its proper effect in killing the practice. Finally he impresses upon his reader the fact that a mechanical drawing should be so self-contained that it needs no verbal explanation. The character of the material, the finish to be put upon it, the dimensions should all be so carefully inserted that it becomes "in effect an illustrated specification," and no term should be so abbreviated that it is possible for any misunderstanding to ensue.

As already stated, the book is not an instruction book, in the ordinary acceptation of the term, but one to be read and heeded by the man who is more or less skilled, and whose attention has either never been drawn to the points here set forth or who has become careless in the practice of them; and, as the great majority of draftsmen are embraced in one or the other of these two classes, it follows that there are few who would not be benefited by the perusal of this dictionary, though it is difficult to understand why it should be called by that name.

American Electric Railway Practice. By Albert B. Herrick, Consulting Engineer and Edward C. Boynton, General Manager of the Orange County Traction Company. 403 pages; 6 in. x 9 in.; cloth; fully illustrated. The McGraw Publishing Company, New York, 1907. Price, $3.00 net.

The work at hand is a very complete study of the elements entering into street railway construction and operation, including preliminary estimates, not only as to cost, but also as to traffic. The chapters include discussion of field engineering for interurban roads, track construction, location of power stations, design of a car house and repair shop and of rolling stock; maintenance of track, overhead structure and equipment; and a number of operating topics as well. In its general field and scope the book is comparable to Mr. Gotshall's Street Railway Economics, but brings practice up to date and deals with a rather more extended range of topics. In discussing competition with the steam roads, on page 4, a table is taken from the *Railroad Gazette* showing the decreases in passenger traffic in certain Ohio regions following the introduction of interurban cars.

The practical suggestions throughout the book are thoroughly good and the work is done in a studious and careful manner. The book should prove of material assistance to those who desire to put themselves abreast of the best current practice in street railway work, and it will be of great value to a large field of street railway officers, from the president of the company, to the power house foreman who desires to increase his usefulness and earning power.

The Earning Power of Railroads. 1907 Edition. Compiled and edited by Floyd W. Mundy, of Jas. H. Olyphant & Co., 20 Broad St., New York. 337 pages, 4¾ x 7 in. Cloth.

This convenient reference book of railroad mileage, earnings, surplus, capitalization, income account, operating expenses and other statistics, makes its annual appearance in the usual form, with current additions to the tabular matter. It is compiled with considerable care and with tolerable, though not always perfect, accuracy.

Its accuracy is sufficient, however, to serve what we understand to be the purpose of the book; a ready reference to suggest lines of inquiry that may be followed up, later, from original sources.

CONTRIBUTIONS

Superelevation.

Pittsburg, Pa., May 4, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to the letter by Mr. John M. Fulton in your issue of May 3, regarding the effect of centrifugal force on a track where there is superelevation of the outer rail, it seems to me that Mr. Fulton has made several errors in arriving at his conclusion that superelevation does not affect the centrifugal force on the rails, unless it be greater than 12 in.

Mr. Fulton errs in comparing a body at rest on an inclined plane to one at motion on a track inclined at right angles to the direction of its motion. If the body on the inclined plane of Mr. Fulton's figure were in motion "at right angles to the paper," it would slide down the inclined plane, unless the force C pushing it up the plane were just equal to the component of the weight in the direction of the inclined plane; and if C exceeded the downhill force, the body would slide up the plane. A small force will move a very heavy weight that is supported on two revolving rollers, as per sketch, Fig. 1, and, unless these rollers are truly horizontal, the weight will slide down to the lowest point. This phenomenon does not in any way contradict the theory of friction. It is merely a matter of the resolution of forces.

It is common knowledge that if an attempt is made to move a body horizontally across an inclined plane, it will slide down, that is, it will take a diagonal direction across the plane. If a train were moving thus across a trackless inclined plane, it would slide down, unless a force were exerted to keep it up. This the centrifugal force supplies, and when the superelevation of the outer rail is correct for the speed, the centrifugal force just equals the component of the load in the direction of the incline. The resultant of the weight of the train and the centrifugal force then just bisects the distance between rails; that is, it is normal to the tie, and there is no centrifugal force on the rail tending to move it either way on the tie. The centrifugal force, however, is still present in a force tending to move the track, rails, ties and all bodily outward, because of the inclination of the resultant load on the track.



Fig. 1.

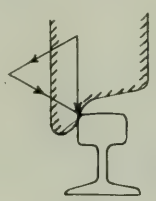


Fig. 2.

In the writer's opinion the simple centrifugal force is not the force that gives rise to the spreading of rails on curves, and the spikes are not the most effective agent in preventing that spreading. The tendency of the outer forward wheel to climb the outer rail, due to the impulse of the locomotive to go in a straight line, is what causes the heavy force on the outer rail. If the axles were set radially to any given curve, and the outer wheels were of larger diameter than the inner ones, so that there would be no slipping, and if the outer rail were elevated the proper amount for a given speed, there would be practically no force on the rails tending to move them radially. The spikes would have no more work than on a tangent, and friction of the rail on the tie would not be called into play to prevent lateral movement. Such conditions, of course, are not attainable on a railroad, but because they are conceivable, there is a suggestion that the centrifugal force, as ordinarily understood, has little to do with spreading of rails in such accidents as the one that occurred a short time ago in New York on the New York Central.

It is not the mere inertia of a train that tends to make it go in a straight line on a curve. On a trackless plane, with larger wheels on one side than the other, it would go in a curve in spite of the inertia tending to make it go straight, and it would exert a strong force against any kind of guide that would force it to go in a straight line. The fact that in a locomotive the inner wheels have the same diameter as the outer ones makes these wheels tend to roll off the side of the inner rail and to force the locomotive against the outer rail. Further than this, the tread being sloped will give a tendency for the inner wheel to seek a section of smaller diameter to fit the shorter length of inner rail. It is these tendencies and forces that cause the wearing on the inner side of outer rail on a curve. The most serious aspect of this climbing tendency of the outer wheel is the fact that there results a wedging force on the inner side of the head of the outer rail, as indicated in Fig. 2. The resultant force on the rail will bear little relation to the centrifugal force, as it may be a large fraction of the wheel load.

It is doubtless this wedging action of the wheels that is the cause of spreading of the rails. It is scarcely practicable to meet such a force by the use of spikes, and it is scarcely probable that the spikes do actually resist it. There is, however, a means by which this force can more effectually be resisted, namely, in the continuity of rails in curves and in substantial splices that allow no motion longitudinally. The force is thus reduced to one of tension on the rail.

EDWARD GODFREY.

The Profitable Weight and Speed of Freight Trains.

Baltimore, Md., May 4, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

With regard to Mr. B. A. Worthington's letter of the 13th ult. appearing in your issue of the 26th ult., it seems impossible to persuade him to fix his mind on anything save the conditions that have governed in all directions the operation of the big slow moving freight train. For example, he says "let us double the traffic and have four freight trains each way per day" instead of the original two. That is to say, he proposes to keep the freight trains of the same consist although the *raison d'être* of the doubling is a reduced consist.

It cannot, of course, be disputed that on an equal number of trains in either direction the number of meetings will be the square of the number of trains one way, so that two trains each way means four meetings, and four trains each way means 16 meetings, and Mr. Worthington says that it would be folly to assume that the gain in the average time for the four trains could all be put into moving time because of the large increase in number of meetings.

I subjoin two time-tables to cover the movement of two trains each way and four trains each way which demonstrate that this folly is nothing more than the quality of an obsessed imagination. The postulates for these time-tables are as follows: Track 50 miles long, stations five miles apart and no station with capacity for more than two trains at one time. The motion speed of the eight trains to be 20 miles per hour and of the four trains 13.5 miles per hour, the latter being half way between the 12 and 15 miles an hour motion speed mentioned by Mr. Worthington. Trains to start 10 minutes apart and even numbered trains to have right to the road.

Stations 5 miles apart.		Trains.					Trains.			
		No. 2.	No. 4.	No. 6.	No. 8.		No. 1.	No. 3.	No. 5.	No. 7.
Sta. A.	Lv.	1:00	1:10	1:20	1:30	Ar.	4:00	4:30	4:45	5:30
" B.	"	1:15	1:25	1:35	1:45	"	3:45	4:15	4:30	5:15
" C.	"	1:30	1:40	1:50	2:00	"	3:30	4:00	4:15	5:00
" D.	"	1:45	1:55	2:05	2:15	"	3:15	3:45	4:00	4:45
" E.	"	2:00	2:10	2:20	2:30	"	3:00	3:30	3:45	4:30
" F.	"	2:15 x 1	2:25 x 1	2:35 x 1	2:45 x 1	"	2:00	3:15	3:30	4:15
" G.	"	2:30 x 3	2:40 x 3	2:50 x 3	3:00 x 3	"	1:45	1:55	3:15	4:00
" H.	"	2:45 x 5	2:55 x 5	3:05 x 5	3:15 x 5	"	1:30	1:40	1:50	3:45
" I.	"	3:00 x 7	3:10 x 7	3:20 x 7	3:30 x 7	"	1:15	1:25	1:35	1:45
" J.	"	3:15	3:25	3:35	3:45	"	1:00	1:10	1:20	1:30
" K.	Ar.	3:30	3:40	3:50	4:00	Lv.	12:45	12:55	1:05	1:15

Stations 5 miles apart.		Train		Train	
		No. 2.	No. 4.	No. 1.	No. 3.
Station A.	Depart	1:00	1:10	Arrive 4:50	5:34
" B.	"	1:22	1:32	" 4:28	5:12
" C.	"	1:44	1:54	" 4:06	4:50
" D.	"	2:06	2:16	" 3:44	4:28
" E.	"	2:28	2:38	" 3:22	4:06
" F.	"	2:50 x 1	3:00 x 1	" 2:35	3:44
" G.	"	3:12 x 3	3:22 x 3	" 2:13	2:23
" H.	"	3:34	3:44	" 1:51	2:01
" I.	"	3:56	4:06	" 1:29	1:39
" J.	"	4:18	4:28	" 1:07	1:17
" K.	Arrive	4:40	4:50	Depart 12:45	12:55

Anyone who cares to work over these time-tables will see that the smaller of them is unfavorable to my side of the argument inasmuch as the actual time required to accomplish five miles at 13.5 miles per hour is 22.2 minutes, while I have used 22 minutes only; but even so it will be observed that the complete movement of the eight trains can be accomplished in four minutes less time than that of the four trains. In addition to this there is an accumulation of 10 hours and 15 minutes of engine hours up to 5.30 o'clock for the eight train movement, during which the engines which have completed their runs can be undergoing repairs or accumulating more net revenue or be placed in reserve under white-lead, according to the demands of the traffic. Similar accumulation for the smaller movement amounts to no more than 2 hours and 22 minutes.

Mr. Worthington will no doubt respond to this that the larger movement has required the use of double the number of engines. So be it; but against the capital cost of the larger number of engines it is perfectly fair to set:

First.—The increased earning power of the cars for the eight train movement circulates 224 as against 160 cars under the four train movement, and does it, too, in considerably shorter average time per car. (This is recommended to the particular considera-

tion of the Joveian-browed deities who preside in the American Railway Association over the efficiency of cars.)

Second.—The capital cost of the extensive additions to track now being urged by the advocates of the big slow moving train.

Third.—The operating advantage of having a larger number of highly trained men in the railroad services.

With regard to the amount of net revenue over and above the expense included in my original table that can be accumulated by the two movements, I submit the following calculations:

Eight Train Movement.

8 trains at 28 cars = 224 cars.	
224 cars at 50 miles = 11,200 car miles.	
11,200 car miles at 9 cts. per car mile	$1,008.00
400 train miles at 55 cts.	220.00
Net revenue	$788.00

Four Train Movement.

4 trains at 40 cars = 160 cars.	
160 cars at 50 miles = 8,000 car miles.	
8,000 car miles at 10 cents per car mile	$800.00
200 train miles at 75 cts.	150.00
Net revenue	$650.00

Even should it be said that the 55 cents cost per train-mile for the larger movement is too low this cost can be increased to 65 cents and still there will be more net revenue remaining to the larger movement by $98. Even 8 cents a car-mile with 55 cents train-mile cost nets $26 more to the larger movement.

A further argument that will be urged against the larger movement will no doubt be the increased wear and tear of track, but I should think in view of present conditions that such an argument would prove rather a boomerang to the advocates of concentrated weight in cars and engines. It is understood present rail and track troubles are to be overcome by revising the rail section, putting less into the head of the rail and more into the web. When this has been accomplished there will be no doubt the same urgency for rail improvement on account of reduced admissibility of wear of the head; only then the agitation will be over another aspect of the problem. Amid these constant differences of opinion between engineers, may it not rightfully occur to those who have a little tenderness for the proprietors of the railroads to suggest the desirability of compromise so as to give the rail a fair run for its money?

Mr. Worthington reads too literally my remark about the exact science employed in the loading of engines of late years. His reference to empirical formulae is right enough; nevertheless the empiricism in his suggestion that it is folly to assume that a fourfold increase in train crossings can be taken up in faster movement seems to need the application of a little exact science in the shape of figures of a time-table. Although the delay time in the larger movement, as per foregoing time-tables, is 18.2 per cent. of the total time the trains are on the road as compared with 8.7 per cent. in the smaller movement, yet the larger movement is completed in four minutes less time. This appears to be a materialistic illustration of "death swallowed up in victory"; the faster movement has swallowed the delays and the dose agrees with it very well.

It is perfectly evident that I shall not succeed in convincing Mr. Worthington that his view of the construction of rates and freight tariffs is fundamentally wrong. I will therefore content myself with reaffirming that a revenue of $1.28 per ton for a haul of 250 miles is not enough for any class of traffic he likes to name in comparison with the present standard of compensation for transportation service, low as that is, and that it is an astonishingly and almost unbelievable low compensation for a railroad on which 70 per cent. of the business was high class traffic.

M. B. WILD.

Continuous Rails for Uniform Track Structure.

Buffalo, N. Y., May 6, 1907.

To the Editor of the Railroad Gazette:

The contribution in your issue of May 3 concerning your editorial in the issue of April 12th on the subject of continuous rails for uniform track structure seems to suggest further comment on this important subject. The statement that "the primary cause of low joints is the impact of passing wheels on the rail ends" does not seem to get to the bottom of the facts. To be sure, this impact is what causes the damage, but to go one step further back: Is not this impact a *result* rather than a *cause*? Your editorial points out this fact in stating that destructive battering is the result of a lack of stiffness in the rail structure. When one simply glances over the four or five pages of cuts which appear in this same issue of May 3d in connection with another article, and which show track deformations, it does not take long to decide that the principle cause of this impact is excessive deflection, and that the problem is not simply a question of the "proper maintenance of track" without any reference to the design or stiffness of the joint. One can see clearly from a glance at these cuts how greatly the impact on the rail ends would be reduced if the joints were as stiff as the rail and did not allow the rail ends to go down to a position where they receive destructive shock from passing wheels. That this deflection and consequent impact at the joints has been largely eliminated by the use of a depending flange is now being practically demonstrated every day by several designs of thoroughly practical joints.

The suggestion might be advanced for the further consideration of such roads as have condemned the depending flange, that they are neglecting a right principle on account of a wrong application; that they may have experimented with a light or poorly designed deep joint involving such undesirable features as would counteract the benefit that should be derived from a suitable depending flange bar, and that they are condemning the depending flange generally on account of a limited experiment with what they properly have determined to be a poor type of depending flange joint. The adding of a depending flange to a bar does not in itself eliminate other undesirable features such as wide spiking flanges, broad base supports, etc. On this account it is very difficult to place the blame for the failure of a joint where it belongs, and some roads are not getting the benefit of the deep-bar joint on account of not carrying their experiments to a complete conclusion. As mentioned in your editorial, the common angle bar has many desirable features. Even with its one-third stiffness it may prove better than some types of depending joints, which, on account of other features, may allow as much deflection as the angle bars; such conditions as this has made the progress of the depending flange slow.

The collecting of ice under rail joints has often been noted, especially on northern roads; but the cause is usually attributed to weak or loose joints which allow the roadbed to pound full of holes and accumulate all the water from an undrained roadbed. There is a depending type of joint now made by one of the steel companies similar to the one outlined in your editorial, which only extends 2¼ in. below the rail base, and it can hardly be conceived how such a flange as this could be blamed for the ice that might collect under the joints in badly drained locations, and it seems reasonable to think that such a short stiff inwardly depending flange aids in breaking up the ice instead of being affected by it.

The "bolt connection" of a joint is mentioned as being the "limiting factor of strength rather than the section of the bar at the rail ends." This is correct, and one will be surprised to find how much less of a factor the bolt connection is with properly designed bars as stiff as the rail than with bars requiring the bolts to do nearly all the work. A proof that this bolt connection can be brought up high enough to give a joint as stiff as the rail is only a question of observation of present bars in track, or of actual demonstration on a testing machine.

In regard to the question of hard angle bars, your editorial outlines what has proven to be the experience of most roads. The increase in stiffness by this means is so slight that there hardly seems to be any defence for the practice on this score; and as for diminishing excessive wear on the bars, the best method for preventing this would seem to be to decrease the deflection and battering and consequent loose bolts by the use of the proper kind of a depending flange bar. Many roads do not have sufficient heavy traffic to show up very quickly the difference between a good depending flange joint and a common angle bar joint made of hard steel. The saving and necessity of the deep bar naturally, of course, increases with the traffic, and it has, therefore, come into general use on such roads as would find it impossible to maintain the old fish-plate joint. This is no argument that the deep joint should be limited to main line tracks carrying heavy and frequent high-speed trains, since it should show the same economies to a less degree under lighter traffic as it does under the heavier service. The excessive cost of properly maintaining the fish-plate joint is exactly what has caused the development and acceptance of the depending flange, and it seems rather to be a question of finding a joint that will require the least care, rather than one that can be entirely neglected. The depending flange is a waste of metal unless held up to the work, and it cannot be expected to eliminate the tightening of bolts, which is only a very small part of the cost of track maintenance. Loose bolts in any joint simply means destruction, and the depending flange seems to be the best means yet found for preventing the shocks and vibrations which cause loose bolts and loss of efficiency in a rail joint.

S. GARVER.

Inside Valve Clearances.

Philadelphia, May 6, 1907.

To the Editor of the Railroad Gazette:

Your editorial on page 603 of May 3, 1907, was read with much pleasure (Locomotive Performance Data Developed at Purdue) and deserves consideration by all interested in the economical performance of the locomotive. What I wish to call your attention to is the part that refers to inside clearance in the valve. The editorial states that it "never existed except where some careless workman planed out the D of valve too much." This is a mistake, as the writer knows of it being used on the Delaware, Lackawanna & Western in the 50s; also it was the standard practice of Wilson Eddy, Master Mechanic of the Boston & Albany, for many years. The engines in freight service had a 5-in. travel of valve with ¾ in.

outside lap at each end and $^{5}/_{16}$ in. inside clearance, i.e., the cavity of valve was $^{5}/_{16}$ in. wider than the exhaust port and the two bridges combined. My object of calling your attention to this matter is that editorials of this nature are what history is made of, and anything not correct is not good history.

HENRY F. COLVIN,
Secretary Rue Mfg. Company.

The 16th Street Track Elevation of the Burlington at Chicago.

Probably the busiest stretch of track on the Burlington is that between its Western avenue yard and Canal street, parallel and immediately adjacent to 16th street, Chicago. Not only does it carry all of the through passenger and suburban traffic of the Chicago terminal division, but all of the freight business passing through its largest city freight houses and its boat-lines' interchange on the river at Canal and 16th streets. The city ordinance providing for elevation of this section required it to start from grade at Canal street and return to grade again at Western avenue, a total distance of 2.4 miles. Prior to beginning the work there were four main-line tracks. There were also, in addition to the Western avenue yard, team tracks amounting to about 1¼ miles of trackage between Halsted and Morgan streets in conjunction with the two freight houses between Canal and Union streets, and a storage yard of some half a dozen tracks aggregating about 1½ miles, from Morgan street to Blue Island avenue. The work included the addition of two main-line tracks, making six in all, to relieve the pressure, which had grown too great for four lines, and the elevation of all tracks and yards within the limits covered by the ordinance.

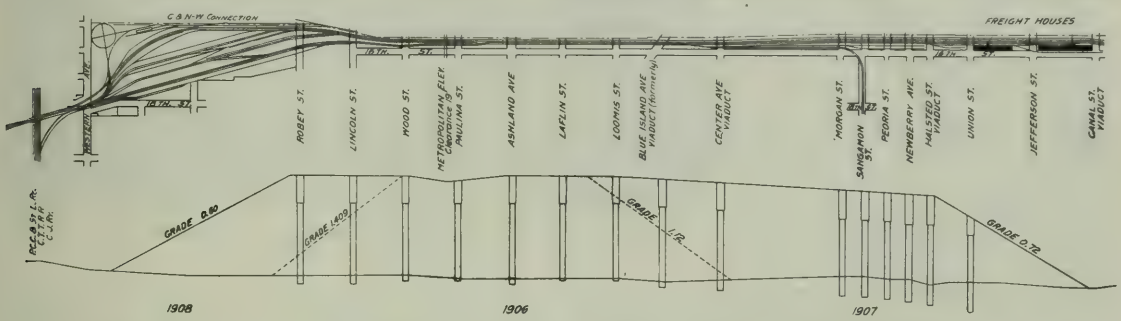


Fig. 1—Plan and Profile of 16th Street Track Elevation; Chicago, Burlington & Quincy.



Fig. 2—Looking West from Paulina Street; Ready to Fill.

As will be seen by the accompanying plate and profile of the work (Fig. 1), a part of same was done in 1906. This was about one-third of the total, starting at Wood street on the west, with run-off reaching west of Robey street, and extending east of Laflin street with run-off to Center avenue. This work was practically completed with the exception of the subway bridges, the tracks being carried over the openings on temporary timber bridges. As already mentioned, two additional main line tracks were laid. The width of right-of-way over the district affected varies from 140 ft. to 200 ft. so that no increase in same was necessary. It was endeavored during the progress of the work to keep at least four tracks open to traffic, although occasionally this was temporarily reduced to three. Filling was begun with the south track. A trestle was built (see Fig. 2) from which the bank was brought up to the new grade. The timber work was then removed and the track, which was one of the two new ones, laid on top of the bank. This was then used as a working track to raise the one next to it, all of the four original main-line tracks being raised in turn in like manner. When the bank was ready the track would be taken to pieces and relaid on the new grade. Each track was thus shifted south to a new position an amount about equal to the distance between track centers. This left space on the north for the other new main track already referred to, making six in all. The filling material was brought from the Burlington's gravel pit at Montgomery, about 42 miles west of Chicago. It was moved in side-dump cars, about 35 to the train, and deposited with a Lidgerwood unloader. As the material was deposited it would be spread with a ballast spreader which would follow each train load. The fill was thus built out to the requisite width, and a final trip of the spreader, taking only a slight cut, left it ready for the track, as in Fig. 3.

Filling for the 1907 work, which is all of that east of the 1906 portion, has not yet been begun, except to raise the grade of the present east run-off to permit the Blue Island avenue subway to be built. As the plan indicates, there was formerly a viaduct to carry this street over the tracks. There are also viaducts at Center avenue and at Halsted street. Blue Island avenue has been closed since the removal of its viaduct in 1906, traffic being diverted over the viaduct at Center avenue. The Blue Island avenue subway is now being completed in preparation for the removal of the Center avenue viaduct.

Adjacent to the Burlington's right-of-way, in the north, is the Chicago & North-Western's double-track line between its Wood street and 16th street freight houses. This line also is being raised under the same ordinance as that of the Burlington, and the two roads are working in conjunction. The right-of-way of the North-Western is very narrow and it will make use of the adjacent track of the Burlington to maintain traffic while raising its tracks; the



Fig. 3—Fill Leveled by Ballast Spreader Ready for Track; North-Western Fill on Left.

Burlington in turn will enjoy a like privilege from its neighbor when necessary. The railroads are required to remove the street viaducts already mentioned, the expense for which is shared by the two on an agreed basis. The crossing of the Metropolitan West Side Elevated Railway just west of Paulina street is a 200-ft. through truss span. This had to be raised 19 ft. to maintain the original clearance, the work being done by the owning company.

Mention has been made of team and storage tracks at the eastern end of the work. With the new arrangement of the tracks, there will be team tracks on the elevation all the way from Union to Laflin streets, with entrance respectively at Union, Morgan, Allport (just east of Blue Island avenue) and Ashland avenue. The roadways for all tracks will be brick paved.

The most interesting single feature of the work is the subway bridges, which embody several features novel to such structures in the Chicago track elevation work. As originally designed these bridges were to be reinforced concrete floor slabs resting on steel cross girders, the steel column supports of the latter to have concrete floating foundations. But the soil on which these foundations were to rest, the blue clay which underlies Chicago, was of a particularly soft, yielding character in this vicinity and it was decided that such a foundation, even with the greatest spread possible, would not sustain the loading. Piling was then considered, but there was doubt about this also, even with the longest piles available, and it was finally determined to carry the foundations to bed rock or hard pan. The subway cross-section (Fig. 5) shows these circular concrete piers, 3 ft. 8 in. in diameter. Meanwhile, the steel work for the bridges for the 1906 work had been ordered, and in due course was erected. However, the character of the foundations finally adopted, eliminating all possibility of settlement, made possible the substitution of reinforced concrete cross girders and columns for the steel work, and designs were accordingly prepared for all-concrete structures for the 1907 work. Details are shown in Fig. 6.

The column reinforcing, it will be observed, is four 3½ in. x 3½ in. x ½ in. angles, 11 ft. long, held to position by 6 in. x ½ in. x 17¾ in. plates riveted thereto at intervals as shown in the detail, the whole being wrapped around with No. 11 high carbon steel wire from the top of the foundation to the bottom of the cross girder fillet. The angles themselves extend well into foundation and girder. The girder reinforcement is ½ in. and 1 in. corrugated steel bars, disposed as shown by the drawing. The columns are 2 ft. square in section and the girders are 4 ft. deep and 2 ft. 6 in. wide.

The large floor slabs—the street slabs—are 24 ft. 2½ in. long, 6 ft. 11¾ in. wide for the standard slab, and 2 ft. 9 in. thick for



Fig. 4—Looking East from Metropolitan West Side Elevated Bridge; Five Tracks Raised; North-Western Tracks on Left.

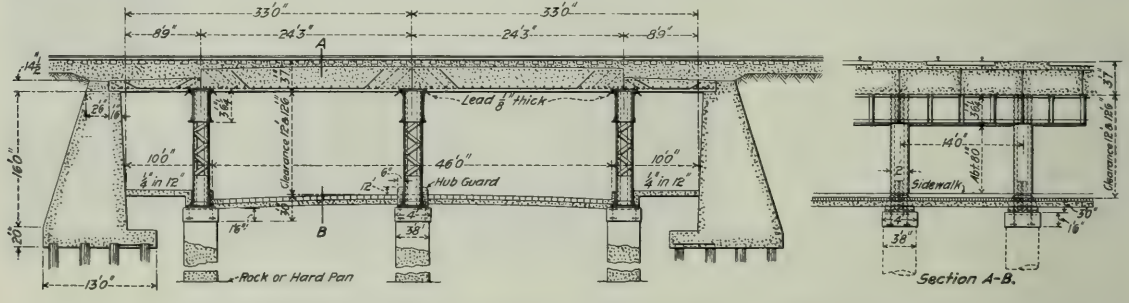


Fig. 5—Canal St. to Western Ave.; Typical Sections at Subway.

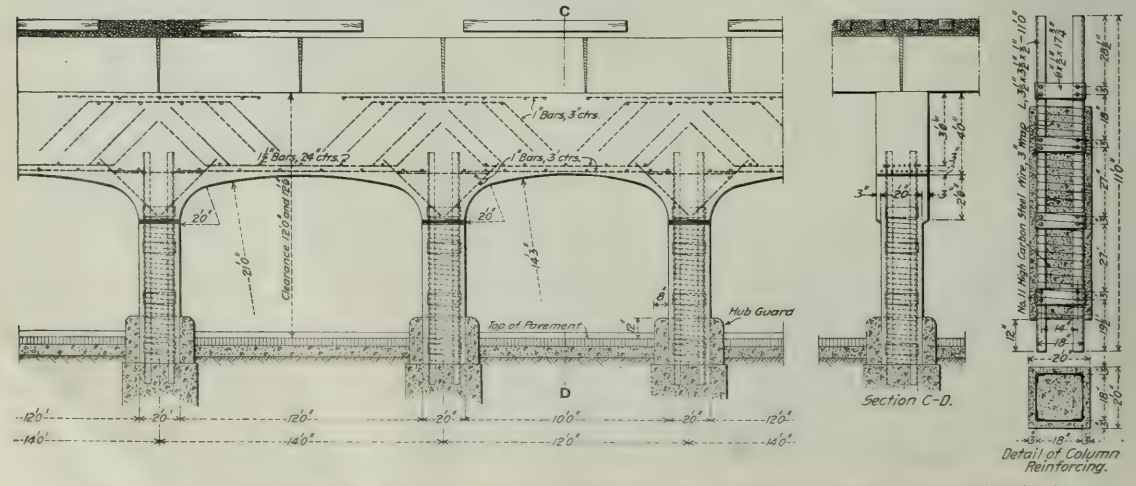


Fig. 6—Typical Section Showing Reinforced Concrete Columns and Cross Girders and Detail of Column Reinforcing.

half of their length, reducing to 2 ft. 6 in. at the sidewalk end to give a 3 in. drainage drop. The standard sidewalk slabs are 10 ft. 8½ in. long, 6 ft. 11¾ in. wide, 1 ft. 5½ in. thick at the street end and 3 in. less at the abutment end. The bridges are designed for Cooper's E-50 loading with a 100 per cent. impact allowance, the whole being considered as acting on a width of 10 ft. The slab reinforcement is 1.29 per cent. of corrugated steel bars, ½ in. and 1 in. sizes, their arrangement being shown in the slab details (Fig. 7). The slabs were made in 6 ft. widths also, to provide for varying track centers, there being 12 ft., 13 ft. and 14 ft. spacings. The slabs for the 1906 bridges were all made last fall. They are a 1:4 gravel mixture and the large street slabs weigh about 34 tons. The derrick car has a 40-ft. boom, and is used for loading the slabs onto cars at point of manufacture as well as for placing them on the bridges. The slabs are brought to the work only as they are needed and the derrick car therefore does the loading at night in order that it may be available during the day for setting.

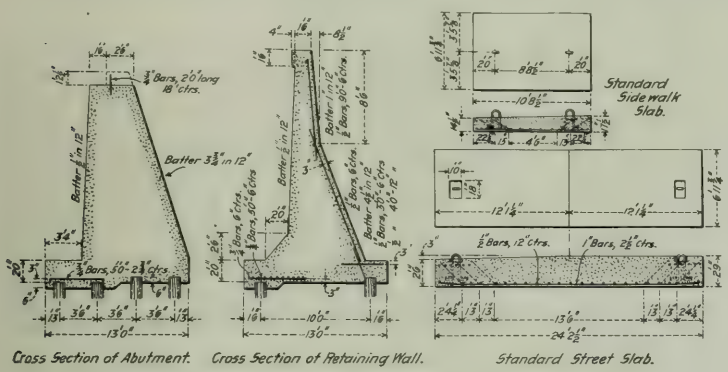


Fig. 7—Typical Sections, Burlington Track Elevation.

For the steel cross girders (Fig. 5) the ends of all slabs resting thereon were shouldered out 1 in. deep and 15 in. back to fit over same. Sheet lead ⅛ in. thick was laid over the top of the girder to protect the steel and a layer of mortar spread over all contact surfaces just before placing the slabs. For the concrete cross girders the slab bottoms will be plain. All slabs have their edges painted with a waterproofing compound before setting. To make the inter-slab joints water tight they are first calked with oakum at the bottom and the waterproofing compound run in on this. The remainder of the opening is then filled with grout. For the sides of the bridges a special parapet slab is made, narrower than the regular slabs and having a parapet 4 ft. ¼ in. high from the bottom of the slab.



Fig. 9—Reinforced Concrete Slabs in Place on Subway Bridge.

Regarding costs, the concrete pier foundations to bed rock were estimated to be no more expensive than pile foundations. On the basis of all-steel bridges for the work, the saving by the use of the concrete superstructures is estimated at about $250,000. This allows for the steel work in the 1906 work.

Cross sections are shown of the retaining walls and abutments (Fig. 7). They are gravel concrete, a 1:4 ½ mixture, and are reinforced with corrugated bars as shown. They rest on piling.

Referring again to Fig. 1, it will be observed that the work west of the 1906 section is marked for 1908. This includes Western avenue yard. This is an exchange yard for interchanging traffic with foreign lines, and also takes care of the business for the lumber districts which are convenient to it. Heretofore it has been the engine terminal for all road engines, both freight and passenger, for the Chicago terminal division. The suburban engines are stalled at 12th street and Stewart avenue. Under the new arrangement all freight engines will be taken care of at Hawthorne yard, west of the city, where suitable facilities are being prepared. Western avenue yard will then have all of the passenger engines, including the suburbans, and its own switch engines and those serving the lumber districts. Western avenue yard is to be entirely rearranged, and although there will be no enlargement, it is expected that its capacity for handling the business for which it is especially designed will be practically doubled. The yard trackage is slightly less than 26 miles, and this will not be materially changed in amount. An ordinance is now pending for connecting the elevation work here described with the section to the west of this, the eastern end of which is just across the P. C. C. & St. L. tracks from Western avenue. This stretch is 1¾ miles long and was done in 1898 and 1899. The ordinance mentioned also includes elevating all the north and south tracks just west of and parallel to Western avenue. These include four main tracks of the P. C. C. & St. L., two of the Chicago Terminal Transfer, two of the Chicago Junction and three of the Burlington. The latter extend only to 26th street, while all of the rest are to elevate to south of 31st street to connection with work already done.

The Burlington 16th street work is under the supervision of Mr. W. L. Breckenridge, Engineer of Lines East of the Missouri river, Mr. F. L. Stone, Engineer of Track Elevation, being immediately in charge. Mr. C. H. Cartlidge, Bridge Engineer, has charge of the bridge work.

A British View of Stock Watering.

Mr. Robert Fleming, an English banker who participated in several American reorganizations and has watched the situation closely, with the advantage of a distant viewpoint, is quoted as follows by the *Statist*:

Condemnation seems to center on the case of the reorganization of the Chicago & Alton, without, so far as I can see, any just grounds. This transaction took place eight years ago. I was myself a member, and so were many others abroad, of the syndicate which purchased the Chicago & Alton, and which represented practically all the stock of the company. Though its members had nothing to do with the scheme of recapitalization, that syndicate got the benefit of past earnings, which had been withheld from the stockholders and put into the property as well as the profit on 3 per cent. bonds bought at 65 and the doubling of the capital stock. The whole profit on the syndicate, which implied a lock-up for twenty months after charging the account with interest, was only 8 per cent. on the money, about 5 per cent. per annum—nothing very extraordinary, surely. We sold our bonds and stocks at the high prices then prevailing for everything. Had the bonds and stocks received been held till now there would have been a heavy loss.

The assent of both houses of Parliament in England has more than once been given to operations by which the ordinary stock of English railroads has been converted from £100 of ordinary stock into £100 of preferred converted ordinary bearing a low rate of dividend, and £100 deferred converted ordinary, thereby doubling the amount of the original stock. There is no essential difference between that operation and the Chicago & Alton plan. Doubling the capital does not double the value. Chicago & Alton preferred is quoted to-day at 59 per cent. and the common at 16¼ per cent. In England the idea was that the conversion gave in the preferred a medium for the less speculative part of the community, and in the deferred ordinary for the more speculative, it being thought that the two things would sell in the market at something more than the undivided stock. The idea has, I think, been largely exploded, and I doubt whether $20,000,000, Chicago & Alton common stock would not sell as well as the $40,000,000 of the two stocks. The Alton pays 4 per cent. on its preferred, and is said to earn as much on its common, and yet the two stocks together sell only in the eighties. The doubling of the stock was a mistake; but in any case it does not increase the revenue one cent. Our Midland Rail-

way, whose ordinary capital was thus increased from £38,000,000 to £76,000,000, cannot on that account get from freight or passengers higher rates and fares than the London and North-Western; nor, if it is ever bought by the Government, will the price be increased one penny.

It seems to me that in condemning watered capital the American public are led by theorists. If a law prohibiting the issue of stock unless for par in cash had existed in that country in the past, many of what are now big systems would never have been built, and if in the future the capital of railroads is to represent no more than the money spent, it follows that no new railroads will be built, unless by existing dividend paying systems.

Annual Report of Florida Railroad Commission.

The state railroad commissioners of Florida, R. H. Burr, J. L. Morgan and N. A. Blitch, have issued the tenth annual report of that body. The general railroad situation in Florida is bad. There have been "almost daily delays in both freight and passenger trains, causing great inconvenience and damage," and the freight train service has been "the worst ever known in the state." The use of heavy engines and cars on poor track is given as a principal cause of the poor service. The railroads also have insufficient docks at their seaport terminals and have not sufficient engines or cars. Shippers are constantly complaining, but they are disinclined to make formal charges. Two pages of the report are filled with a list of the fines which have been imposed by the commission on the railroads of the state during the year. Suits are pending to compel payment of the first five in the list, and against most of the others there is a note that the Attorney-General "has been requested to enter suit." Several fines for failing to bulletin passenger trains have been paid. The commission is not discouraged at the refusal of the companies to pay fines, because their imposition "has been worth many times more to the shippers of the state than the fines in themselves amount to." The suits concerning fines and other matters pending in the courts are set forth at considerable length in the report. Concerning new railroads and projected lines the report has the following notes:

The Atlanta & St. Andrews Bay, in operation from Dothan, Ala., south to Domer, Fla., 36 miles, is building an extension south through Jackson and Washington counties to Panama City on St. Andrews Bay, 49 miles. The Seaboard Air Line is extending the Tallahassee, Perry & Southeastern, formerly the Tallahassee Southeastern, from its present eastern terminus at Covington southeast to Perry, about 20 miles. The Charlotte Harbor & Northern is being built from Arcadia, De Soto County, southwest to Deepwater on the Gulf at Boca Grande, 58 miles. The Apalachicola Northern is building a line to connect River Junction (Gadsden County) and Quincy with Apalachicola, and will reach Deepwater at St. Josephs Bay, about 100 miles, is nearing completion. The Tampa Northern has secured control of the Brookville & Hudson, and proposes to extend its line from Tampa north to Thomasville, Ga. The work to be completed within 18 months.

The report contains the freight tariffs, demurrage rules and other regulations prescribed by the commission, and the usual statistics.

The Rehabilitation of the Brooklyn Rapid Transit Company.

The Brooklyn Rapid Transit Company is a holding corporation controlling through ownership of stock or by lease through constituent companies, elevated and surface lines with 557 miles of single track. These lines at one time or another during the last 50 years have been owned by nearly 60 different railroad corporations, but by foreclosure, reorganization, lease, consolidation or merger have been resolved into 10 constitutent companies. With few exceptions the lines are operated under lease by the Brooklyn Heights Railroad, all of the stock of which is owned by the Brooklyn Rapid Transit Company. To quote Col. T. S. Williams, Vice-President of the company, it is "the most varied collection of transit undertakings ever assembled under one corporate roof—horse railroads, cable railroads, electric railroads, elevated railroads, municipally owned and operated railroads, steam railroads, successful railroads, bankrupt railroads, railroads in public streets, railroads on private rights of way—a joint museum and hospital of corporate relics."

The development of the system down to 1899 may be divided under three heads, surface street railroads, surface railroads on private rights of way (originally steam railroads) and elevated railroads. The first surface street railroad was the Brooklyn City Railroad, incorporated in 1853. This was followed by the incorporation of a number of other surface street railroads during the next 15 years. The franchises given these companies were perpetual and were usually offered to the bidder who would agree to carry passengers for the lowest rates of fare. The growth of horse-car lines was gradual up to 1893, when electricity was first substituted as motive power. From 1893 until 1898 there was a big demand for surface road franchises both on the part of existing companies and by new corporations.

In 1862 the first steam railroad line was built from the outskirts of the old city of Brooklyn to Coney Island, and a number of these roads to other seashore resorts were built in subsequent years. They were incorporated under the general railroad law of 1850, were operated by steam and were generally subject to the regulations governing all steam railroads as to rates of fare, etc. They occupied private rights of way acquired by purchase or condemnation or, in some cases, the routes of old plank road companies. Because these steam railroads did business only in the summer time they were not highly profitable. They were subsequently merged with the surface and elevated lines. After 1893 most of them were changed from steam to electric operation, and the street and elevated roads with which they were connected were thus extended from the city to the outlying resorts.

The first elevated railroad in Brooklyn was chartered in 1874 and opened for operation in 1885. Subsequently a large mileage of elevated track was built. In 1899 the work of converting the elevated lines from steam to electric operation was begun.

The network of surface and elevated lines built at different times by many different companies naturally bore little relation to each other. Franchises for these early roads were granted indiscriminately and often unwisely. Some sections of the city had an overabundance of transportation facilities with several surface car lines paralleling each other closely, and with elevated lines besides; other sections of the city were without transit facilities of any kind. There was great confusion and congestion in the business district, and in particular at the Brooklyn Bridge, to which a majority of the lines led. Instead of competition's giving good service, the conflict of interests prevented any attempt at rearrangement and betterment.

In 1893 the Long Island Traction Company, the forerunner of the Brooklyn Rapid Transit Company, was incorporated. The property of the Brooklyn Heights Railroad, the Brooklyn City Railroad, and the Brooklyn, Queens County & Suburban were taken over under lease, but the results of the consolidation were not what had been expected, and in 1895 the Long Island Traction Company was sold under foreclosure to the present Brooklyn Rapid Transit Company. The system was extended by lease and purchase of one or two additional subsidiary companies of little importance, and in 1898, 266 miles of single track (first track, second track and sidings) were under the control of the B. R. T. through ownership or lease of five constituent companies. In 1899 eight more companies, including the Brooklyn Union Elevated, the Kings County Elevated and the Nassau Electric Railroad, were taken over, which with 53 miles additional added by purchase and by extension of old lines during the last seven years, have increased the single-track mileage to 557 miles. The Brooklyn Rapid Transit now comprises 10 constituent railroad corporations either leased or with complete stock ownership vested in the holding company.

The capital stock of the Brooklyn Rapid Transit Company was originally $20,000,000. In 1899 it was increased to $45,000,000 in order to provide for taking over the additional lines purchased at that time. Some of the roads taken in were in good condition and were profitable; others were badly run down and had but little earning power. The company attempted to handle the big problem which had been undertaken and to increase its facilities to keep pace with the rapid increase in population of the city. In the three years, 1895 to 1898, before the acquisition of the new lines, it had spent out of capital $1,267,814 on tracks, $206,623 on buildings, $87,092 on power house equipment, $76,238 on miscellaneous improvements, and $519,000 on new cars and car equipment, a total of $2,156,767.

With the taking over of the new companies in 1899 came further large necessities for spending. Before the consolidation the elevated railroads had been investigating the possibilities of electric traction. They had been led to do this by the great increase of travel which followed the extension in 1898 of elevated service across the Brooklyn Bridge. The cost of electrification and the rebuilding which electrification involved fell upon the new owners. The surface cars had begun to run across the bridge late in 1897 and this traffic had already grown remarkably, making necessary large improvements to the surface lines. The city of Brooklyn was beginning to grow rapidly as another result of the same cause, and this growth called for funds for extensions of the existing lines to reach the new outlying districts which were being built up. In 1900 came the necessity for another expense, the electrification of the steam roads running to the various seashore resorts. This also involved large costs, including that of abolishing grade crossings.

In 1900 the proceeds from the sale of $6,000,000 bonds were available for these improvements. In the year ended June 30, 1900, 585 new cars were bought. After competitive experiments and trials lasting over two years, in 1902 a contract was made for complete electrification of the elevated roads. In this change of motive power the Brooklyn Rapid Transit took the lead in its territory, its installation being second only to a short stretch of elevated track in Chicago and an electric traction operation in London. The

company did not, however, have sufficient capital to carry out these extensive improvements as they should have been managed, and a great deal of its effort was misdirected.

By July 1, 1901, the available funds had been used up and expenditures had to be stopped. The natural consequence was that the partially finished improvements made small return in greater efficiency of operation and that the transportation service on both the elevated and surface lines, instead of improving, grew worse. The tremendous increase in business over the Brooklyn Bridge continued and the problem of handling the traffic grew more and more difficult, so that the company, however unjustly, came in for most, if not all, of the public indignation at the disgraceful crowding which prevailed at both ends of the bridge. The city authorities, on the other hand, failed to co-operate in any attempt to improve these conditions. On this account, and because of the lack of funds, the company was compelled to adopt the general principle of doing nothing. With a property which for years had been suffering the gradual processes of decay and which had had to meet tremendous increases in traffic without corresponding improvements, this stopping of betterments and necessary repairs naturally resulted in a deplorable condition in almost every detail of the working plant.

By the end of 1901 the property was in a thoroughly bad state. Large numbers of cars were old and out of date, the power plants were inadequate, the track structure in the streets, never having been perfectly bonded, was a constant source of loss of power, and the elevated structures were dilapidated and in places unsafe to carry the longer and heavier electric trains which were about to be put in operation. The interlocking plants at elevated junctions were antiquated and of little or no use as safety devices. Some wooden sheds 25 years old at the end of a wooden trestle were the repair shops for the 400 or 500 elevated cars. Because of lack of car barns, surplus cars were stored at night in the streets. When a neighborhood objected the cars were stored in some other locality. Offices were scattered all about the city with the naturally resulting poor organization.

These instances are typical of the condition of the property early in 1902. At that time Edwin W. Winter, formerly President of the Northern Pacific, who had been called in by the directors in an advisory capacity, urged the necessity of at once spending at least $25,000,000 in putting the property, which had been supposed to be in fairly good condition, on its feet. It was not a case of spending this large amount in the most economical way over a period of years, but of putting it into the property with the utmost despatch. A refunding mortgage of $150,000,000 was authorized March 20, 1902. Of the proceeds from the sale of these bonds a sufficient amount was to be reserved to refund the bonds of the Brooklyn Rapid Transit Company and of the subsidiary companies as they fell due, and the remainder used in acquiring additional properties and carrying out improvements and extensions. This mortgage was filed on July 1, 1902, and the first proceeds from the sale of $5,000,000 of the refunding bonds became available in October of that year. In February, 1903, Mr. Winter was elected President and the task of rehabilitating the property placed directly in his charge.

It was a large work which the new President undertook. Complete reorganization, far-reaching reconstruction and extensions were necessary. Not only had many of the existing lines to be rebuilt, but the different elements of the system, widespread and unrelated surface, elevated and steam lines had to be brought into such relation with each other that they would all fit into a comprehensive system of transportation to meet the fast growing increase in travel. The demand for rapid transit had for years been forging ahead of the available facilities faster and faster. The problem was not alone to provide increased facilities to keep pace with the growing population, but as well to make up for the years of lost time and misdirected effort. Many of the improvements which had been made had to be rearranged, entirely rebuilt or abandoned. There was a shortage of cars, of power, of terminals and of those important adjuncts of such a city transit system, storage and repair facilities. The elevated roads in many respects were worse off than the surface lines, for the work of reconstruction from steam to electricity had been only partly finished.

It is not possible to take up the improvements in their chronological order. While most of them were of major importance, equally imperative, there were many delays in acquiring property and obtaining permits which prevented their completion in order of necessity. They may better be divided into three general heads: shops and yards; terminals and structures; power houses and new equipment; in which order they will be considered here.

When the change was made from steam to electricity on the elevated lines a large number of new motor cars were bought and most of the old steam equipment rebuilt. All of the work of wiring, putting in motor trucks and strengthening and repairing the old car bodies was done by the company. The existing shop and yard facilities for doing this work and properly caring for the equipment in service were such old shop buildings and trestles as had been handed down from steam operation or temporary buildings built on extensions of the elevated structure. Electric equipment requires careful and regular inspection and prompt repair to be kept in safe running condition, and one of the first improvements begun was the construction of suitable inspection and storage yards with shops for making repairs.

The elevated lines are in two groups, the southern district and the eastern district. The southern group includes all the lines which run to Coney Island over the Fifth avenue elevated structure and also the Brighton Beach line. The eastern group includes the Fulton street, Lexington avenue, Myrtle avenue and Broadway lines, all of which, except the Myrtle avenue line, come together at East New York. There had formerly been elevated shops at East New York serving the eastern district and a small shop at Thirty-sixth street and Fifth avenue, where the Culver and Sea Beach lines to Coney Island leave the elevated structure. Large modern shops and yards were planned at these two points.

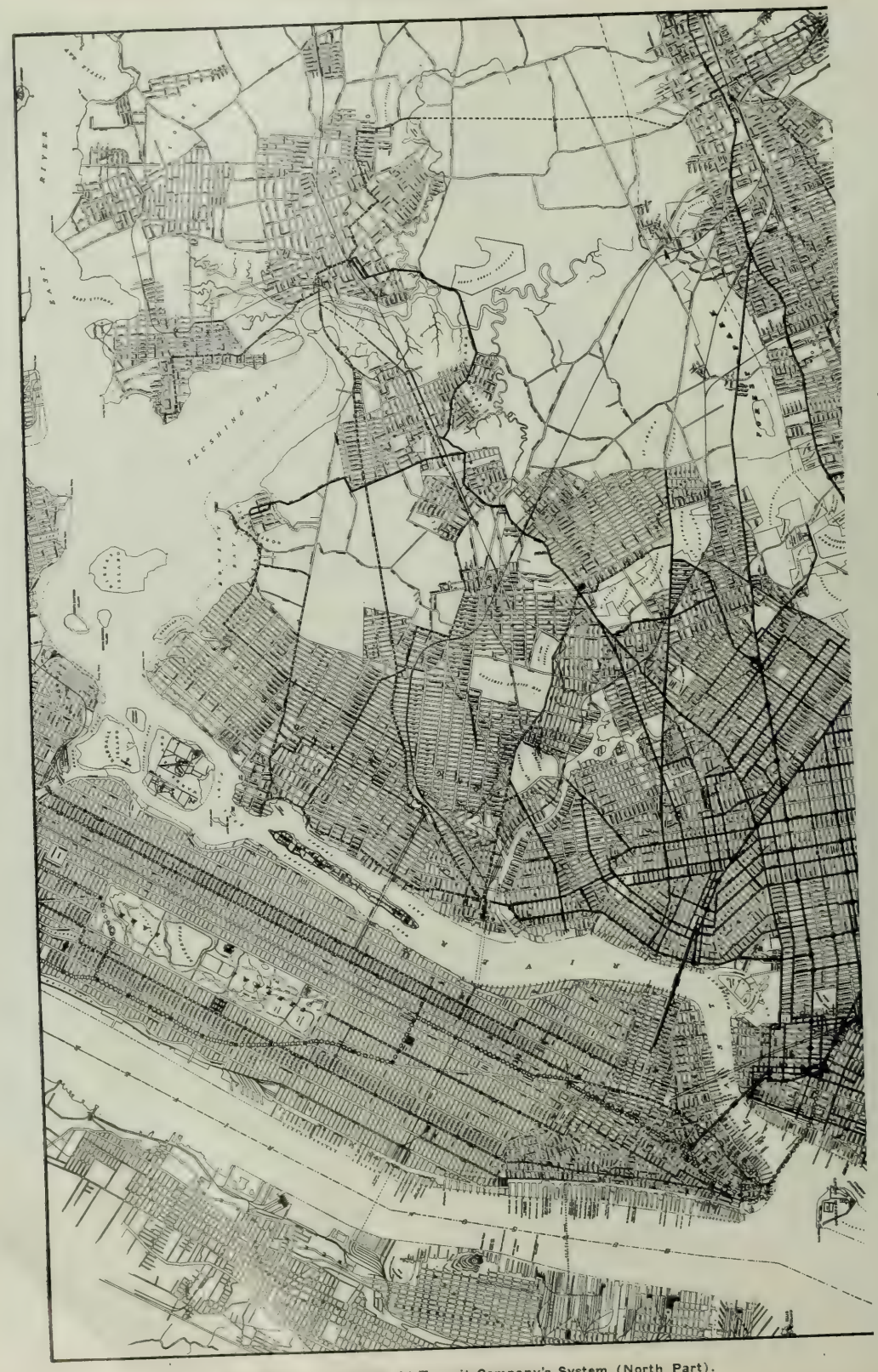
At Thirty-sixth street and Fifth avenue, the old building which was originally the Union passenger station where passengers were transferred from the elevated and surface lines to the cars of the old Prospect Park & Coney Island Railroad, was abandoned as a station and entirely rebuilt as part of the new shop plant. The old connection from the elevated structure to the Culver line, over which elevated trains ran to Coney Island, was removed and in grading for the storage yard an incline on an earth fill was built south of the yard leading to the elevated structure with two tracks around a sharp curve. A separate shop track connects with the storage yard ladder.

The old station building was remodeled into offices, locker rooms and carpenter shop on the ground floor for the shop employees and officers, and locker rooms and recreation rooms for the operating department on the second floor, which is on a level with the elevated structure. The boiler room and machine shop are in an addition to the old building. On a level with the ground floor and in the rear are the 10 inspection pits, which are completely enclosed. The structure covering the pit is fireproof and separated from the shop building by a heavy firewall. The roof is of the saw-tooth type supported by steel trusses on iron columns. This gives good light and ventilation. The pits are reinforced concrete, about 4 ft. deep and long enough to take a six-car train. The hot air heating system is used in connection with the pits for melting snow and ice and drying out the machinery. One of the pits is equipped with a hydraulic drop table for removing and replacing trucks to be repaired. These are dropped to the level of the machine shop floor and run into the shop on a track served by an overhead traveling crane which is used for dismantling. All cars on the southern district lines are taken in the shops here once every three days for inspection and light repairs, and once in 30 days are brought in for a thorough overhauling of trucks and electrical machinery. The end of the shed is closed with steel rolling doors and the tracks lead out to the main storage yard, which has a capacity of 340 cars. Overhead trolley wires instead of third rail are used in the yard and inspection shed, as south of Thirty-sixth street the elevated trains running through to Coney Island are operated by trolley. This plant has been in operation only a few months. The old shops—temporary sheds built on trestles to the west of the structure—have been torn down and the space is now used as a spare storage yard when required. This shop and yard cost $309,000.

At East New York the company has built for the eastern district even more complete shops and storage yards, which are also used as construction shops and storehouse for the entire system. They are located on an irregular piece of land between Bushwick avenue, Gillen place and Broadway, and have direct connection with the East New York loop, which joins the Broadway line to the Fulton street line. The ground slopes away from Bushwick avenue towards Broadway, and much of it had been filled in in irregular ridges covering old wooden trestles on which the shops and storage tracks for the steam elevated trains had been built. These shops were dilapidated frame buildings, firetraps, and utterly unsuitable for electric equipment.

Before leveling off this tract a massive concrete retaining wall was built enclosing the space for the shop building at the corner of Bushwick avenue and Gillen place. The space so enclosed was excavated down to the level of Broadway for the lower floor of the shops, which include the machine shop, smith shop and armature shop. On the second floor, which is on a level with the elevated structure, is the wood working and paint shop with drop elevator for lowering the trucks to the machine shop below. North of the shop building and on the second floor level are the eight covered inspection pits each long enough for a six-car train and similar in construction to those at Thirty-sixth street. All cars are inspected every three days and overhauled every 30 days. This building is separated from the main shop building by a heavy firewall supported on the main retaining wall. North of the inspection pits are storage tracks with a capacity of 264 cars. There are 12 tracks in three bays of four tracks each. Each bay is separated from the next by a hollow tile firewall, extending up above the roofs of the cars. The elevated yard is now on a solid earth fill supported by retaining walls.

In connection with the shops is a two-story general storehouse



Map of the Brooklyn Rapid Transit Company's System (North Part).



Map of the Brooklyn Rapid Transit Company's System (South Part).

in which all shop and system supplies, including material for the track and signal departments, station supplies and electric equipment are stored. This building, like all the others, is of the most approved fireproof construction with brick walls, reinforced concrete floors and roof, and protected columns.

A surface storage yard has also been built here, which will hold 327 of the largest size trolley cars. The tracks are arranged in pairs with fireproof walls between. An old building to the south of Gillen place is used for inspecting and making running repairs to surface cars stored at this point. The club building of the Brooklyn Rapid Transit Employees' Benefit Association also occupies part of the company's property on Gillen place. A reinforced concrete building with an entrance from the elevated structure has been built for a train despatcher's office and locker rooms for the employees of the operating department.

On the south side of Gillen place there is an incinerator plant built to dispose of city refuse. The Brooklyn Rapid Transit has a contract with the city for disposing of ashes and other refuse, except garbage. The refuse is collected by carts and brought to several loading stations. Ashes are loaded on cars and hauled to the marsh lands back of Coney Island, where they are used for filling in. Combustible refuse is sent to the incinerator at East New York or to a similar plant run in connection with the Central power plant at Third avenue and Fourth street. At the Central power plant the steam generated in the boilers of the incinerator is used to heat the boiler feed-water, but at East New York it is used for heating the shops and supplying steam to the hammers in the smith shop. More than $700,000 has been spent on the improvements at East New York which are now, with the exception of a sub-station under construction, entirely completed and in running order.

These two new shop plants built within the last three years at a cost of over $1,000,000 are typical of the improvements made under Mr. Winter's administration. They are examples of the most modern and efficient electric railroad shops in the country. The general public does not appreciate the value of such improvements in bettering the transportation service, yet they are the controlling factors in the safe, comfortable and reliable operation of electric street and elevated cars.

(To be concluded.)

The Union Pacific Gasolene Weed Burner.

Keeping the right-of-way on branch lines free from weeds during the summer months is a troublesome matter to many railroads. On many branch lines, along sidings and commercial tracks that are infrequently used, the roadbeds are ballasted with dirt, and from early spring until late fall the rank growth of weeds is a source of great annoyance and considerable expense. It is a common sight on such roads in the western prairie country for the weeds to be 2 ft. or 3 ft. high, and on commercial tracks seldom used, sunflowers and other rank growths are seen as high as 7 and 8 ft. along both sides of the track. This condition obstructs seriously the movement of trains, causes slippery rails with consequent annoyance in operation, and necessitates considerable reduction in tonnage and thereby a decrease in revenue.

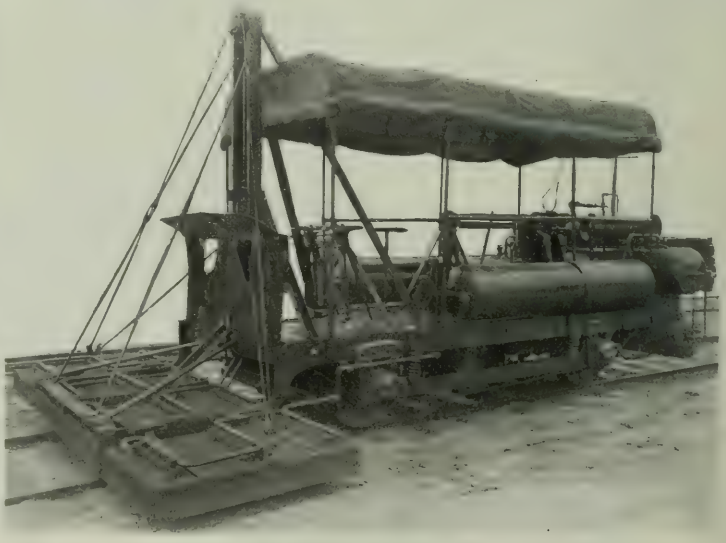
It is absolutely necessary to get rid of this growth at any cost. The pilot of the locomotive has been made use of to some extent by fitting it with knives, but this has not been of much benefit, and in the main it has been necessary for the track department to engage large gangs of men to cut this growth at great expense with scythes and shovels. This cost is practically continuous throughout the summer months, as the growth is as fast as a reasonable number of men can keep pace with. The season at which this work must be done is also the time when laborers are in great demand in the fields, and it is often almost impossible to get the men at any cost during this period. Since on these branch lines the traffic is usually relatively light, the operating officers often begrudge this unproductive outlay for labor.

A year ago the Union Pacific Railroad set about finding some means of doing this work at a minimum cost. Many suggestions were considered, such as cutting the weeds by machinery and sprinkling the right-of-way with a saturated solution of salt and water, which would tend to kill off the weeds; but after numerous experiments in the way of machines for the work, A. L. Mohler, Vice-President and General Manager, suggested a gasolene weed burner. One was accordingly developed in the Omaha shops under the direction of W. R. McKeen, Jr., Superintendent of Motive Power, and has been doing the work very successfully and at greatly reduced cost. It is carried on a four-wheel all-steel car with regulation standard wheels, axles, boxes, pedestals, etc. At one end of the car is a gasolene engine secured to the floor, which propels the car and pumps the air for forcing the gasolene to the burners and elevating the side wings of the burner frame. The propelling mechanism is designed for two speeds, the slower speed of 3 to 4 m.p.h. being used while burning weeds, and the higher one of 12 to 15 m.p.h. in going to and from work.

There are a number of tanks on the car to carry a supply of gasolene sufficient for a day's run on the road. The gasolene is forced by compressed air into a system of burners at the back of the car, arranged to deliver the flame close to the ground. This practically kills the weeds, while cutting them in no way stops the growth, of course. The framework for carrying the piping to which the burners are secured is divided into three sections, the center one of which extends a little beyond the rails. The side sections are hinged to the center section to enable them to be lifted out of the way of obstructions outside of the track and to clear cattle-guards, etc. They can also be set at any elevation in order to bring the burners close to the ground on any kind of grading. With these three sections in operation a strip 12 ft. wide—3½ ft. each side of the rails—is cleared.

It has been found advisable to make a first burning early in the year when the growth has reached a height of 6 to 8 in.; then to go over it again a few days later when it has dried somewhat. In the second burning the weeds are entirely consumed and the roots killed. It is sometimes necessary to repeat this performance three months later. The machine is capable of burning from 20 to 25 miles a day, running about 3 to 4 m.p.h. Three men, all told, are required in the operation of the device, the car being moved over the road under orders the same as a regular train. Where the weeds are cut by hand it requires approximately 16 men to cut one mile of track per day, hence the machine does the equivalent work of about 300 men. It destroys the weeds at a cost of $5.74 per mile as against $22.40 per mile when cut by section men.

This solution of what was previously a difficult problem to the Union Pacific thus proved a simple matter. The gasolene weed burner is in reality an automobile mounted on railroad car wheels, equipped with the weed-burning apparatus. It carries the fuel for the burners as well as for its power, and its operation is so simple that it is comparatively easy for one man to handle it. It is said that in good weather a trip through the country on this weed burner is a very pleasant ride.



Union Pacific Gasolene Weed Burner.

At eight large stations on the Government railroads in Japan tablets are hung up "to provide means of writing reminder for such of the passengers who have anything to communicate to their fellow travelers who do not arrive in time."

Economy in Power.

BY A. STUCKI.

Year by year power driven machines are steadily substituted for hand labor. Competition in every branch of industry, railroading not excluded, becomes more severe every day, and, besides that, the tendency of the present age points toward a further development in every branch of industry and science. But in order to succeed properly in all the different stages in this onward march, the fundamental question should constantly be borne in mind, *i. e.*, How can we get the maximum power from the fuel stored up in the ground?

Not so many years ago this question could have been answered with comparative ease, then being only a matter as to what design of boiler and engine equipment would give the best results. To-day, however, the question is more complex, as in addition we will have to consider the steam turbine and the gas engine, with a number of closely related devices—the oil, gasolene and naphtha engines. Even in the steam equipment itself we have possibilities in fuel which we formerly did not make use of, namely, oil and pulverized coal.

First, let us take up the question of relative economy in fuel, what it means in heat units and what it means in dollars and cents. It is not the intention, however, to go into theoretical deductions and scientific researches, but simply to state some average figures which, although based on practical results and on experiments, may not be absolutely correct, but one sufficiently so to form a guide in the selection of the power system in laying out a shop or extending an old one.

To begin with a steam plant, it is a well-known fact that the losses in energy are very great. For clearness sake, let us consider a 1,000-h.p. installation, return tubular boiler, bituminous coal (Pittsburg) at $2.50 per ton delivered, 13,000 B. t. u. per lb., high speed, non-condensing engines and 160 lbs. of steam pressure. The losses in the boiler average about 40 per cent., and are mostly due to imperfect combustion, loss of heat by the escaping gases through the stack and loss of coal in the ashes, and, therefore, instead of evaporating 12.8 lbs. water from 212 deg. to 370 deg. 7½ lbs. is a fair average, for service conditions. Mechanical stokers, down draft furnaces and economizers are often used to increase the efficiency. The latter device alone is said to improve the result nearly 5 per cent. The feed water is often treated so as to prevent the formation of scale in the boiler, and it was also found that heating the air before it enters the firebox is beneficial, but if we consider that it takes about 20 lbs. of air for every pound of coal burnt, it is easily understood why this is not done in practice.

It makes little or no difference whether the heat strikes the flues from the inside (fire tubes) or whether the water in the tubes (water tubes) is heated from the outside, except that the danger from explosions in the latter case are lessened. This point will be touched on later.

To increase the efficiency of the boiler, other fuels besides coal have often been tried.

Oil burned with compressed air or steam, to spray the same, produced quite satisfactory results, and one pound of fuel oil containing 19,000 B. t. u., costing 47 cents (3¼ cents per gallon), may be looked upon as evaporating 11 lbs. of water, under the circumstances mentioned above. This means that a pound of fuel costs 320 per cent. that of coal and evaporates only about 47 per cent. more water. Besides this, it must not be overlooked that the oil market is subject to sudden fluctuations, while the coal is not.

Pulverized coal has also been used with good success. Coal, in this case, is dried and then ground to powder. However, when crushed very fine and suspended in air, it forms a high explosive, and for this reason coal is only ground medium fine. Still, a very good combustion can even then be obtained. An average of about 8¼ lbs. of water being evaporated per lb. of coal dust, conditions being the same as mentioned in the beginning, and if the extra cost of the drying, grinding and conveying machinery is not considered, pulverized coal would certainly be a cheaper fuel than ordinary coal.

Arriving at the second item of a steam plant, the engine, we know, that for every 2,544 B. t. u., theoretically speaking, we should obtain a horse-power for an hour. Instead of that it takes 26 lbs. of steam at 1,014 B. t. u. each, or 26,364 B. t. u. in all, which is equal to 2,544:26,364, or 9.7 per cent. efficiency. Some of these losses are due to cylinder clearance, cylinder cooling and loss of energy in the exhaust steam. The amount of fuel needed is 26:7.5 = 3.5 lbs. of coal, or 0.4375 cent per h.p.-hour, or $13,125 per 1,000 h.p.-year, the year being counted as 300 days, 10 hours each.

By compounding or expanding, triple or quadruple, also by installing condensers, it has been possible to reduce the steam consumption to about 16 lbs. h.p.-hour, which, in connection with the boiler first mentioned means 2.3 lbs. of coal per h.p.-hour, or .2875 cent 1,000 h.p.-year, in this case will cost $8,625. (With this kind of an engine the feed water will be much cooler, when entering the boiler, than with a high speed engine, hence by right the boiler cannot be expected to evaporate quite as much water as before.)

Of late the steam turbine has come right to the front. Notwithstanding the facts that this machine is very compact, and void of complicated valves and reciprocating parts, it is about as economical in steam consumption as the high duty engine, whose place it takes. It can successfully be used with and without condenser; however, the best results are obtained by superheating the steam.

Taken as a whole, the efficiency of the steam plant is very small, to put it light, and it certainly is a relief to know that the gas engines of to-day are able to do much better. The underlying principle consists in introducing the fuel in a gaseous form directly into the cylinder, mixing it there with air until a highly explosive gas is obtained, after which it is ignited. The blow of this explosion is then directly absorbed by the piston. By such a method it is plain that a very much higher efficiency can be obtained than in the steam engine. It is also plain that, in case of natural gas being used, the great losses inherent to the steam boiler are entirely done away with, and last, but not least, the gas engine enables us to make use of valuable gases which heretofore went to waste, thus not only doing away with losses in the efficiency, but actually doing away with the fuel bill. This has reference principally to coke oven and blast furnace gases.

On nearly the same principles are based the naphtha, gasolene and oil engines, the fuel simply being caused to evaporate before being brought into the cylinder. After this is done, the functions are the same as we find them in a gas engine. These engines in small units do good work in various capacities throughout the country, but, as mentioned before, the price and the market conditions of these fuels would exclude them for large installations.

Inasmuch as the coke oven gas has a high calorific value, over 600 B. t. u. per cubic foot, it forms a magnificent fuel for gas engines.

The blast furnace gases, on the contrary, are very much weaker, having but 90 B. t. u. per cu. ft. Nevertheless, it is estimated that for each ton of pig iron produced a sufficient amount of gas escapes to produce 600 h.p.-hour.

The natural gas of the Pittsburg district contains about 1,000 B. t. u. per cu. ft., and it takes about 10 cu. ft. to produce one h.p. for an hour. It takes about 10 cu. ft. of air for each cu. ft. of gas to make the explosive mixture. Gas at 15 cents per 1,000 cu. ft. will, therefore, result into 15 cents per h.p.-hour, or $4,500 year for 1,000 h.p.

One pound of Pittsburg coal will produce about 69 cu. ft. of producer gas of 144 B. t. u. each. Mixing the gas with about an equal amount of air will give an explosive mixture about 25 per cent. weaker than the mixture from the natural gas just mentioned, a fact which should be borne in mind in rating a gas engine. Taking the calorific value of the two gases as a basis of comparison, it will take about 68 cu. ft. of producer gas for each horse-power per hour, which, coal as above, will result in a cost of .1225 cent, or $3,675 per year for 1,000 h.p.

The figures so far mentioned are, for convenience sake, tabulated. They can very readily be adjusted so as to compensate for variations in the market prices of the different fuels.

Steam equipment.	Engine— High-speed.	Engine— Trip. expansn.
Kind of fuel	Coal.	Coal.
Boiler pressure, lbs.	160	160
Water evap., lbs. coal	7½	7
Efficiency boiler,pr.ct	60	60
Using condenser	No.	Yes.
Steam pr h.p.,hr.,lbs.	26	16
Efficiency of engine	9.7	14.1
Total efficiency	5.5	8.5
Fuel, per h.p. hr., lbs.	3.5	2.3
Cost of fuel:		
Per ton	$2.50	$2.50
Per h.p. hour	.4375	.2875
Per h.p., per year	$13,125	$8,625

Gas engine equipment.	Gas— Natural.	Gas— Producer
B.t.u. per cu. ft.	978	144
Air used, cu.ft. of gas	9.7	1.2
B.t.u. per cu. ft. of expl. mixture	91	65
Gas. per lb. coal,cu.ft	..	69
Efficiency of producer in per cent.	..	76.4
Gas used,h.p. hr.,cu.ft	10	68
Efficiency, eng., p.ct.	26	26
Total efficiency	..	20
Cost:		
1,000 cu.ft. gas, cts	15	1.81
Coal per ton	..	$2.50
Fuel per h.p. hr.,cts	.15	.1225
Fuel, per 1,000 h.p. per year	$4.500	$3.675

Fuel economy, however, is by no means the final goal of engineering, but simply one item toward getting a maximum service in a certain given time for the least amount of money. Therefore the following points should likewise be considered:

Cost and maintenance of installation.

Reliability.

Safety.

Attendance.

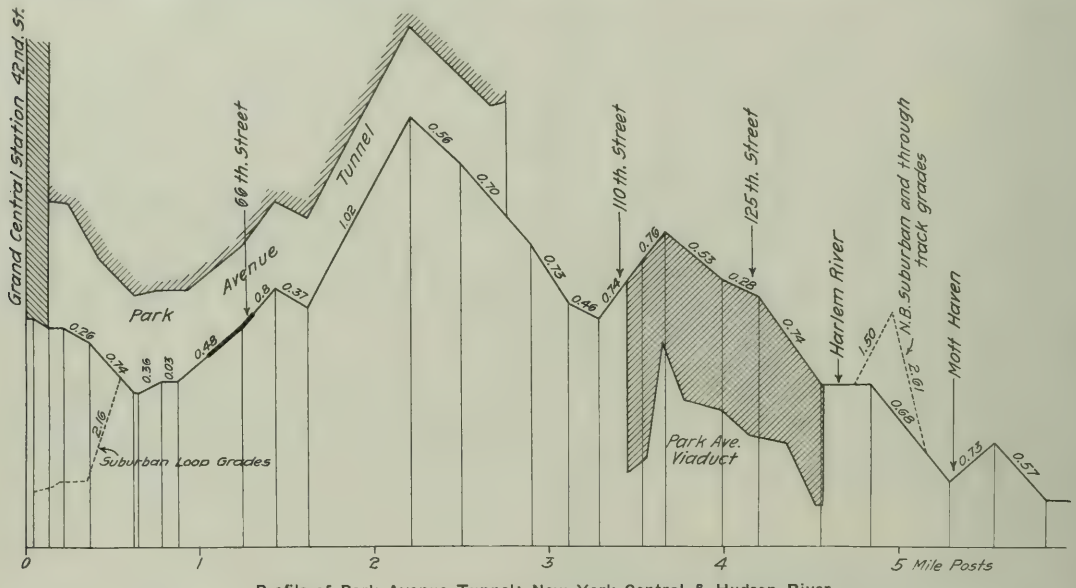
Adaptability to various conditions.

Comparing first the installation necessary in a steam plant with that of a gas engine it will not be hard to recognize a tremendous difference in favor of the latter. With the boiler and engines, we have to provide stokers, stacks, feed pumps, feed water heater, coal and ash conveyors, expensive piping, coal bins, water softeners, economizers, and, in high duty work, condensers, while with the gas engine, disregarding coke oven gas, blast furnace gas and natural gas, as special cases, nothing is necessary, except the gas producers with their scrubbers, and coal and ash conveyors. It goes without saying that the initial cost of a gas engine plant is much less than the steam plant outfit, and, speaking in a general way, the maintenance of a few details amounts to less than a good many.

It is true a good many gas engines have been tried, abandoned

and replaced by steam engines on account of not having been found reliable, and an engine giving out just when possibly its service is most needed is very costly, no matter how low the fuel cost may be. But in justice to the gas engine, the writer must say that in all cases of this sort, which were brought to his attention, the conditions were such that nothing else but a failure could be expected. In one case of gas engine explosion, he found that it was one of the earlier designs and had been doing service continuously for over eight years, notwithstanding the fact that the man in charge pronounced it out of order and unsafe, but was compelled to run it, as there was no substitute at hand.

Right here is the secret of success. Can you expect any machinery to run continuously without provision being made for periodical overhauling and emergency cases? I have heard men say that their gas engines did admirably the first few months, and after that at once refused to work, giving constant trouble from then on. Such a statement is merely preposterous. Why not hunt up the reason for such a change, and remedy the trouble? On the other hand, I have seen gas engine installations run year in, year out, with the regularity of a clock, and all the engineer in charge



Profile of Park Avenue Tunnel; New York Central & Hudson River.

insisted on was a periodical cleaning and inspection of the igniter and the other small details so essential in the gas engines.

Speaking about the relative safety of the steam and gas engine outfits, we all admit that there should be no danger in either, and there is no danger if everything goes as intended. But why is a high pressure fire tube boiler not to be tolerated in the basement of a well regulated office building? Why will steam cylinder heads burst occasionally? Because accidents will occur in spite of what you do. The same way with the gas engine. However, one redeeming feature is the absence of a boiler, beyond doubt the greatest source of danger.

Again, we often hear that any man can run a steam plant, while it takes an expert to run a gas engine. This is only partly true. It is much easier to find a man familiar with the steam equipment than to find one who is willing to study carefully the ins and outs of a new device, but after he has mastered the task he invariably will prefer the latter, simply because there is much less to attend to.

Often, it is true, steam is needed also for heating buildings. This can easily be provided by setting up an extra small boiler of low pressure near where the steam is needed.

Others may demand steam as a means for driving hydraulic pumps and air compressors. But we must not forget that it takes from 90 to 120 lbs. of steam for every horse-power per hour in a hydraulic pump, and the sooner we give up such wasteful practice the better. Electrically driven pumps are now kept in the open market. It is true they are more complicated, but look at the saving in power. Besides this, an electrically driven pump can be located near the presses or riveters, doing away with a great deal of piping and friction, and making the whole shop that much more flexible. The same thing can be accomplished by driving air compressors by electricity, and the location of the power house can be chosen solely with a view of minimum handling of fuel, entirely independent of the shops.

Tractive Power of Electric Locomotives.

On the afternoon of April 26, northbound train No. 19 (Lake Shore Limited), consisting of nine heavy Pullman cars hauled by a Central-Atlantic type steam locomotive, was disabled and stopped in the tunnel on the 0.5 per cent. up-grade under 66th street, New York City (see profile). Following this train was a local train of seven standard day coaches hauled by one of the new electric locomotives. The electric locomotive, coupled on behind No. 19 and pulling its own train, started the entire load on the grade without assistance from the steam locomotive, which was dead. The 16 cars and two locomotives weighed approximately 1,000 tons. The electric locomotive started with good acceleration and pushed No. 19 north to 125th street up the 1.02 per cent. grade one-half mile long from 72d street to 83d street, without any difficulty and at good speed.

Of the 477 trains daily now entering and leaving the Grand Central terminal, 135 are New Haven trains handled by steam locomotives, and the remaining 342 trains are New York Central. Of the 342 trains, 280 (equal to about 82 per cent.), are now handled electrically, and it is expected that the remaining 62 trains will also be handled electrically within the next week or two. The partial change to date has resulted in a marked improvement in the visual conditions in the Park avenue tunnel.

Central Railroad Office at Berlin.

The *Zeitung des Vereins* states that certain sections of the railroad work that have heretofore been handled by the individual companies in accordance with their individual ideas, but which, for the purposes of comparison ought to be handled in a uniform manner will now be taken care of in a central office that has been created in Berlin. The amount of work that has been imposed, by the increase of traffic on the one hand, and the desire to simplify, accelerate and treat the business scientifically, on the other, has been the real cause of the establishment of this new department which began work at the commencement of the present fiscal year, April 1. This central office will report directly to the Minister of Public Works. It is to rank with the management of the railroads and will be called upon to decide for the whole system of State Railroads in all matters belonging to its jurisdiction just as these were formerly decided by the individual managements. The matters which will be controlled by it will be: (*a*) All affairs connected with the rolling stock, especially as regards freight cars and their utilization; (*b*) the construction and purchasing of all materials entering into the superstructure, safety appliances, locomotives and cars; (*c*) the direction of investigations and tests for improvements intended to increase the capacity and safety of railroad appliances, including rolling stock and other things used in the handling of traffic; (*d*) the purchase of important materials; (*e*) the elaboration of through service and a uniform regulation of train movement; (*f*) the distribution of applications for em-

ployment, and (g) the promulgation of a uniform system of beneficent institutions for all of the State Railroads.

Objects and Effects of State Regulation.*

In some of the states, owing, perhaps to a failure to understand the true relations of the railroads to the business of their communities and the identity of interests between the public and the roads, there is a tendency to regard railroads as different from all other business undertakings and as the proper objects of burdensome restriction rather than of helpful encouragement. This tendency is being manifested in legislation that would universally be recognized as destructive if applied to any other business. It has been carried to such lengths that thoughtful business men who recognize the importance of efficient transportation agencies to the success of their own business may well consider what are to be the final results. They may well give thought to what will be the ultimate effect upon their individual business undertakings of policies the tendency of which is to cripple the carriers and lessen their ability to provide service.

Is antagonism to railroads to be carried to the point that will destroy the properties, or only to the point that will cripple them? What will be the inevitable effect on the general prosperity of the country of either of these degrees of destruction? These are questions that every business man should ask himself and that he should propound to those responsible for enacting and executing legislation. If these questions are answered without prejudice it will be found that, in every case, legislation that goes farther than proper regulation cripples every business interest along the lines of the railroads affected as surely as it cripples the railroads themselves.

The phenomenal growth in the volume of business in the United States in the past few years has resulted in the demand for transportation increasing faster than the railroads have been able to increase their facilities. Just at this time, when increased facilities are of infinitely more importance than any possible reduction in either freight or passenger charges, legislative policies are adopted by some of the states the inevitable effect of which, if persisted in, must be to postpone or make impossible urgently needed railroad improvements and extensions.

Do not understand me as being opposed to such proper governmental regulation of carriers as is necessary to prevent discrimination and to assure reasonableness of charges. It is the legislation that goes beyond proper regulation and becomes destructive that should be condemned by public opinion, not only as a matter of simple justice and fair play, but in the interest of the public as well. That the belief that much of the current state legislation tends to destruction rather than to regulation is not confined to railroad men is shown by an interview with Chairman Knapp, of the Interstate Commerce Commission, recently published in the Chicago *Tribune*. Referring to the public antagonism to railroads displayed in some parts of the country, Mr. Knapp said:

"To my mind, the most serious and difficult phase of the situation, and the greatest menace to the needed development of our railroad systems is the hostile attitude of the states. Serious trouble is likely to arise unless, by some means, tolerably harmonious action as between Federal and state authorities can be brought about."

In the same interview Mr. Knapp expressed the opinion that the courts will ultimately hold much of the recent state legislation to be unconstitutional. That is a question for the lawyers and the courts, on which Mr. Knapp's opinion is far more valuable than any that I might express. I base my argument against legislation of this character on the ground that it is economically unsound, and that, by injuring the railroads upon which the public must depend for transportation, it will inevitably react upon the people of the states in which it may be enacted.

If you will look into this matter thoughtfully I think you will agree with me that every business man should be an active, militant advocate of such public policies as will allow the strong and healthy growth of the railroad systems of the country, and that he should be an active opponent of everything passing the bounds of reasonable and proper regulation that would tend to retard such growth.

I cannot conceive that the people of any locality should deliberately favor a policy that would restrict investments, but business men will not put their money in any locality unless they are assured that its transportation agencies are strong enough and prosperous enough to expand their service with the growth of business. Since the construction of railroads first began they have ever been the forerunners of investments. In this day, in localities already supplied with railroads, further investments depend on the assurance of the adequacy of railroad facilities. For these reasons southern industrial development and southern railroad development must go hand in hand, in the future, as they have in the past. Stifle or restrict railroad development in any section, and the inevitable result will be to stifle or restrict all industrial progress and material advancement in that section.

I think that no one who studies the subject carefully and without prejudice can differ with me in the conclusions that the interests of a railroad and of the people depending upon it for transportation are identical, and that, while the public is entitled to the best service that the railroad can give, the railroad is equally entitled to just and fair treatment at the hands of the public. I think it must also be as clear to the business men of the South as it is to me that, if the railroads of this section are to increase their efficiency as transportation agencies and as allies with southern communities for southern development, they must spend large sums of money within the next few years. The practical question that confronts the railroad managers of the South is: How is this money to be obtained? This is not only a vital question for the railroads, but it is also a vital question for the southern people.

Notwithstanding the statements that are sometimes made to the contrary, but little of this money can be drawn from the earnings of the roads. The inadequacy of this source is shown by the fact that if the Southern Railway Company, from its organization, had expended for improvements every dollar of net income, after paying operating expenses, taxes and fixed charges, and had never paid a penny in dividends or carried a penny to surplus, the total to date would have amounted to only about $3,600 per mile estimated on its present mileage. How far short of requirements this would have fallen is shown by the fact that it has spent, or contracted to spend, for capitalized betterments and improvements in this period within a fraction of $14,000 per mile on its present mileage. With the rapid increase in operating expenses, due to higher prices and advancing wages, the proportion of net income to gross earnings becomes smaller and the utter inadequacy of income to supply funds for extensions and improvements is made much more manifest. By far the greater part of the money needed can be obtained only by borrowing. Ability to borrow depends on credit, and the credit of a railroad depends upon present and prospective income, just as the credit of any individual or of any business concern depends on ability to show that future income will be sufficient to meet interest charges and assure the security of the principal.

This being true, an attack upon the earning power and credit of a railroad, through legislation arbitrarily reducing its charges or imposing onerous and restrictive conditions on its operation, is an attack upon its ability to maintain its service and to extend and improve its facilities, and all such legislation must react upon the very persons it is intended to benefit.

But, it is said, if the railroads were not paying dividends on *excessive* capitalization, their credit would not be injured by legislation of this character and their surplus revenues would be sufficient to pay for betterments. This argument is based on the assumption that the capitalization of railroads as a whole is excessive, that the railroads of the country, taken as a whole, are greatly overcapitalized. An eminent authority on this subject is Chairman Knapp, of the Interstate Commerce Commission. On a previous occasion I have quoted his language as follows:

"I regard the common talk about the overcapitalization of railroads as wholly ignorant and mistaken. I believe that, in far more instances than the people suppose, a fair valuation at this time would give figures far exceeding the present estimate."

Mr. Knapp knows, as does every practical railroad man, that capitalization cannot be predicated upon mileage. He knows that many other factors must be considered. He knows that upon every railroad system there are many miles of line that have cost many times the figure for average cost per mile on which these popular estimates have been based, and that the costs of yards, terminals and equipment must be duly considered and allowed for. It is a matter of common knowledge, especially to well-informed business men, that the cost of railroad terminals in all cities of considerable size is very large and greatly increases the average cost per mile of a railroad system. Equipment is another large item which depends upon volume of traffic more than on length of line and which adds very materially to the average cost per mile of every railroad system.

This whole question of capitalization, however, is one that interests security holders rather than the shipping public—the buyers of transportation. Capitalization does not affect rates. No one of the critics of railroad capitalization has ever suggested any practicable method of basing rates on capital. It cannot be done, and President Hadley, of Yale, one of the most profound students of transportation problems, was right when he said that railroad men "do not try to make their rates correspond to their capital." In practical experience it is found to be impossible. It is found that rates have to be so adjusted as to move commodities to competitive markets in competition with the products of rival producing localities, in competition with other carriers, and in competition with other similar products. The rates that will attract traffic and that will enable producers in the territory contiguous to a railroad to expand their markets and increase their production must be accepted, or the business will not move.

I think that every fair-minded man who will study the question thoroughly and dispassionately will agree with me as to the far-sighted wisdom of the legislature of Tennessee in declining to enact some of the legislation that was proposed during its session. Con-

*From an address by W. W. Finley, at Memphis, Tenn., Apr. 22.

sider, for a moment, propositions to reduce passenger fares on the railroads in the southern states. These are based on the ground that fares have been reduced in some other sections of the country. No account is taken of the radical differences of conditions affecting the passenger business of the railroads of the southern states and those with which comparison is made. Every farmer knows that there are some soils on which crops can be grown profitably even if the selling price is so low as to make their cultivation unprofitable on less fertile land. Exactly the same thing is true of railroad passenger traffic. It will undoubtedly be conceded that a railroad is justly and fairly entitled to reasonable compensation for the service that it performs. There are some sections of the country, where the population is dense and where a large percentage of the people live in large cities, affording regular and heavy suburban and interurban traffic, in which passengers can be carried at an average rate of fare per mile that would be ruinous to roads in less densely populated sections of the country. People who live in cities are ordinarily more actively engaged in business and travel more than people who are scattered through rural sections. The southern states, as a whole, are not fertile of passenger traffic for the railroads. It costs practically as much, or nearly so, to haul a passenger train with the cars empty as it does to haul it with every seat filled.

Any possible reduction in passenger fares would be of very little benefit to the average individual, but, in the aggregate, such reduction would seriously affect railroad income and cripple the efforts of the roads to increase and improve their passenger service. This is important to all the people of the South, for the reason that improved and safer passenger service and more comfortable and convenient passenger stations are far more important to this entire section than any possible reduction in passenger fares.

speedily, a great expansion of transportation facilities. The railroads are willing and anxious to supply these facilities. As business men, therefore, you are vitally and personally interested in seeing that the railroads have fair play and a square deal; that their passenger and freight rates are not arbitrarily reduced so as to cripple their credit and prevent them from improving their facilities, and that they are not subjected to restrictive regulations as to car service and traffic movement that will make it impossible for them to give equal and fair treatment, to the extent of their ability, to all buyers of transportation, whether for interstate traffic or for intrastate traffic.

Ten Wheel Locomotive for the Central Railway of Peru.

The American Locomotive Company has recently completed an order of 10 locomotives for the Southern and Central Railroads of Peru, intended for heavy mountain climbing in both freight and passenger service. The grades that these engines will be called upon to ascend are of 3 and 4 per cent., and reach to an altitude of 15,600 ft. In general design there is nothing to mark them as varying from the standards of American construction, but they have some interesting details that adapt them to the work that they have to do. The noticeable features seen in the accompanying cut are the presence of the operating mechanism for the Le Chatellier water brake and the method of valve stem connection to the combination lever of the Walschaert gear, by which it is arranged to operate a valve for outside admission. The inside admission with the piston valve having been so common as to be accepted almost as a standard practice, this use of the flat slide valve and outside admission seems almost like a variation of species. As in the case



Ten-Wheel Passenger and Freight Locomotive for Central Railway of Peru.

So-called "reciprocal demurrage laws" and all laws proposing to penalize railroads for failure to perform services in excess of their physical resources or to supply facilities in excess of their financial resources are also directly antagonistic to the interests of the public. The application of the designation "reciprocal demurrage" to a law imposing penalties on a railroad for failure to supply cars is misleading, for reciprocity implies equality of treatment, and there is absolutely nothing reciprocal in these laws. Demurrage is a charge, in the nature of rental, for the use by a shipper as a warehouse of property that does not belong to him and that is diverted from its true use as a vehicle as long as he holds it. A charge imposed on a railroad for failure to supply a car is a penalty, and can be properly imposed only when the road is able to supply the car and wilfully neglects to do so.

These laws are inimical to the best interests of the public because every penalty that is imposed under them lessens, to just that extent, the ability of the roads to increase their facilities and to perform the service required. They are also inimical to the interests of the great body of shippers and of the general public because, being operative only within the borders of the state in which they are enacted, their inevitable tendency is to bring about discriminations in favor of the comparatively few shippers whose business is confined entirely to that state and against the great majority of shippers whose business is not confined by state lines. They also operate to bring about discriminations in favor of the intrastate traffic in the state imposing the highest penalties. Laws requiring freight to move at a minimum rate of speed regardless of whether conditions are such as to make this movement impossible are injurious, both to the railroads and the people, on the same ground.

For these reasons I feel justified in urging upon you that your own interests demand from you something more than a mere passive belief on your part in the self-evident truth that the railroads should have fair play. The South needs, and needs urgently and

of other engines that have been illustrated heretofore, advantage is taken of the application of the Walschaert gear to secure a very substantial cross bracing of the frames, and the strong combination casting carrying the brackets for the lifting shaft and the link is used to good advantage. As will be seen from the illustration the link bracket is a separate casting with a deep, well-braced foot extending back on the cross brace. There are two waist sheets between the cylinders and the firebox; the forward one being bolted to the cross-brace at the guide yoke and back on to the brace just considered. This latter really extends down to take the two lower rails of the frames so that there is a rigid vertical connection at this point between all four members of the frame and the barrel of the boiler.

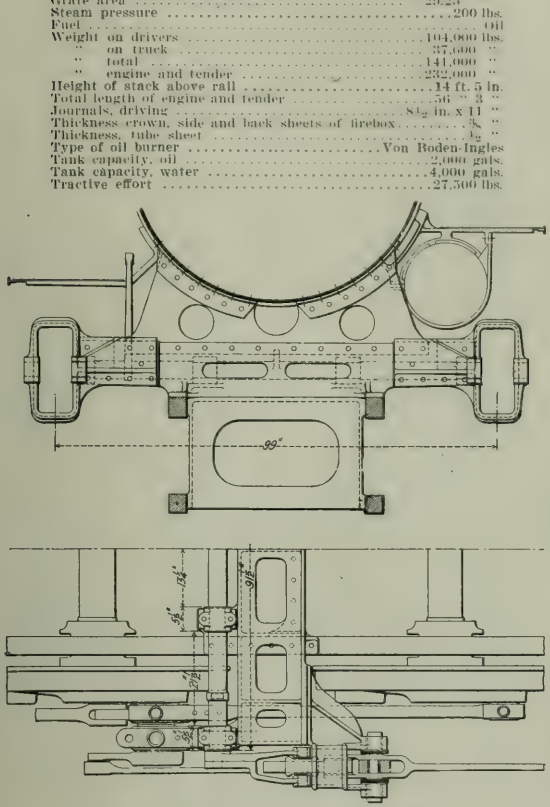
The method of fastening the eccentric crank to the crank-pin is that of using a split ring fitted on the crank, drawn together with a bolt and held in position by a key. The firebox is fitted for burning oil, but it does not vary from ordinary construction, except that the bottom is horizontal for its whole length instead of having the drop at the front in accordance with prevailing practice. The depth below the bottom of the shell to the bottom of the foundation ring is 18¼ in. and the tube-sheet is straight. The crown tapers back from front to rear and drops 2½ in. in the 102⅛ in. of the length of the firebox.

In addition to the Le Chatelier water brake, a further precaution for the service on the steep grades is the use of two 9½-in. Westinghouse air pumps.

The following are some of the principal dimensions of these engines:

Cylinder diameter	19 in.
Piston stroke	26 "
Wheels, diameter, driving	58 "
" " truck	30 "
" " tender	33 "
Wheel base, rigid	13 ft. 0 "
" engine	23 " 2 "
" engine and tender	47 " 5 "
Firebox length	102⅛ "

Firebox width	114 "
Tubes, number	272
" diameter	2 in
" length	12 ft. 0 "
Heating surface, tubes	1,804 sq. ft.
" " firebox	148 "
" " total	1,952 "
Tube heating surface equated to firebox heating surface (Vaughan's formula)	505.32 "
Total equated heating surface	653.32 "
Grate area	29.25 "
Steam pressure	200 lbs.
Fuel	Oil
Weight on drivers	104,000 lbs.
" on truck	37,500 "
" total	141,000 "
" engine and tender	232,000 "
Height of stack above rail	14 ft. 5 in.
Total length of engine and tender	56 " 3 "
Journals, driving	8½ in. x 11 "
Thickness crown, side and back sheets of firebox	⅜ "
Thickness, tube sheet	½ "
Type of oil burner	Von Boden-Ingles
Tank capacity, oil	2,000 gals.
Tank capacity, water	4,000 gals.
Tractive effort	27,500 lbs.



Plan and Elevation of Frame Cross Bracing.

Weight on drivers / Tractive effort	3.8
Weight on drivers / Total weight	.74
Total weight / Tractive effort	5.13
Tractive effort x diameter of drivers / Heating surface	817.0
Heating surface / Grate area	66.9
Firebox heating surface / Total heating surface	0.082
Weight on drivers / Heating surface	53.3
Total weight / Heating surface	72.3
Volume of 2 cylinders 8.52 cu. ft. / Total heating surface	229.0
Volume of 2 cylinders / Grate area	3.44
Volume of 2 cylinders /	

The impression that the railroad up Vesuvius was destroyed by the recent eruptions is partly correct and partly incorrect. There were, in fact, two connecting railroads. The one first built, and until comparatively recently the only one, began at the foot of the crater cove, and about 2,600 ft. above the sea, and was a cable road, ascending 13,000 ft. in a distance of 2,700 ft., nearly to the edge of the crater. This railroad was completely destroyed and the power house at the foot is now buried under 80 ft. of ashes, now mud. Whether any part of the plant under the ashes is fit for further use is not yet known. This cable road was formerly reached by an excellent carriage road, which was replaced a few years ago by a tramway partly worked by adhesion and partly by cog-wheels. This road was damaged comparatively little by the eruption, and most of it has already been restored, and passengers are carried to a point whence a climb of less than an hour by a practicable path brings them to the edge of the new crater. The railroads are the property of Thos. Cook & Son.

Signaling at the New England Railway Club.

The paper on railroad signaling read before the New England Railroad Club in March by Mr. W. H. Elliott, was printed in the *Railroad Gazette* of March 22, page 405. The discussion on this paper was participated in by Messrs. Morrison, Signal Engineer of the New York, New Haven & Hartford; Potter, locomotive engineman of the same road; Young, Signal Engineer of the Boston & Maine; Cheever, Superintendent on the same road; Droege, Superintendent on the New York, New Haven & Hartford; W. C. Smith, Signal Engineer of the Boston Elevated; Lindall, of the same road; F. E. Kinsman, of the Kinsman Block System Company, and R. H. Soule. Following is an abstract of the principal points brought out in the discussion:

Mr. Morrison—Referring to the distinctive color, I would suggest that one more color be added, and that is blue purple, for use in dwarf or slow-speed signals. Referring to track circuits in place of detector bars, I would not recommend the installation of track circuits in place of detector bars except where it was absolutely necessary—owing to the difficulty of shunting out the relays, especially if there is foreign current in the track, also on account of the expense of maintaining these track circuits. If any one of them fails it ties up the movement of the lever controlling the switches. I believe that flagging rule No. 99 could be changed to advantage where a proper system of automatic signals on double-track road is installed.

Regarding the locking of drawbridges, no expense should be spared. While we have all of our different rails on drawbridges locked, we formerly locked them together, but are making arrangements now to lock each rail independent. We will also lock the rails on our lift or jackknife bridges so that, should there be any derangement of the points, it would be impossible to give an approaching train a clear signal. As to automatic stops, I have examined a great many patent papers and models, and conversed with a number of parties claiming to have automatic stops, and have not as yet seen or heard of one that I would recommend be installed on a steam surface railroad.

Mr. Potter—You certainly want to get rid of the red light on the dwarf signal. I was just thinking of an instance. Superintendent W. L. Derr rode with me on the engine about a year ago. He was not familiar with this division. He was on the fireman's seat. When we swung round the curve at Roxbury, going about a 60-mile-an-hour gait, the signals at Chickering came in view. Well, for a guess you would have estimated the number of red dwarf signals at about 50, all in a bunch close to the ground—and all coming into view in a second. The high semaphores were all right. I saw Mr. Derr come off the seat, and I imagine every individual hair on his head stood on end. He said, "What is ahead of you?" I replied, "Nothing but what we are going through." Well, said he, "If we are going through anything wait till I get back to the hind end of the train. If I had anything to do with this division I would simplify those signals so d—d quick it would make your head swim." When we see those lights so near the ground, just about where a man would hold a red light to stop you, we have got to watch the light to see if it stands perfectly still. * * *

Mr. Cheever—I think that the present best type of automatic signal is about as safe as flagmen, and I am thoroughly in sympathy with the Railway Signal Association that flagmen need go back only far enough to see that the signal next behind them is at danger.

Mr. Young—Mr. President, after a flagman has gone back and stayed back the necessary length of time, and is called in by the engineer, and he puts his torpedoes down and goes in, you have got to wait that length of time before the train can start. Isn't it better for him to go back and see that the stop signal is up, and then return and be ready to start with his train at once, as soon as the train is ready to go? As for dwarf signals, the Boston & Maine has for 18 years put blue lights in on all new work.

Mr. Elliott—In reference to automatic stops there is a question as to how much the use of the stop will interfere with switching movements. Where safety is concerned nothing should deter us from securing that end, and as completely as possible; on the other hand, we are in the transportation business and must move trains, we must do it in as regular time as possible, we must make proper movements in order and securely, and if the stop is going to prevent us from making the proper movements we will not be

able to do our business. It is well that the matter is going to be threshed out by the commission, for I note that the law has been passed and the money will be available the first of July. Should it be found that the automatic stop does not interfere with switching movements, backing-up movements, double-heading trains or running trains in the reverse direction on a given track, there is little doubt but that the stop will come into use for certain classes of traffic.

Mr. Smith, of the Boston Elevated, answered a number of questions concerning the automatic stop in use on that road. He does not deem the system suitable for application on surface railroads.

Mr. Kinsman spoke of experiments now being carried out by his company on the New York Central. To provide for all possible demands his company proposes to provide an apparatus for making mechanical contact with a train above the surface of the rail. The effect of oscillation, due to irregularities of the track rails, especially where the frost is coming out of the ground, and also as a result of varying speed at which the train is run, is a serious matter. The Kinsman Company recommends the use of the sectional contact as against the continuous-current contact for the reason that under present practice definite points of control are demanded, and these points should be at or near the visual signal. A continuous contact for surface roads will result in the too frequent stoppage of trains at uncalled-for points along the line where the contact may be the least bit out of alinement or otherwise defective. It is not believed that steam railroad men are ready for that or to string trolley wires for this purpose. The Kinsman block system is so arranged as to detect any imperfection in the work of the visual signals and at the same time have any defect in the Kinsman system of wires or apparatus indicated by the action of the visual signal. In other words, each tends to check off the action of the other. This fact, together with the use of the recording device, constitutes an "unprejudiced surprise" checking system and a record of the condition of both every time a train passes a signaling point. It also establishes a disciplinary condition which tends to encourage the greatest care by engineers, inasmuch as a too frequent record of unexplainable automatic stops would be regarded with disfavor by the management; and at the same time it tends to protect a careful engineer from unfair criticism, as often follows in the case where conditions were entirely out of his control. This record also helps the Maintenance and Inspection Departments, by promptly reporting defects which might not otherwise be discovered in several days. It follows, therefore, that the four-part combination of a faithful engineer, a proper-working visual signal, a substantially constructed automatic stop and a permanent record of the integrity of the apparatus and operation of the train, can be depended upon to produce results which have been almost undreamed of heretofore.

For electrical roads we are installing a device by which the absence of the current in well-defined portions of the circuit will stop the car, and for steam roads we are now pushing the form which includes the guard rails placed at or just beyond the signal station or post for the purpose of protecting the engineer against those things which he cannot himself guard against.

Mr. Lindall told of an instance where the automatic stop saved a train on the Boston Elevated, in which the motorman had become unconscious while descending the steep grade from the elevated line at the North station down to the subway, south of that point. He believed that in this one instance the apparatus fully paid for all it had cost the Boston Elevated. Besides this there have been several derailments where the first notice that the motorman had of anything wrong was the application of the brakes by the automatic trip striking something. When the trips were first put on only ½ in. lap was allowed, but to provide for variations in trucks and for wear of rails the settling of springs and other inequalities, the trips were changed so as to allow for a lap of 1 in., and the trip now has a spring, so that when struck improperly by accident it will depress and not be broken. Since these changes no failures of trips have been known. No train in passenger service has passed a signal at danger without being tripped and no train has thus wrongfully passed a signal without the superintendent knowing it.

Mr. Soule, being invited to speak, gave a bit of history. He said: "I believe that I enjoy the distinction of having been the first signal engineer that was appointed in this country. It was absolutely without precedent to have such an officer on railroads, but in 1876, when the Pennsylvania Railroad was getting ready for the Centennial celebration at Philadelphia, it became necessary to take some action; and on the 4th of March of that year I was notified that I was to take up that work. There was a good deal of it to be done. The Centennial exhibition was to open on the 10th of June, and there was not much time to lose. So at noon on that very day, the 4th of March, I took the train to Philadelphia, and the next morning a party consisting of the General Manager, the Chief Engineer, the General Agent and myself, went over to New York and inspected the Toucey & Buchanan apparatus, which was in use on the New York Central. In that connection I wish to say that I think that Mr. Toucey, the General Superintendent, and Mr. Buchanan, the Superintendent of Motive Power of the New York Central, should have a great deal of credit for the work they did as pioneers in introducing systematic signaling into this country. The officials had a conference, and the New York Central tendered the use of its apparatus without royalty to the Pennsylvania. So I spent a week in New York picking up the threads and learning the apparatus, and at the end of that time one afternoon I got a couple of big express wagons and sent them to the old Thirtieth street shops of the New York Central road, and loaded them with patterns. I got them over to Jersey City and put them aboard a baggage car, and they were in Altoona the next morning. From those New York Central patterns there were built six interlocking apparatuses, which were installed near Philadelphia in preparation for the Centennial. Well, all railroad men came to the Centennial celebration, and I rather think that that was the first practical exhibition of interlocking and signaling on a large scale that the railroad men of this country had.

There was one interlocking apparatus in this country, however, at that time, but that had been built in London. That was a Saxby & Farmer, shipped over to this country and set up by English mechanics. That was installed at East Newark Junction on the Pennsylvania Railroad. But in 1877, the year after the Centennial, there were some changes made in the arrangement of the tracks over there, and it fell to my lot to rearrange that interlocking apparatus. The English patents were afterwards bought by the Union Switch & Signal Company, who also bought the Toucey & Buchanan patents.

Mr. Elliott—Referring to what has been said by Mr. Soule, the last Toucey-Buchanan interlocking machine was removed from service on the New York Central only last November. So well was the machine designed and built that it gave good service up to the time it was replaced by a larger machine of modern type. The time is coming when complete block signaling will be installed on many roads. We shall then be in the position that was so well stated by Mr. Joseph Crawford, of the Pennsylvania Railroad, when he said, "On important railroad lines detailed train rules and written train orders should be things of the past, and all movements of trains, not only when running on tracks designated for their use, but also when running on tracks assigned to trains running in the opposite direction, should be controlled and directed by signals, and the rear ends of trains when running slowly or stopped should be protected by fixed signals instead of by train flagmen." I trust we may soon reach this desired condition. (Applause.)

Mr. Young, replying to some questions about the automatic stop, thought that it would come in time, but that the first duty of railroads was to equip the whole of their lines with visual signals; that done it will then be time to put in adjuncts.

Track Deformations and Their Prevention.*†

BY G. CUENOT,
Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway.

IX.

STUDY OF WOOD USED FOR TIES.

Hard woods are principally used in France, oak or beech being preferred, but when these are not easily obtainable, or are too expensive, pine is used; but these woods are not utilized as they are found in commerce. They are first submitted to preservative processes, creosote generally being used. The timber, as purchased, is not that of the first quality used for framing—which costs in France 120 francs per cubic meter, say $55 per thousand feet b.m.—but second quality wood is used, especially second quality oak. The price of sap wood and wane oak, prior to the preservative process, is about $20 per thousand feet, while beech costs about $16 per thousand feet. Thus the untreated oak tie costs about 87½ cents and the untreated beech tie about 68 cents.

Beech makes an excellent wood for tie purposes, but is difficult to preserve and becomes worm eaten very rapidly if it is not allowed to dry under favorable conditions, especially if the bark is removed after the tree is cut down. Pine wood is quite resistant to compression but, owing to the loose texture of its fibers, it resists poorly the tearing caused by the fastenings and has a shorter life in service than the harder woods do unless the fastenings are made in a way which will be discussed further on.

Mr. Michel, Chief Engineer of the P. L. M. Company, has made a study of the relative compressibility of these species of wood to the limit of permanent deformation. According to him the resistance to compression of oak or beech, common pine, larch or spruce is as follows:

Species of wood.	Perpendicular to fibers.	Parallel with the fibers.	Proportion.
Oak or beech	3,413 lbs. per sq. in.	2,560 lbs. per sq. in.	.75
Common pine	2,845 " " "	2,133 " " "	.75
Larch or chestnut	1,707 " " "	1,138 " " "	.75
Spruce	1,138 " " "	683 " " "	.60

But this resistance to compression varies considerably according

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†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.

to whether the wood is treated or not, and also according to whether or not it is sustained between the walls of an envelope, as in the case of the composite tie. In the first case, with treated wood, the resistance to compression diminishes, as will subsequently be shown. In the second case, however, that of the composite tie, it increases very materially because the wood held fast between the walls of the metallic frame is sustained and the fibers have less play in relation with each other.

But before discussing these questions mention should be made of the process of treatment which is employed, since this has a considerable influence on the durability of the tie and consequently on its steadiness in the track. The experiments made have been carried on principally with beech, but the information derived can easily be extended to other kinds of wood. The quantity of creosote which can be used depends upon the amount of moisture in the wood which is being treated; therefore, the seasoning of the wood must first be considered.

In the first experiment, pieces of beech wood 9.84 ft. long, 6.3 ft. high and 6.3 ft. wide were cut immediately after the tree had been felled and were placed in rows on supports under shelter, to be seasoned. These pieces of wood, which contained on an average 45 per cent. of their weight of water in the beginning, were weighed separately, at first every 15 days and then at longer intervals. The successive losses of moisture are given in the following table:

Periods of weighings.	Duration of seasoning.	Successive proportions of moisture remaining in the wood at each weighing. Ordinates.	Character of wood, according to the degree of seasoning.
1896.			
1st May.	Beginning.	44.6 per cent.	From 45 to 40 per cent. of moisture some days after felling, the water flows from the wood and forms pools at the foot of the pieces when they are on end.
15th May.		38.0 "	
1st June.	1 month.	31.6 "	From 40 to 35 per cent. of the wood still surcharged with water appears translucent at the surface, when it has just been cut; the fresh shavings are semi transparent when interposing them between the eye and the light.
15th June.		28.6 "	
1st July.	2 months.	26.5 "	
15th July.		24.5 "	
1st Aug.	3 "	23.0 "	Below 30 per cent. moisture, it is difficult at first sight to state the degree of seasoning.
15th Aug.		22.5 "	
1st Sept.	4 "	22.0 "	With 20 per cent. of moisture, it can be said with certainty that the wood has arrived at its maximum practical seasoning without stove-drying, because it will scarcely dry more when exposed to the air another year.
15th Sept.		21.8 "	
1st Oct.	5 "	21.7 "	
15th Oct.		21.6 "	
1st Nov.	6 "	....	It is probable that the ties in the middle of a pile could not attain this degree of seasoning.
1st Dec.	7 "	....	
1897.			
1st Jan.	8 "	....	The wood after 5 to 6 years of seasoning under shelter, still contains 10 to 12 per cent of moisture.
1st Feb.	9 "	21.8 per cent.	

This wood was clearly not piled under conditions, as regards seasoning, identical with those of ties piled in the ordinary manner, since these are exposed to the weather and would presumably be slower in drying, but the extreme limits of seasoning remain the same; that is, the maximum of moisture at the beginning will be 45 per cent., and at the end it will be about 21 per cent. These limits are sufficiently accurate for the discussion which follows:

It will be seen by the above table that nearly the maximum seasoning was obtained in 4½ months after felling, from the first of May to the 15th of September, during the fine season. From the 15th of September to the 15th of February following the percentage of moisture of the wood remained stationary around 22 per cent., with slight fluctuations; then, during the fine season following, up to October, 1897, the rate of moisture descended to 20 per cent.

According to previous statements, beech wood, after six years of seasoning under shelter, still contained from 10 to 12 per cent. of moisture; but from the point of view of practical drying of ties, it is scarcely possible, without stove drying, to lower it below 22 per cent. of moisture.

The quantity of water contained in pine is at least equal, if not greater than, that which is found in beech, that is to say about 45 per cent. immediately after felling and 20 per cent. after seasoning. It is not the same in the case of oak; the percentage of moisture which it possesses is certainly less, the fibers of the wood are more compressed, and the quantity of water which they enclose more restricted. It is difficult for me, for want of precise experiments, to give an exact figure; it can be said, however, that this wood dries very slowly, keeps its moisture a very long time, and absorbs, consequently, a very small quantity of creosote. On this account, it is difficult to say when the preservation process can best be undertaken. This refers to the heart of the wood, not to the sap, which loses its water very rapidly.

When cross sections of new beech cross ties creosoted with 35 lbs. and containing much moisture (30 per cent. for example, which is very common), are immediately examined after the injection has been made, it is noticed that the creosote has penetrated into the end by the annual layers of the autumn wood, and that the spring wood, though considered more porous, has not been absolutely impregnated; the wood resembles a series of concentric rings alternately creosoted or intact.

The sections, made quite near the extremities, show the wood impregnated for a certain distance without alternations; at 3.94 in. the rings commence to be defined, 7.87 in. they are very clear, and occupy nearly the whole section of the wood. (Fig. 24.)

But proceeding towards the mortises for plates, the notable portions of these rings disappear (Fig. 25) and become more rare in proportion as they approach the middle of the length, where, often, there is no longer any trace. (Fig. 26.)

On the other hand, it is seen that the creosote has also penetrated through the lateral surface, by reason of the degree of moisture in the wood; above 35 per cent. there is almost no more penetration, scarcely two to three millimeters (0.08 or 0.12 in.), sometimes none; towards 30 per cent. the creosote has penetrated to a depth of two to three millimeters (0.08 to 0.12 in.), for the color of the wood goes on getting weaker in the direction of the depth.

In the moist wood, as above, there exist few cracks arising from seasoning; when they are observed they are in the direction of medullary rays, not penetrating to more than two to three centimeters (0.79 to 1.18 in.), and the creosote has penetrated a little deeper by them. These cracks do not follow the meshes, but form freely among them.

If a transverse cut is made at the extremity of a beech tie injected with 35 lbs., freshly creosoted in the moist state (30 per cent. for example), it is observed that the concentric rings of the annual layers form alternations of wood creosoted and not creosoted; but by leaving the piece of wood of small sectional volume in the air, the rings of creosote, clearly limited and defined on the cut surface,

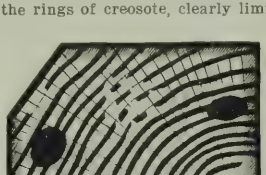


Fig. 24.

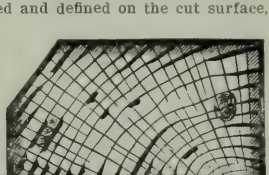


Fig. 25.

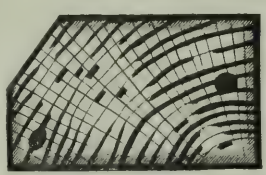


Fig. 26.

spread out by the seasoning and the creosote is diffused in the circular intervals of wood previously intact. When this piece of wood has finished drying (which requires one or several days, according to the thickness of the piece and the temperature), the creosote is diffused in a diluted greenish tint, which sometimes occupies the whole mass. In the sections of these moist ties made towards the mortises for plates, or towards the middle of the tie, are parts the least injected, where, at the moment of making the section, only small portions of wood creosoted are seen, the diffusion on drying is exceedingly slight.

But if these samples of wood imperfectly creosoted are preserved in moist sand, no diffusion apparently takes place. According to that it would seem that there was advantage, for the diffusion of the creosote, in keeping the ties after creosoting exposed for a long time to the air, but it is observed that this diffusion, which is well done, and within a short time, with the small samples, is much slower with the ties exposed to the air.

On the other hand, the tie from which the piece in question has been cut, is preserved even in the air with its tints in rings, without any diffusion, during several months, and to such a degree that it keeps at least 30 per cent. of its original moisture; once placed and buried in the ballast, it losses or absorbs moisture very slowly, according as it is more moist or more dry than the medium surrounding it when it is first placed in the track. When it has reached the degree of moisture of the ballast, the latter diminishes or increases according to the seasons. In ties weakly creosoted with 35 lbs. in pure gravel ballast, in position for at least five years, the wood not injected, in the interior of the tie, contained from 30 to 35 per cent. of moisture in the month of September, after a month of dryness and an ordinary summer; in a ballast of broken stone this proportion of moisture is much less, from 20 to 25 per cent., which favors diffusion.

In these kinds of ties the impregnation is generally produced by the rings of autumn wood; it was not diffused, and the rings, although compared, remained in their primitive state. The limiting amount of moisture at which the diffusion commences to work is not known, but it is evidently less than 30 per cent.

When the amount of creosoting is reduced from 46 to 35 lbs.,

beech ties are imperfectly creosoted, and the white wood* not creosoted appears on the mortise for the plate, that is to say, at a distance of a centimeter (0.39 in.) from the surface. With the aid of a special auger, numerous samples of untreated wood were taken from these ties, and from 30 to 35 per cent. of water was found. When they have 30 per cent. moisture they are only superficially creosoted, except at the extremities over 9.84 in. long, where the injection has penetrated without reaching the mortises for plates. Some ties of this nature employed in the annual track renewals from 1889 were submitted to a special examination. By sounding them from time to time it was proved that they were rapidly worm-eaten, and that at the end of four years a large number of them, from 15 to 30 per cent., according to their position in the track, commenced to decay in their interior; 10 per cent. were already replaced at the end of this short lapse of time.

(To be continued.)

Effects of Steaming and Preserving on the Strength of Ties.†

The effect of steaming upon the strength of the wood depends upon its pressure and duration. The action of either one of these depends upon the kind of wood. A light, open structure, or sap-wood, suffers more than a close-grained wood, or heartwood. Seasoned timber suffers more severely than green wood.

Formerly it was thought that the heat of the steam would evaporate the moisture and sap in the cells. It is doubtful if the temperature rises high enough in the tie under ordinary conditions of steaming to effect this evaporation. There is, however, a leaching effect and also a heating of the air in the cells whereby the sap however, a permanent change of structure, for upon resoaking wood that has been steamed and dried the increased fiber-saturation point and weakness again prevails. The steam pressure may be high enough or prolonged so unduly as to scorch the wood, depending upon the quality of the wood and its condition of seasoning. It seems from the generality of evidence in circular 39 that a steaming for four hours at 30 lbs. pressure, or for six hours at 20 lbs. pressure, was nearly the limits of safe treatment. Mr. Chanute recommends in the case of fresh cut wood 30 lbs. to begin with, and 20 lbs. toward the close of the operation.

It is generally admitted that creosote enters only the openings of the cells and does not penetrate or impregnate the cell walls themselves, and for this reason creosote of itself probably has no effect on the strength of the cell walls. It only acts to retard the seasoning process, and thus creosoted timber will have the strength of green timber if there has been no steaming process, or will have the strength of steamed timber. Indeed in the Rueping process it is possible that the wood becomes seasoned in the cylinder, and thus with a light absorption of oil the timber may be stronger after the process than before. This is not a unique result of the process, but might be accomplished by some other non-steaming process, such as "boiling."

Circular 39 gives in a very complete manner the details of the tests on small pieces of timber tested at St. Louis. It also contains the results of tests upon full-sized loblolly pine ties that had been steamed and subjected to treatment with zinc chloride or with creosote. This table is reproduced in the tables. These full-sized ties had been seasoned for about one year after treatment, and the net result of the steaming was to diminish the strength of these ties under the various kinds of tests applied thereto. The creosoted ties represent an abnormal impregnation of 28 lbs. of creosote per cubic foot. The modulus of rupture of this timber, which had been steamed at 20 lbs. for four hours, and then treated with 28 lbs. of creosote per cubic foot, and then seasoned for eight months, was 69½ per cent. of the strength of the original seasoned ties. This, in the writer's opinion, shows mainly the effect of the creosote in preventing the natural increase of strength due to the seasoning of the tie. It has been stated above that no substantial increase of strength can be expected when large timbers are seasoned, but railroad ties are not included within this observation.

After having recorded the above observations and relations, the writer concludes that the fiber stresses to be used in the design of trestles constructed of creosoted timber can only be determined with some degree of certainty after a series of tests shall have been conducted on large timbers of bridge material that have been treated by the improved processes prevailing at present.

SPECIMENS, FULL-SIZED LOBLOLLY PINE TIES, SEASONED, TREATED, AND RE SEASONED BEFORE TESTS.

Treatment.	Cylinder conditions — steaming — Period, hrs.	Pressure, per sq.in.	Temperature, Deg. F.	Bending. Modulus of rupture, per cent.	Strength (static). Compression — Parallel to grain, per cent.	Compression — At right angles to grain. per cent.	Average of the 3 strengths, per cent.	Spike pulling — force required to pull spike. — Screw, per cent.	Spike pulling — Common, per cent.	Rings, per inch.	Weight, air-seasoned, lbs., per cu.ft.
Steam at various pressures	4	10 lbs.	237	99.2	79.3	91.1	89.9	118.5	110.7	4.9	38.0
	4	20 "	258	93.7	78.4	99.1	90.4	103.6	109.4	5.2	37.3
	4	30 "	274	87.8	83.4	92.7	88.0	100.1	96.5	5.3	37.9
	4	40 "	286	88.4	78.1	74.6	80.4	93.0	77.9	5.2	37.8
	4	50 "	295	69.1	60.6	74.4	68.0	80.4	70.3	4.8	36.1
Steam, for various periods	2	20 "	257	82.4	81.9	87.1	83.8	97.9	93.7	5.1	38.1
	4	20 "	258	93.7	78.4	99.1	90.4	103.6	109.4	5.2	37.3
	6	20 "	256	87.5	78.8	92.0	86.1	83.0	79.0	4.8	36.7
	10	20 "	256	77.0	75.5	73.2	75.2	84.1	76.8	4.9	36.7
Zinc chloride, 2.5 per cent. solution	4	20 "	258	74.7	65.1	68.6	69.5	75.3	73.8	4.3	41.5
Creosote, 28 lbs. per cu. ft.	4	20 "	257	69.5	61.2	60.1	63.6	68.2	68.1	4.6	65.3

Untreated wood = 100 per cent.

Physical Characteristics and Average Strengths of the Untreated Wood.

Moisture, per cent. (approximate)	20.0
Weight per cu. ft. (air-seasoned), lbs.	38.4
Rings, per inch.	5
Modulus of elasticity, lbs. per sq. in.	1,568,000
Bending strength at elastic limit, lbs. per sq. in.	3,429
Bending strength at rupture, lbs. per sq. in.	5,458
Compression strength parallel to grain, lbs. per sq. in.	4,452
Compression strength, right angles to grain (rail bear'g), lbs. pr sq.in.	503
Spike pulling—common spike, lbs. per sq. in.	3,598
Spike pulling—screw-spike, lbs. per sq. in.	7,748

Amount of Water and Preservatives Absorbed by Full-Sized Seasoned Loblolly Pine Ties During the Cylinder Treatment.

Treatment	Cylinder conditions.* Period, hrs.	Pressure, per sq. in.	No. of ties.	Weight, full sized ties.‡ Before steaming.	After steaming.	After treatment
Steam, various press.	4	10 lbs.	16	132.1 lbs.	137.2 lbs.	.....
	4	20 "	16	129.5 "	136.4 "	.....
	4	30 "	16	136.6 "	142.9 "	.....
	4	40 "	16	140.8 "	148.9 "	.....
	4	50 "	15	134.8 "	139.1 "	.....
Steam, various periods	2	20 "	16	136.6 "	145.9 "	.....
	6	20 "	15	128.7 "	139.5 "	.....
	10	20 "	16	128.1 "	138.8 "	.....
Creosote, 28 lbs. pr cu.ft.	4	20 "	15	135.7 "	140.0 "	237.2 lbs.
Zinc chloride	4	20 "	15	141.6 "	146.2 "	247.2 "

*Steaming.
‡Nominal cross section 6.75 in. to 9.25 in.
†2.5 per cent. solution.

is driven out. Mr. Octave Chanute and Mr. C. G. Crawford have recently dealt with these matters in addresses before the Memphis meeting of the Wood Preservers' Association.

When steam is applied to the wood and is condensed the fiber takes up more water than that found in green timber. In other words, the fiber-saturation point described above is raised, and just as green timber is weaker than dry timber, so in the same way steamed timber is weaker than green timber. In the case of small pieces, within undetermined limits of steaming, which depend on the condition and kind of wood, the strength may be regained when the wood is redried to its original moisture content. There is,

*The wood which remains with its natural color, without any trace of steaming, is called white wood in beech; the most common color of beech is clear yellow; it is often white as poplar; exceptionally, it is reddish. The heart-wood which appears towards the age of 30 to 35 years, is red very hard and appears to be proof against the injection of an amount of 33 lbs. Untreated sap-wood is not found in the cross-ties of 1877, subjected to 55 lbs. of creosote. All the wood in these old ties is strongly impregnated with creosote, the whole of the wood is strongly impregnated with creosote.

†From the report of Prof. W. K. Hatt to the American Railway Engineering and Maintenance of Way Association.

Russian Petroleum.

The production of petroleum in Russia, which because of the riots at the Baku wells fell off nearly one-third from 1904 to 1905, increased in 1906, but only by a small amount, order not yet having been completely restored, and the immense damage by burning in 1905 not nearly made good. In millions of gallons the production has been for three years:

1904.....3,058 1905.....2,052 1906.....2,225

This reduced production has been a very great misfortune to Russia, because petroleum forms a much larger part of its full supply for industrial purposes than in any other country, nearly one-third of its locomotives using it and most of the river steamboats. The producers of petroleum, however, seem not to have suffered at all—quite the contrary—the value of the petroleum produced having been approximately, in millions of dollars:

1902....27.2 1903....47.2 1904....44.9 1905....40.9 1906..56.9

Thus the production last year, while 23 per cent. less in quantity than in 1904, sold for 27 per cent. more money, the average price having risen from .62 to $1.07 per barrel. The Russian petroleum is heavy oil, yielding a comparatively small percentage of illuminating oil, so that a much larger proportion than of our oil is useful only as fuel. The effect on the national industries of an increase of more than 70 per cent. in the cost of fuel may be imagined.

GENERAL NEWS SECTION

NOTES.

Both houses of the Illinois legislature have passed two-cent fare bills, and will undoubtedly agree on a law.

The Chicago & Eastern Illinois is considering plans to carry Illinois coal to New Orleans by boat from Joppa, its terminus on the Ohio river.

The railroads of Kansas put on sale on the first of May 500-mile and 2,000-mile books of tickets at two cents a mile, conforming to the law passed by the last legislature.

The Department of Agriculture last week handed to the Department of Justice evidence concerning 468 offenses against the 28-hour law regulating the transportation of live stock. About 900 other cases are under investigation.

The New York, New Haven & Hartford has made increases in the pay of conductors, trainmen and telegraph operators, but no definite information is given out concerning the amount of the increases. The Union Pacific and Southern Pacific have increased the pay of clerks and stenographers.

The Interstate Commerce Commission, in response to an inquiry from the Toledo, St. Louis & Western, has decided that the practice of allowing a percentage on tickets sold by Sunday-schools, labor unions, etc., for excursions they arrange, is illegal. Special rates may be made, of course, but the railroads must do the soliciting and advertising, and receive full cash fares.

The Canadian Pacific announces that this summer, in addition to the two regular daily through trains, and the special transcontinental limited train, there will be one additional fast passenger train across the continent three times a week, running through in about 85 hours. The Canadian Pacific will also run an express train between St. Paul and Spokane, using the new Spokane & International.

The Circuit Court at Bellefontaine, Ohio, May 1, in the case of Miller against the Toledo & Ohio Central, decided that the collection of 10 cents additional from a passenger who pays fare on a train is unlawful under the present Ohio two-cent statute, notwithstanding a provision for refunding the 10-cent excess. The court holds that, to come within the law, the rate, including the excess, must not be over two cents a mile.

The Federal Grand Jury at New York City has found indictments against the Rock Island on twelve counts; the New York, Ontario & Western on thirty counts; the Chicago, Milwaukee & St. Paul on thirteen counts, and the Western Transit Company on twelve counts, for making illegal rates. It is said that rebates to the American Sugar Refining Company, commonly called the Sugar Trust, constitute the principal offenses.

The Pennsylvania Railroad announces that the first examination of applicants for the Frank Thomson Scholarships will be held in June, at New York. The college entrance examination board of New York City has been selected to conduct the examination. Applications are to be sent before June 3 to Thomas S. Fiske, secretary, sub-station No. 84, New York City. The examinations are open to all sons of Pennsylvania Railroad employees.

The advance of 5 cents a ton in soft coal to the Atlantic seaboard, which was announced a month ago, went into effect on May 1. It is estimated that the five principal roads carrying this traffic will, by this change, increase their revenue about $5,000,000 a year. On the same day advances, averaging one-half cent a bushel, were made in the rates on grain from Lake Erie to New York and other seaboard points. The principal roads have also made advances of 10 per cent. in the rates on iron and steel.

The Interstate Commerce Commission, in an opinion by Chairman Knapp, has ordered the Delaware, Lackawanna & Western to resume the delivery of oil in tank cars at its freight station at Clymer street, Brooklyn, N. Y. The company discontinued delivery of oil at that place last October. The commission says that by this action the road will put the complainants out of business in Brooklyn, or else compel them to go to the Standard Oil Company to get their supplies of oil. In either case the action of the road will inure to the benefit of the Standard. An officer of the railroad said to a reporter that the delivery of tank cars at the station named was stopped because a number of small fires had broken out there last year, oil being frequently spilled when the cars were being unloaded.

The roads west of Chicago have agreed to a considerable lengthening of time of through passenger trains after all. Beginning June 9 the minimum time between Chicago and the Missouri river is to be 20 hours, or 3 hours and 30 minutes longer than that of the fastest train now running. The time between Chicago and Denver will be lengthened from 27½ hours to 32 hours; and between Chicago and the Pacific coast from 71¼ hours to 72 hours. The eastbound time from the Pacific coast will be the same as the westbound.

Without laying down a general rule as to what constitutes "doing business" within a judicial district, such as would give the court jurisdiction over a suit, the Supreme Court of the United States has held, in an action brought against the Chicago, Burlington & Quincy, that service on its division freight and passenger agent at Philadelphia was not sufficient for the maintenance of the suit. It affirmed the dismissal of the suit, which was brought by Robert M. Green to recover damages for personal injuries received in an accident on the Burlington road in Colorado.

Following the decision of the Interstate Commerce Commission that party tickets must be open to all persons alike, the railroads south of the Potomac and Ohio rivers and east of the Mississippi have announced that all reduced rates for parties will, on June 1, be withdrawn. Theatrical and such like parties will thenceforth have to pay regular fares. At Chicago it is reported that the Western Passenger Association has decided to ignore the rule. The Santa Fe led the opposition to the ruling, declaring that not until the courts ordered it to do so would it open its party rates to the public.

On the carriages and cabs run by the Pennsylvania Railroad in New York City, carrying passengers to and from the Twenty-third street station of that road, the fares have been raised. A hansom carrying one or two persons for 1½ miles or less now costs 50 cents instead of 25 cents as formerly; four-wheel carriages now cost 50 cents instead of 40, and for additional miles, for either kind of carriage, the charge is now 25 cents instead of 15. The former rates are said by an officer of the company to have been so low that the business was done at a loss; and the present rates are less than those charged by public cab drivers.

It is announced that the traffic and operating departments of the Union and the Southern Pacific are to make strenuous efforts to prevent a recurrence of the coal famine next winter by trying to induce coal dealers to lay in their winter's supply in the summer months. A personal canvass is being made in all the cities, and coal dealers are being urged personally to co-operate with the railroads. "It is the purpose of the railroads to either get the west and northwest adequately coaled during the warm months or to place the blame for any future famine where they say it rightfully belongs—with the dealers who wait until the last moment to get their winter's supply." So much for moral suasion. From the Indian Territory it is announced that the Missouri, Kansas & Texas, evidently believing that "money talks," will issue special rates of 25 cents a ton off the regular rate on lump, egg and mine run coal, effective June 15 and expiring August 15, from all mines in the Indian Territory and Arkansas; this to encourage dealers and the public generally to put in a reserve supply in the summer.

Notes on Cuban Railroads.

There is a curious old railroad here at Camaguey, Cuba, the oldest in America outside of the United States, and the first ever built within the dominion of the King of Spain. It is 53 miles long, the track has a broad gage of 5 ft., and it runs from the port of Nuevitas on the north coast of Cuba to this venerable town of Camaguey. It was built in 1837 to accommodate eight large sugar mills owned by eight of the ancient families of the region. Nuevitas was then an important port and the shipping place of a great deal of sugar, which was hauled from the plantations in ox carts. Each planter had his own road until the eight neighbors got together one day and for the sake of economy decided to combine and build a broad, smooth highway to the sea, with cut-offs to the different plantations. One of the planters who had recently visited Baltimore

and seen the railroad which John W. Garrett built from Baltimore to Ellicott's Mills a few years previous, suggested that a railroad would be better than a cart road. He explained to his neighbors the advantages of rolling wheels over smooth iron rails instead of on the bare ground, and demonstrated the economy of using a steam engine instead of oxen as motive power.

The road was finished in 1838. It cost about $1,000,000, and the capital stock was divided into eight shares of $125,000 each, which were taken by the heads of the eight aristocratic families who entered the scheme at the start. During the 70 years that have elapsed, control of the Nuevitas-Camaguey Railway has remained in the hands of the original owners. The eight shares have been subdivided among their descendants until there are now about 200 stockholders, called "couponistas." Frequent attempts have been made to buy up the road, but the owners of the shares would just as soon part with their lives. The property pays big dividends. The lowest on record was 12 per cent. and the highest 40 per cent. a year. Dividends are declared every 30 days. At the end of every month the treasurer collects all the money due, pays all the bills, strikes a balance, and then goes around from house to house with a tin box under his arm and gives each "couponista" his or her share of the profits. He is accompanied by a private secretary whose duty is to furnish a financial statement to each person interested and take charge of the receipt. This duty was performed by the same treasurer for more than 40 years, and his visits to the houses of the shareholders were as regular as those of the milkman. The men shareholders take turns as officers and directors of the road. The only permanent officials are the Superintendent, who is the technical man, and the Treasurer. A new President and a new Board of Directors are elected during the first week of every January and they serve in turn without compensation.

During the sugar season there are two trains a day in each direction, mixed freight and passenger cars. During the rest of the year there is only one train each way. The fare is $2 for the 53 miles, and has always been the same. There has been no change in the passenger rates since 1838, although freight rates have frequently been raised or lowered according to circumstances. The company now owns 11 locomotives, 10 passenger cars, 67 box cars, 22 cattle cars, 28 flat cars and 12 cabooses. The locomotives were bought in the United States, but the cars were all built in the company's shops, and some of them have been running continuously since 1850. The connecting railroad has endeavored to persuade the company to change the gage from 5 ft. to standard, so that cargoes can be sent through to Nuevitas without changing cars. But the directors are afraid that the other road will get the better of them in some way or other unless they act independently. Therefore they will not change the gage or accept through bills of lading. Portions of the roadbed have not been disturbed for more than 30 years. Trains are still running over rails that were laid in the '60s. The ties are all of jique wood.

Jique (pronounced hickey), acana, jucaro negro, all hard woods which do not grow large and cannot be used for cabinet work, are just as good as mahogany for ties and will outlast steel rails in this climate because they won't rust. On the Nuevitas-Camaguey line are jique ties that have been in use for 50 years. Some of them have been taken out and used for fence posts after 30 years in the roadbed. There is a tramway at Camaguey with rails of jique wood over which the cars have been running for more than a quarter of a century, and they do not show wear any more than steel after the same service. Much of the wood is so hard and heavy that it will sink in water.

Mahogany is often used for ties by the railroads in Cuba as well as in other tropical countries, but Sir William Van Horne has forbidden it on his road. He considers it a crime to cut small mahogany trees, as there is plenty of other timber in the forests suitable for construction purposes. A bridge on the Cuba Railroad near Santiago is built entirely of mahogany, but in violation of orders. The contractor did not know, or claimed not to know, that the caoba tree, as it is called in Spanish, was the mahogany which Sir William had tabooed, and the latter did not learn that he had a mahogany bridge on the line until it had been in use for several months.

The track on the Cuba Railroad is inclosed with wire fences on either side the entire distance to keep cattle from interfering with the trains, and many of the fence posts have blossomed like the rod of Aaron and are bearing flowers and fruit. The soil is so fertile and vegetable life so vigorous that any stick which retains the sap of the parent tree in its fiber will take root wherever it is placed in the ground. When these fences were built the posts were cut in the adjoining forests, and those that were green have survived and are now flowering trees. Surveyor's stakes have been known to take root and grow. Another curious freak of nature is orchids growing on telegraph wires. The atmosphere, like the soil, is full of fertility, and slips of air plants which have become detached from the trees and have lodged across the wires are now growing as bravely as any parasite you ever saw. The trees are draped with orchids.—William E. Curtis in special correspondence of the *Chicago Record-Herald*.

Agreements Canceled Between Harriman Lines and Salt Lake Route.

R. S. Lovett, General Counsel of the Southern Pacific Company, has informed the Interstate Commerce Commission that a traffic agreement between the Southern Pacific Company and the San Pedro, Los Angeles & Salt Lake Railroad, which was made public by the Interstate Commerce Commission hearings at Los Angeles some months ago, was abrogated and canceled on April 15, 1907, because of the enactment by the California legislature of a law to prohibit contracts in restraint of competition.

This traffic agreement, which was to run for 99 years, was put in force June 18, 1903. Its two most important provisions were as follows:

Article 2. In partial consideration of said covenants and agreements of the said Southern Pacific company, said San Pedro company hereby covenants and agrees with said Southern Pacific company that it will, upon the execution of this agreement, adopt, print, publish, and put in force at all points on its leased, owned or operated railroad for the handling of local business thereon, the lawful freight rates, tariffs, classifications and charges used by the said Southern Pacific company, for the hauling of any local business which may be the subject of competition between them.

Article 3.—Each party hereto mutually covenants and agrees to and with the other that after the adoption and putting in force of rates as provided by Art. 2 neither of them shall or will change any such rates without the consent of the other party thereto, unless such change shall be necessary in order to meet the rates, charges, classifications or tariffs of any competing company or competing line of railroad or to conform to the final decree or judgment of some court of competent jurisdiction, or some lawful or valid requirement of state or national law.

Another contract which was to have run for 99 years and which is reported also to have been canceled on April 15, was between the Oregon Short Line (Union Pacific) and the San Pedro company. This contains the following provision:

Article 1.—Said San Pedro company hereby covenants and agrees to and with said Short Line company that it will not hereafter during the term of its agreement extend its main line of railroad or any of its branch lines, nor construct or build any lines of railroad, nor assist or advise in the building or construction of any other railroad northward from Salt Lake City, nor which may run into the territory northward of the parallel of Salt Lake City, Utah.

Train Robbers Near Butte.

The eastbound through express train of the Northern Pacific was stopped by masked men 18 miles east of Butte, Mont., on the morning of May 7, about 2 o'clock, and the engineman, James Clow, was shot and killed, the fireman at the same time being wounded. The robbers ran away without trying to enter the cars. A sheriff was on the train and, with one of the trainmen, pursued the bandits, but without success. A satchel full of giant powder was left on the tender. Engineman Clow was on a train attacked by robbers in February, 1903, not far from Butte.

Award of Cotton Manufacturers' Medal.

At the annual meeting of the National Association of Cotton Manufacturers, held on April 24 at the Massachusetts Institute of Technology, the association medal was presented to Charles B. Burleigh in acknowledgment of the merits of a paper on "The Curtis Vertical Steam Turbine," read before the association at its fall meeting Sept. 13, 1906. This medal was established at the annual meeting of the association in 1899. It may be given to any person whose work has been, in the opinion of the governing board, an advantage of sufficient importance to the purposes to which the organization is devoted.

Another A. C. Trolley Line Opened.

The first section of the alternating-current part of the Illinois Traction system was opened between Peoria and Bloomington, April 21. On that date a regular time-table was put into operation, cars leaving the terminal stations on the odd hour throughout the day from 5 a.m. to 11 p.m. Beyond the usual delays incident to warming up new equipment, the single-phase motors and auxiliary apparatus are said to have worked well. This road is one of the four single-phase lines in the Middle West which have adopted single-phase alternating-current apparatus made by the General Electric Company.

TRADE CATALOGUES.

Wheel-Truing Brake-Shoes.—The Wheel-Truing Brake-Shoe Co., Detroit, Mich., is mailing to the trade a card showing a half-tone view of a large shipment of its shoes made recently. There is also a brief statement of their advantages and the saving effected by the use of these shoes.

Manufacturing and Business.

The New York offices of Robert W. Hunt & Co. have been moved from 66 Broadway to the new West Street building, 90 West street.

The H. F. Vogel Contracting & Railway Supply Co., St. Louis, Mo., has received an order from the Ozan Lumber Co., of St. Louis, for twenty-five 40-ft. flat cars. They will be built by the Danville Car Co., Danville, Ill.

Among recent improvements in the car stations of the International Railway at Buffalo are four Northern three-motor electric traveling cranes of 10 tons capacity and one overhead electric track and trolley. These were furnished by the Northern Engineering Works, crane builders, Detroit, Mich.

On April 23d the main building of the machine shop of the Indianapolis Switch & Frog Co., Springfield, Ohio, was practically destroyed by fire. This building was 400 x 225 ft., and will be rebuilt at once as a fireproof structure. There was almost no loss of material or work in course of erection, and temporary arrangements are being made to complete, as far as possible, unfinished orders.

Henry Rohwer has opened an office as consulting civil engineer at 1321 Wright Building, St. Louis, Mo. Mr. Rohwer has had wide experience in all branches of railroad and municipal engineering. He entered railroad service in 1869 as topographer on surveys with the Burlington & Missouri River and remained with that road for five years. From 1877 to 1881 he was City Engineer of Omaha, Neb., and during that time he planned and supervised the building of the water works and sewage systems for the city. Later he went to the Oregon Short Line as Resident Engineer in charge of new construction, resigning to go to the Missouri Pacific as Assistant Engineer of Maintenance of Way. In 1901 he was appointed Chief Engineer of the Missouri Pacific and in 1905 Consulting Engineer for the same company. He has been associated with the St. Louis Municipal Bridge and Terminal Commission in the selection of a site for the new municipal bridge across the Mississippi river, for which $3,500,000 in bonds have been voted by the city.

Iron and Steel.

Cuban roads have recently bought 2,000 tons of rails for delivery this year.

The Chicago Union Traction Company has given an order for 10,000 tons of grooved rails.

The Harriman lines are reported to be making inquiries for rails. Only open hearth rails are wanted.

J. G. White & Co., New York, are about to order 3,700 tons of 60-lb. rails and accessories, 90 switches with frogs and 1,000 tons of steel bridges for the Philippine Railway.

The Carnegie Steel Company has an order for 46,000 tons of standard rails from the Savannah, Augusta & Northern for shipment during 1907 and 1908. Several smaller lots have also been booked, aggregating 3,000 tons, for early shipment.

Bids are to be opened next week for several thousand tons of steel for the Manhattan approach to the Blackwell's Island bridge, New York. The Brooklyn Rapid Transit Company is in the market for 1,200 tons of structural steel, and the Interborough Rapid Transit Company for 3,000 tons. It is estimated that orders are now pending for nearly 100,000 tons of structural steel.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Mechanical Engineers.

The spring meeting of this society is to be held in Indianapolis, Ind., May 28-31. The headquarters and meetings are to be in the Claypool Hotel, where 75 rooms have been reserved for convention guests. A number of excursions to points of interest in and around Indianapolis have been arranged; full information will be found in the June "Proceedings." At a business session to be held May 29, committee reports are to be made on the following subjects:

"Standard Proportions for Machine Screws."

"Preliminary Report of the Committee on Refrigerating Machines."

"Collapsing Pressures of Lap-Welded Steel Tubes," Reid T. Stewart.

"The Balancing of Pumping Engines," A. F. Nagle.

"A Comparison of Long and Short Rotary Kilns," E. C. Soper.

At the meeting to be held on the evening of the same day the subject is to be automobiles, and papers are to be presented as follows:

"Bearings and Moving Mechanism," Henry Hess.

"Air Cooling of Automobile Engines," John Wilkinson.

"Materials for Automobiles," Elwood Haynes.

"Special Auto Steel," T. J. Fay.

"Railway Motor Car," B. D. Gray.

At the next session the subject is to be Superheated Steam; the papers to be read are as follows:

"The Specific Heat of Superheated Steam," A. R. Dodge.

"Determination of Entropy Lines for Superheated Steam," A. M. Greene.

"The Flow of Superheated Steam in Pipes," E. H. Foster.

"Co-relation of Furnace and Superheated Conditions," R. P. Bolton.

"The Heating of Storehouses," H. O. Lacount.

Thursday afternoon is to be devoted to excursions; on the following day a visit is to be made to Purdue University, Lafayette, Ind. A professional session is to be held in one of the university buildings, at which papers on the following subjects are to be read: "Performance of Cole Superheaters," W. F. M. Goss; "Experiences with Superheated Steam," G. H. Barrus; "Use of Superheated Steam on Locomotives in America," H. H. Vaughan; "Superheated Steam in an Injector," S. L. Kneass; "A. Hirn's Analysis of Locomotive Test," S. A. Reeve.

The University of Illinois extends to the members of the society attending the convention in Indianapolis a cordial invitation to visit the university, where they will be received by Dr. L. P. Breckenridge, Professor of Mechanical Engineering and Director of the Government Research Station.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Ann Arbor.—See Detroit, Toledo & Ironton.

Arkansas Southeastern.—J. S. Burch has been appointed General Freight and Passenger Agent, with office at Randolph, La.; effective April 1, 1907.

Atchison, Topeka & Santa Fe.—C. W. Kouns, Superintendent of Transportation, has been appointed also to the new office of Assistant to the Second Vice-President, with office at Chicago.

Broxton, Hazlehurst & Savannah.—The officers of this company, which bought the line formerly known as the Ocilla & Valdosta, are as follows: H. C. McFadden, President and General Manager; W. N. Smith, Superintendent; C. B. Gwyn, Auditor, all with offices at Fitzgerald, Ga.; J. J. Hazel, Master Mechanic, with office at Ocilla, Ga. The President and General Manager has direct supervision over traffic.

Central Railroad of New Jersey.—J. E. Brokaw, Assistant General Auditor, has been appointed Auditor of Disbursements, succeeding G. O. Waterman, Jr., resigned. D. H. MacFarland succeeds Mr. Brokaw. The offices of both are at Philadelphia, Pa.

Chattanooga Southern.—W. W. Kent, who is one of the two Receivers recently appointed for this company, will hold also the titles of General Manager and General Freight and Passenger Agent, the duties of which offices he will perform.

Chesapeake & Ohio.—David C. Green, Assistant Secretary, has resigned.

Chicago & North-Western.—The executive and financial offices in New York of this company and of the Chicago, St. Paul, Minneapolis & Omaha have been moved to 111 Broadway.

Chicago, St. Paul, Minneapolis & Omaha.—See Chicago & North-Western.

Colorado & Wyoming.—J. F. Welborn has been elected President and D. C. Beaman, Vice-President, of this company and of the Crystal River Railroad, both with offices at Denver, Colo. R. L. Hearon has been appointed Traffic Manager of both roads, with office at Denver.

Crystal River.—See Colorado & Wyoming.

Detroit, Toledo & Ironton.—The offices of the following officials of this company and of the Ann Arbor Railroad have been moved from Toledo to Detroit: President, General Manager, Auditor, General Traffic Manager, General Passenger Agent and Assistant General Freight Agent.

Dublin & Southwestern.—M. T. Lanigan has been appointed Auditor of this company and of the Wrightsville & Tennille, with office at Tennille, Ga., succeeding Otis Ellison, resigned.

East Tennessee & Western North Carolina.—The offices of F. P. Howe, President, and J. S. Wise, Secretary and Treasurer, have been removed from Philadelphia to Johnson City, Tenn.

Gila Valley, Globe & Northern.—See Phoenix & Eastern.

Jackson & Northern.—A. S. McCombe has been appointed Assistant Secretary and Treasurer, with office at Pittsburg, Pa., succeeding W. B. Goucher, resigned.

Manistique, Marquette & Northern.—C. H. Cox has been appointed Auditor, with office at Manistique, Mich., succeeding W. C. J. Bienemann, promoted.

Mobile, Jackson & Kansas City.—W. D. Stratton, Chairman of the Board, has been elected also First Vice-President, with office at New York City. Eugene Harvey has been elected Assistant Secretary and Treasurer, with office at Mobile, Ala., succeeding S. B. Murray, resigned.

New Orleans, Fort Jackson & Grand Isle.—H. C. Warmoth, President, has resigned.

Orange & Northwestern.—P. Baber, Auditor, has resigned.

Phoenix & Eastern.—Epes Randolph, President of various Southern Pacific lines in Arizona, has been elected also President of the Phoenix & Eastern, which the Southern Pacific recently bought from the Atchison, Topeka & Santa Fe. W. A. Drake, Vice-President and Assistant General Manager of the Phoenix & Eastern, has resigned, and the office has been abolished. The duties of the position will be hereafter performed by Mr. Randolph. The authorities of the following officials of the Gila Valley, Globe & Northern have been extended over the Phoenix & Eastern. E. A. McFarland, Chief Engineer; J. W. Small, Superintendent of Motive Power; C. E. Walker, Purchasing Agent, and J. C. McClure, Engineer of Maintenance of Way. C. M. Scott has been appointed Superintendent.

Texarkana & Fort Smith.—P. E. Woolley has been appointed Auditor, succeeding E. P. Hall, resigned to go to the Kansas City Southern.

Williamsville, Greenville & St. Louis.—W. B. Rose has been elected Vice-President and General Manager, with office at St. Louis, Mo. A. C. Delano has been appointed Superintendent and Auditor, with office at Greenville, Mo.

Wisconsin Central.—F. E. Dewey, Assistant to the President, has resigned.

Wrightsville & Tennille.—See Dublin & Southwestern.

Operating Officers.

Canadian Northern.—E. A. James, General Manager, having been granted extended leave of absence on account of ill health, D. B. Hanna, Third Vice-President, will for the present perform also the duties of General Manager.

Erie.—W. J. Sharp, Superintendent at Hornell, N. Y., has been appointed Superintendent at Rochester, N. Y., succeeding J. C. Tucker, resigned on account of ill health. R. S. Parsons, Assistant General Superintendent at Cleveland, Ohio, succeeds Mr. Sharp, and his former title has been abolished.

W. C. Hayes, Superintendent of the Delaware division, has been appointed also Superintendent of the Jefferson division, with office as before at Susquehanna, Pa.

Grand Trunk.—U. E. Gillen, Assistant Superintendent at London, Ont., has been appointed Superintendent of the Middle division, succeeding W. G. Brownlee, promoted. A. J. Nixon, Trainmaster at Stratford, Ont., succeeds Mr. Gillen. C. G. Bowker succeeds Mr. Nixon.

Grand Trunk Pacific.—M. C. Sturtevant, General Assistant, has resigned to go into private business as a railroad contractor, and his former position has been abolished.

Lake Shore & Michigan Southern.—J. M. Horgan, Trainmaster of the Western division, has been appointed Trainmaster of the Franklin division, with office at Ashtabula, Ohio, succeeding J. H. Reynolds, transferred. J. W. Britt, assistant trainmaster of the Eastern division, succeeds Mr. Horgan.

Lehigh & New England.—A. S. Wright, Car Accountant, has resigned to go to another company and his former position has been abolished.

Mexican Central.—R. N. Elliott, having returned from leave of absence, has been reappointed Superintendent of Terminals at Tampico, succeeding W. T. East, who has been Acting Superintendent of Terminals during the absence of Mr. Elliott.

Mobile, Jackson & Kansas City.—J. H. Garner has been appointed Trainmaster, succeeding P. M. Seay, resigned.

New York, New Haven & Hartford.—J. P. Hopson, Superintendent of the Berkshire and Naugatuck divisions, has been appointed Superintendent of the New York division, with office at New York, succeeding A. R. Whaley, resigned to go to the New York Central & Hudson River.

Norfolk & Southern.—The office of R. P. Foster, Assistant General Superintendent, has been removed from Goldsboro, N. C., to New Bern, N. C. S. L. Dill, Superintendent of the Beaufort division, has been appointed General Agent of the transportation and traffic departments, with office at New Bern. J. R. Hawkins succeeds Mr. Dill.

Pittsburg, Westmoreland & Somerset.—Lauros H. Allen, Secretary, has been appointed also General Manager, succeeding N. Byers. Chas. H. Balme has been appointed Assistant to the General Manager.

Rio Grande Southern.—A. S. Meldrum has been appointed General Superintendent, with office at Ridgway, Colo.

Seaboard Air Line.—J. H. Witt, Superintendent of the Third division, has been appointed Superintendent of the First division, with office at Richmond, Va., succeeding W. R. Hudson. W. A. Gore succeeds Mr. Witt, with office at Abbeville, S. C. The office of J. M. Shea, Superintendent of the Second division, has been removed from Raleigh to Hamlet, N. C.

Tehuantepec National.—W. M. Cartwright has been appointed Superintendent of Transportation, succeeding to the duties of C. Greene, formerly Superintendent, with office at Rincon Antonio, Oaxaca. H. O'Connor, Auditor, has been appointed also Car Accountant, succeeding E. J. Ford.

Wisconsin Central.—A. J. Van Valkenburg, Superintendent of the Northern division, has been appointed Superintendent of Transportation, with office at Milwaukee. O. W. Johnstone succeeds Mr. Van Valkenburg, with office at Abbotsford, Wis. C. M. Winter has been appointed Superintendent of the Southern division, with office at Fond du Lac, Wis., succeeding A. R. Horn.

Traffic Officers.

Beaumont, Sour Lake & Western.—Roy Terrell has been appointed General Freight and Passenger Agent, with office at Beaumont, Tex.

Bessemer & Lake Erie.—F. C. Baird has been appointed General Freight Agent, with office at Pittsburg, Pa., succeeding O. J. Hammon, resigned.

Erie.—T. F. Powell has been appointed General Agent at Jamestown, N. Y.

Georgia, Florida & Alabama.—J. H. McWilliams has been appointed Traffic Manager, and the office of General Freight and Passenger Agent, previously held by him, has been abolished.

Michigan Central.—C. C. Griggs, commercial agent at Detroit, has been appointed Assistant General Freight Agent at Detroit, succeeding C. J. Hupp, promoted.

Newton & Northwestern.—C. H. Crooks has been appointed General Freight and Passenger Agent, with office at Boone, Iowa, succeeding W. H. Benn, resigned to engage in other business.

Engineering and Rolling Stock Officers.

Chicago, Indiana & Southern.—B. C. Rich, Assistant Chief Engineer, has been appointed Chief Engineer, with office at Gibson, Ind. Byron Layton, Engineer of Maintenance of Way, has been appointed Signal Engineer, with office at Gibson, Ind.

Erie.—E. A. Wescott has been appointed Assistant Mechanical Superintendent, with office at Meadville, Pa.

G. H. Burgess, Engineer of Terminal Improvements at New York, has resigned, to go into other business.

Missouri Pacific.—Henry Rohwer, Consulting Engineer, has resigned to go into private business as a consulting engineer at St. Louis.

Mobile & Ohio.—The office of C. F. Blue, Superintendent of Way and Structures, has been removed from St. Louis to Mobile, Ala.

New York Central & Hudson River.—C. E. Lindsay, Division Engineer of the Mohawk division, has been appointed Engineer of Maintenance of Way of the Electric Division, with office at New York. J. D. Newbert succeeds Mr. Lindsay, with office at Albany, N. Y.

Northern Pacific.—A. C. Terrell has been appointed Division Engineer at Spokane, Wash., in charge of the lines between Ellensburg and Trout Creek, succeeding L. S. Oakes, resigned to go to a construction company.

LOCOMOTIVE BUILDING.

The Manufacturers' Railway, of St. Louis, is said to have ordered three locomotives.

The Long Island has ordered five locomotives from the American Locomotive Company.

The Indiana Steel Company, Chicago, is in the market for 12 switching locomotives.

The United Verde & Pacific has ordered one locomotive from the Baldwin Locomotive Works.

The Lehigh & Hudson River has ordered 12 locomotives from the Baldwin Locomotive Works.

The Victoria, Fisher & Western has ordered one locomotive from the Baldwin Locomotive Works.

The Rio Tinto Company, Ltd., has ordered four locomotives from the Baldwin Locomotive Works.

The Illinois Northern has ordered one locomotive from the Lima Locomotive & Machine Company.

The Minnesota Transfer has ordered four switching locomotives from the American Locomotive Company.

The Calumet & Southeastern has ordered one locomotive from the Lima Locomotive & Machine Company.

The Ouachita Navigation & Logging Company, Felsenthal, Ark., is in the market for one 15 to 30-ton locomotive.

The Duluth, South Shore & Atlantic has ordered nine consolidation locomotives from the Baldwin Locomotive Works.

The Tennessee Copper Company, New York, has ordered one locomotive from the American Locomotive Company.

The American Smelters Securities Company has ordered five locomotives from the American Locomotive Company.

The Granite City & Mississippi River has ordered one switching locomotive from the Hicks Locomotive & Car Works.

The Carnegie Steel Company, Pittsburg, has ordered two additional locomotives from the Baldwin Locomotive Works.

The Lyon Cypress Lumber Company, Garryville, La., has ordered one mogul locomotive from the Baldwin Locomotive Works.

The J. D. MacArthur Company, Winnipeg, has ordered one 10-wheel locomotive from the Hicks Locomotive & Car Works.

The Moron Sugar & Land Co., Cuba, of which J. J. Warren, of Havana, is President, is in the market for broad gage locomotives.

The Saddle Mountain Railway, Arizona, has ordered one narrow gage saddle tank locomotive from the Hicks Locomotive & Car Works.

The Chicago & Milwaukee Electric, as reported in the *Railroad Gazette* of March 1, has ordered two switching locomotives from the Hicks Locomotive & Car Works.

The Stewart Sugar Co. (formerly the Silviera Sugar Co.) has ordered four 50-ton mogul locomotives from the Baldwin Locomotive Works for its plantation railroad in Cuba.

The Japanese Government Railways administration is in the market for 24 locomotives. The contract will be placed through Mitsui & Co., or one of the other Japanese export houses having New York offices.

The Chicago, Lake Shore & Eastern has ordered eight simple consolidation and 12 six-wheel switching locomotives from the American Locomotive Co. Specifications for these locomotives were published in the *Railroad Gazette* of April 26.

J. G. White & Co., New York, are about to order for the Philippine Railway six mogul 3-ft. 6-in. gage locomotives. These engines will weigh 60,000 lbs. and their coal capacity will be four tons and water capacity 2,500 gallons. The other specifications are similar to those of the four locomotives ordered last fall.

The Rio Tinto Company has placed a contract direct with the Baldwin Locomotive Works for four locomotives. Formerly contracts were placed principally through the British firm of Vivian Bond & Co., 68 Beaver street, New York, but after this all requirements in this market will be ordered direct from the mines in Spain or through the London headquarters.

The Mobile & Ohio has ordered from the Baldwin Locomotive Works for October, 1907, delivery, 20 ten-wheel simple locomotives. The specifications are as follows:

General Dimensions.

Type of locomotive	Ten-wheel
Weight, total	170,000 lbs.
Weight, on drivers	130,000 "
Diameter of drivers	62 in.
Cylinders	21 in. x 28 in.
Boiler, type	Wagon top
" working steam pressure	200 lbs.
" number of tubes	361
" diameter of tubes	2 in.
" length of tubes	15 ft.
Firebox, length	120⅛ in.
" width	41⅛ in.
" grate area	34.3 sq.ft.
Heating surface, total	2,944 "
Water capacity	7,000 gals.
Coal capacity	15 tons

Special Equipment

Axles	Otis steel
Bell ringer	Western
Boiler Steel	Otis
Boiler check valve	Hancock
Brakes	Westinghouse
Couplers, Tender	Gould
Couplers, Tender	Washburn
Crank pins	Otis steel
Draft rigging	Miner
Headlights	Pyle-National
Injectors	Monitor
Journal bearings	Eureka bronze
Pilot beams	Commonwealth cast steel
Piston rods	Otis steel
Safety valves	Consolidated
Oil box on tender	Symington
Valves	Richardson
Sanding devices	Leach
Lubricators	Nathan
Springs	Railway Steel Spring Co.
Steam gages	Ashcroft
Tires	Midvale
Wheels, truck and tender	Paige
Brake shoes, Drivers	Perfecto
Brake shoes, Tender	Streeter

The Yokohama Railroad has ordered from the American Locomotive Company for December, 1907, delivery, five simple (2-6-2) tank 3-ft. 6-in. gage locomotives. The specifications are as follows:

General Dimensions

Type of locomotive	Tank locomotive
Weight on drivers	47,000 lbs.
Total weight	87,000 "
Diameter of cylinders	15 in.
Stroke of pistons	22 "
Diameter of drivers	52 "
Boiler, type	Straight top radial
" working steam pressure	160 lbs.
Heating surface, total	826 sq. ft.
Tubes, number	171
" material	Brass
" maker	either American Tube Co., Benedict & Burnham or Coe Brass Mfg. Co.
" outside diameter	1¾ in.
" length	9 ft. 8 in.
Firebox, length	70 "
" width	28¾ "
" material	Copper
" maker	either Park Steel Co., Hendricks Bros., Benedict & Burnham, or Coe Brass Mfg. Co.
Grate area	14 sq. ft.
Tank capacity for water	1,200 gals.
Coal capacity	1½ tons

Special Equipment

Vacuum brakes	New York
Boiler lagging	Sectional magnesia
Couplers	Hook and screw coupling
Injector	Sellers
Sight feed lubricators	Nathan
Springs	either Pickering Spring Co., Charles Scott Spring Co., A. French Spring Co., or Diamond State Car Spg. Co.
Tires, driving wheels	either Standard Steel Works, Latrobe Steel Works, or Midvale Steel Co.

CAR BUILDING.

The Colorado & Southern is in the market for two dining cars.

The Manufacturers' Railway of St. Louis is said to have ordered 200 refrigerator cars.

The Morgantown & Kingwood is said to be in the market for 500 steel hopper cars.

The Baton Rouge (La.) Electric Gas Co. has ordered nine cars from the St. Louis Car Co.

The Pacific & Idaho Northern has ordered three Hart convertible cars from the Rodger Ballast Car Co.

The Buffalo Creek & Gauley, Clay, W. Va., has ordered two Hart convertible cars from the Rodger Ballast Car Co.

B. P. Cheney, a Director of the Atchison, Topeka & Santa Fe, has ordered one private car from the Pullman Co.

The Moron Sugar & Land Co., Cuba, of which J. J. Warren, of Havana, is President, is in the market for cane cars.

The Atchison, Topeka & Santa Fe has ordered 50 bunk cars from the Chicago, New York & Boston Refrigerator Company.

The Lyon Cypress Lumber Company, Garryville, La., has ordered 12 flat cars from the Russel Wheel & Foundry Company.

The Cordova Central has placed a contract with the American Car & Foundry Co. for several passenger and freight cars.

The Atlantic Coast Line has ordered 50 low side gondolas of 60,000 lbs. capacity from the Hicks Locomotive & Car Works.

The Fairchild & Northeastern has ordered five 41-ft. flat cars of 60,000 lbs. capacity from the Hicks Locomotive & Car Works.

The El Paso & Southwestern has ordered 27 steel underframe tank cars of 80,000 lbs. capacity from the E. A. Bryan Company.

The Portland Railway, Portland, Ore., has ordered 15 41-ft. flat cars and 10 36-ft. flat cars from the Hicks Locomotive & Car Works.

The Associated Oil Company, San Francisco, Cal., has ordered 10 steel underframe tank cars of 80,000 lbs. capacity from the E. A. Bryan Company.

The Ouachita Navigation & Logging Company, Felsenthal, Ark., is in the market for 15 new or second hand logging cars from 40,000 to 60,000 lbs. capacity.

The Idaho & Washington Northern, Coeur d'Alene, Idaho, has ordered two first class coaches, one smoking car and one baggage car from the Pullman Co.

The Starkes' Heater Car Company, Chicago, as reported in the *Railroad Gazette* of May 3, has increased its requisition for prices on 25 special freight cars to 100.

The Portland Railway, Light & Power Company, Portland, Ore., is said to have ordered 40 flat cars of 60,000 lbs. capacity from the American Car & Foundry Co.

The Wilkesbarre & Hazelton has ordered four wooden gondolas of 60,000 lbs. capacity, three box cars and one flat car of 50,000 lbs. capacity from the Hicks Locomotive & Car Works.

The Spadra (Ark.) Creek Coal Co. is in the market for four steam motor cars and four trailers for a new eight-mile line between Clarksville and Spadra. The contract will be placed by M. L. Mardis, Vice-President of the company.

The Louisiana Railway & Navigation Company has asked bids on 500 wooden box cars of 60,000 lbs. capacity. These cars will be 37 ft. 10 in. long, 8 ft. 3 in. wide and 6 ft. 11½ in. high, inside measurements. The special equipment includes Carnegie steel axles.

The Illinois Central, as reported in the *Railroad Gazette* of March 29, has ordered two dining cars from the Pullman Co.; the order for 15 day coaches is indefinitely postponed. The company is also ordering material for 400 box cars to be built at its own shops.

The Pennsylvania has ordered 60 coaches, 20 baggage and five combination passenger and baggage cars from the Pressed Steel Car Co., 90 coaches from the American Car & Foundry Co., and will build five coaches at the Altoona shops. These cars will be of steel construction throughout.

The Milwaukee Refrigerator Transit Company, Milwaukee, as reported in the *Railroad Gazette* of May 3, is building 100 refrigerator cars of 60,000 lbs. capacity at its own shops. These cars will measure 36 ft. long, 9 ft. wide and 10 ft. high, outside measurements. The special equipment includes:

Bolsters	Bettendorf
Couplers	Latrobe
Draft rigging	Farlow
Journal boxes	Bettendorf
Trucks	Bettendorf

The Mobile & Ohio, as reported in the *Railroad Gazette* of April 12, has ordered from the American Car & Foundry Company, for September, 1907, delivery, 750 gondolas of 80,000 lbs. capacity, and 1,000 box cars of 60,000 lbs. capacity. The gondolas will weigh 33,700 lbs. and will measure 37 ft. 1½ in. long, 9 ft. 8 in. wide and 3 ft. 9 in. high, inside measurements, and 40 ft. long over all. The box cars will weigh 33,000 lbs., and will measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements, and 36 ft. 10 in. long, 9 ft. 6½ in. wide and 12 ft. 6¾ in. high, over all. The bodies and underframes of all cars will be of wood. The box cars will have one end door. The center plates and side bearings of all cars will be cast integral with the bolsters. The special equipment includes:

Bolsters	Cast steel
Brake beams	Simplex
Brakes	Westinghouse
Brake-jaws	Western Railway Equipment Co.
Brasses	Eureka bronze, lead lined
Couplers	Latrobe steel
Doors, box car	Jones
Draft rigging	Miner
Dust guards	Harrison
Journal boxes	Franklin
Paint	St. Louis Surfacer Co.
Sill pockets	Western Railway Equipment Co.
Springs	Railway Steel Spring Co.
Trucks, Gondola	Cast steel side frames
Trucks, Box	Arch bar

The Missouri, Kansas & Texas, as reported in the *Railroad Gazette* of March 15, has ordered 2,000 box cars of 60,000 lbs. capacity, 900 gondolas of 100,000 lbs. capacity, and 100 dump coal cars of 80,000 lbs. capacity from the American Car & Foundry Company for September and October delivery. The box cars will weigh 36,000 lbs. and will measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The gondolas will weigh 42,000 lbs. and will measure 42 ft. long, 9 ft. 4 in. wide and 4 ft. 2½ in. high, inside measurements. The dump coal cars will weigh 38,000 lbs. and will measure 36 ft. long, 9 ft. 4 in. wide and 5 ft. high, inside measurements. The special equipment for all includes:

Bolsters	American steel
Brake beams	Damascus
Brake-shoes	Sargent
Brasses	Climax
Couplers	Major
Door fastenings for box cars	Positive
Doors for box cars	Security
Draft rigging	Miner
Dust guards	Security
Journal boxes	Symington
Paint	Sherwin-Williams
Roofs for box cars	Chicago; Cleveland inside
Wheels	American Car & Foundry

RAILROAD STRUCTURES.

Laredo, Tex.—The National of Mexico, according to reports, has plans made for a second railroad bridge, to be built over the Rio Grande at this place, to cost about $500,000. The proposed joint bridge to be built by the National and the St. Louis, Brownsville & Mexico, for which plans were made some time ago and approved by the Mexican Government, is still under consideration.

Needles, Cal.—The Atchison, Topeka & Santa Fe, it is said, will build a new bridge over the Colorado river at this place.

Peoria, Ill.—The Chicago, Rock Island & Pacific has bought land in Peoria as a site for new yards and passenger and freight terminals.

Pierre, S. Dak.—The Chicago & North-Western, it is said, is making surveys for new shops to be built during the coming summer at a cost of over $200,000.

St. Louis, Mo.—The Wabash, which last year built a new freight house at Fourth and Franklin streets, will make further improvements, to include a new freight house 75 ft. x 646 ft., on Collins street, extending from Franklin avenue to Carr street.

San Francisco, Cal.—Local reports state that the Western Pacific has decided to at once begin the construction of its terminal at Oakland. The work will involve the filling of a mole 1,000 ft. wide between 4,000 and 5,000 ft. long, and includes a new station with slip approaches at the western end. The work, which will take about 18 months to complete, will cost in the neighborhood of $2,500,000.

Winnipeg, Man.—The Canadian Pacific has given to Contractor McDiarmid, of Winnipeg, contracts for putting up roundhouses on its line at Cranbrook, Coleridge, Strathcona and Swift Current.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Atchison, Topeka & Santa Fe.—The Texas Legislature has granted the Southern Kansas Railway Company of Texas permission to take up the track on that portion of its line formerly known as the "Panhandle Railway" from a point 1.25 miles west of Panhandle, Tex., to Washburn, 14.3 miles, and to build a new line from the point 1.25 miles west of Panhandle to Amarillo, a distance of 25 miles. Excepting the preliminary survey, no work has been done on this line. The President of the S. K. is J. E. Hurley, Topeka, Kan., General Manager of the Atchison. Work will probably be started soon; no contracts have been let. (April 26, p. 598.)

According to W. B. Jansen, Fourth Vice-President, the appropriation for new work on the Santa Fe lines this year is $2,000.000 instead of $10,000,000, which the management had intended spending on improvements.

Atchison, Topeka & Santa Fe (Coast Lines).—It is reported that this company is planning to build an extension of the line running from Kramer, Cal., north to Randsburg. The proposed extension is from Randsburg northeast to Ballarat, in Death Valley, about 75 miles, through a mining region.

Bessemer & Lake Erie.—Construction work on the Western Allegheny, the new line connecting Butler and New Castle, Pa., has been finished and the road is to be put in operation in a short time. It was built to give the B. & L. E. entrance into the furnace district in the vicinity of Youngstown.

Blue Valley.—Incorporated in Missouri with $100,000 capital and office at Kansas City, Mo., to build five miles of railroad in Jackson County. The incorporators include A. Massey, E. L. Browne, J. S. Chick, Jr., J. Georgen and W. E. Winner.

Boston Elevated.—At a recent meeting of the stockholders, it was voted to issue stock to provide for the construction of the Cambridge subway, to extend the elevated line to Forest Hills, and for power additions and other improvements.

Canadian Pacific.—It is reported that this company is negotiating to buy the Owen Sound & Meaford, projected from Owen Sound, Ont., on the Canadian Pacific east 18 miles to Meaford, on

the Grand Trunk. The O. S. & M. has recently been granted a subsidy of $90,000 by the Dominion Government.

CHENANGO VALLEY (ELECTRIC).—Incorporated in New Jersey with $100,000 capital to build an electric line from Hamilton, N. Y., south to Binghamton, about 55 miles. The incorporators include: H. O. Coughlan, J. R. Turner and L. H. Gunther.

CHICAGO & EASTERN ILLINOIS.—Henry I. Miller, President of this company, has confirmed the report that surveys are being made for a line to connect this road, by way of Evansville and Joppa, with the Mobile, Jackson & Kansas City. This would give a short route between Chicago and New Orleans and Chicago and Mobile.

CHICAGO, MILWAUKEE & GARY.—See Illinois, Iowa & Minnesota.

DENVER & GULF.—Incorporated in Oklahoma with $2,000,000 capital to build from Denver, Colo., southeast to Snyder, Okla., about 500 miles. The office of the company is at Texhoma, Okla. F. Banks, of Sweetwater, Tex.; W. E. Wilson, of Prentiss; W. R. Evans, J. Hicks and C. Gleem, of Texhoma, and R. E. Davis, of Granite, incorporators.

EL RENO, OKLAHOMA & SHAWNEE.—Incorporated in Oklahoma, with office at Oklahoma City, and capital of $2,500,000, to build a line from El Reno via Oklahoma City to Shawnee, 75 miles, with a branch south to Norman, 20 miles. The incorporators include: S. P. McIntyre, N. M. Elds, J. N. Martin, E. E. Houghton and J. M. Wright, of Oklahoma City.

GRAND TRUNK PACIFIC.—Preliminary surveys are being made by this company on the line of the Pacific, Omineca & Northern route from the head of Kitamat Arm, British Columbia, north about 125 miles to Hazleton, on the Skeena river. The charter rights of this road were bought about two years ago by the G. T. P., but since then nothing has been done. The route is needed by the G. T. P. to secure proper transportation for the construction supplies for the main line to the interior owing to the insecurity of navigation on the Skeena river.

IDAHO.—Incorporated in Idaho with $4,500,000 capital, to build a line from Boise east, thence north to the Sawtooth mountains, in Custer County, approximately 150 miles. The incorporators include: L. A. Coate and H. E. Neal, of Boise, Idaho; A. M. Bannister and C. F. Hunter, of Detroit, Mich.

ILLINOIS, INDIANA & GARY.—See Illinois, Iowa & Minnesota.

ILLINOIS, IOWA & MINNESOTA.—J. H. Seaman, President of this company, announces that the proposed Rockford Belt, the Illinois, Indiana & Gary, and the Milwaukee & Rockford, have been consolidated with this company. At the annual meeting announcement is to be made of a change in the name of the consolidated system to the Chicago, Milwaukee & Gary Railroad Co. The total mileage embraced in the system will be about 300 miles. The I., I. & M. now operates 125 miles. An extension from Rockford, Ill., to Milwaukee and another to Gary, Ind., will soon be built.

ILLINOIS TRACTION.—This system, which operates various lines from Danville, Ill., southwest to St. Louis, Mo., with a branch from Danville south to Ridgefarm, and an east branch from Staunton to Hillsboro, also one from Decatur north to Bloomington, a total of about 295 miles, has just finished an extension from Bloomington northwest to Peoria, 42 miles. The company has projected a line from Champaign northwest to Bloomington, also one from Bloomington southwest to Springfield, thence west to Jacksonville, and a north connecting line from Lincoln to Peoria, aggregating 250 miles. Considerable improvement work is also contemplated in St. Louis, Mo.

INDIANAPOLIS, LOGANSPORT & CHICAGO.—An officer writes that contracts are to be let in July or August for building this line. The projected route is from Logansport, Ind., south through Young America, Russiaville, Kempton and Sheridan to Indianapolis, 68 miles. Maximum grades will be seven-tenths of 1 per cent. and maximum curves 3 deg. E. N. Talbot is President and W. A. Osmer, Chief Engineer, Logansport, Ind.

INDIANA ROADS (ELECTRIC).—A number of Indianapolis capitalists are organizing a company to have a capital of $4,000,000 to build an interurban road from Terre Haute, Ind., via Crawfordsville and Frankfort to Kokomo, about 100 miles.

INTERCOLONIAL.—Bids are wanted May 10 by D. Pottinger, General Manager, Moncton, N. B., for double-tracking the main line of this road between Moncton, N. B., and Painsec Junction, seven miles.

KANSAS CITY, MEXICO & ORIENT.—President A. E. Stilwell, of this company, has announced that all of the necessary material has been bought to place the line in operation from Emporia, Kan., south to San Angelo, Tex., this year; and the company hopes to have the work finished so that by temporarily securing trackage rights from Wichita to El Dorado, 30 miles, and from Emporia to Kansas City, 114 miles, through trains may be run from Kansas City to San Angelo by the end of this year. Grading on this entire section, which will be 711 miles long, is about finished. The road is now in operation from Wichita south to Clinton, 192 miles, and from Knox City south to Sweetwater, 76 miles. The company also expects to connect the southern end of this road, in operation as far north as Eloro, with the Southern Pacific at Alpine, so that work can be started from that point north to complete the gap of 229 miles between Alpine and San Angelo.

LOUISIANA EAST & WEST.—See Texas & Pacific.

MANILA RAILROAD.—An officer announces that grading was started March 21 on the proposed lines on the Island of Luzon, aggregating 428 miles, to be built by the syndicate formed by Speyer & Co., New York. No contracts for any of the work are to be let, as the company is building the line with its own men. (March 15, p. 386.)

MANUFACTURERS' RAILWAY.—See West End Terminal.

MEXICAN ROADS.—The state of Chihuahua has granted a concession to Rudolfo Valles, of Parral, to build a railroad from Morita, on the Jiminez-Parral branch of the Mexican Central, south to Allende, 20 miles. It is stated that the Los Colorados Mining Company, which has large mining properties at Allende, is backing the railroad enterprise.

MEXICO, PERRY & SANTA FE TRACTION.—This company, with office in Mexico, Mo., is to soon start work on a line from Mexico northeast to Perry, 20 miles. S. L. Robinson, Belleville, is President and General Manager; C. W. Gaither, St. Louis, First Vice-President; W. W. Mundy, Mexico, Mo., Second Vice-President; J. D. Bates, Centralia, Third Vice-President, and H. D. Ahlbrandt, St. Louis, Secretary and Treasurer.

MILWAUKEE & ROCKFORD.—See Illinois, Iowa & Minnesota.

MISSOURI, TENNESSEE & GEORGIA.—This company claims to have completed its financial arrangements and that surveys are to be started at once for its proposed line from Caruthersville, Mo., southeast through Tennessee to Florence, Ala., 150 miles. I. H. Dugan, President, Humboldt, Tenn. (April 26, p. 599.)

MOBILE, JACKSON & KANSAS CITY.—See Chicago & Eastern Illinois.

OWEN SOUND & MEAFORD.—See Canadian Pacific.

PACIFIC, OMINECA & NORTHERN.—See Grand Trunk Pacific.

PAN-AMERICAN.—It is announced that this line will probably be finished to the Guatemala border by July 1—several months earlier than was expected. Track laying is progressing at the rate of more than half a mile a day. The line will soon be finished to Esquintla. The same interests have obtained a concession from the government of Guatemala to extend the line through that country to the city of Guatemala. Owing to the existing disturbed condition of political affairs in that country it may be some time before work is begun on the Guatemala division.

PHILADELPHIA & READING.—Local reports state that work on the elevated structure to be put up by this company to abolish the grade crossings in Philadelphia between Montgomery avenue and Cumberland street will be started shortly. At present there are nine crossings between these two streets. The company is to have a new freight yard in place of the two freight yards at Tenth and Berks streets and Broad and Huntingdon streets.

PHILADELPHIA & WESTERN (ELECTRIC).—This company, which was incorporated to build a line from Sixty-third and Market streets, Philadelphia, west to Parkesburg in Chester County, 45 miles, has finished the first 12½ miles from Philadelphia to Strafford. Preliminary tests are being made in preparation for the early operation of this section. W. R. Molinard, Vice-President and Chief Engineer, Philadelphia, Pa.

PIKE-LITTLE CREEK.—Incorporated in Kentucky to build from Beaver, on the Chesapeake & Ohio, in Pike County, Ky., to headwaters of Little creek, 15 miles. R. T. Little and J. C. Howard, Little Creek, Ky., incorporators.

ROCKFORD BELT.—See Illinois, Iowa & Minnesota.

ROCKY RIDGE.—An officer writes that this company has about finished its line from Rocky Ridge, Pa., on the East Broad Top Railroad, north to Evanston, five miles. R. S. Seibert, President, Orbisonia, Pa.

RUSSELL FORK.—Incorporated in Kentucky to build a line from a point on Russell Fork through the coal fields of Dickenson and Buchanan counties, Va., 35 miles. Surveys to begin at once. J. W. M. Stewart, of Ashland, is interested.

ST. LOUIS & ILLINOIS BELT.—See West End Terminal.

SOUTH DAKOTA CENTRAL.—This company, which has projected an extension from Rutland, S. Dak., north to Watertown, 75 miles, and which built six miles last year, has secured all of the necessary right of way. Work is now under way on the remainder of the line, and it is expected to be finished this year. (March 15, p. 392.)

Southern Kansas of Texas.—See Atchison, Topeka & Santa Fe.

Southern Pacific.—Local reports state that this company has about finished surveys and rights of way are being secured for a line from Fallon, Nev., east via Stillwater to Wonder Mines in Churchill County, and that work is soon to be started.

Syracuse & Chittenango Electric.—Incorporated in New York with $500,000 capital and office at Syracuse. The company proposes to build an electric line from Syracuse to Chittenango. W. H. Dowe and G. S. Terry, of New York, and C. B. Everson, of Syracuse, Directors.

Tennessee & North Carolina.—An officer writes that this company is considering the question of building an extension of its road from Waterville, N. C., to Canton, but that no plans are being made for an extension from the northern end west towards Knoxville, Tenn. (April 26, p. 600.)

Texas & Pacific.—According to a statement of L. S. Thorne, Vice-President and General Manager of this company, the Louisiana East & West is to be operated as a part of the Avoyelles division of this road. The line which is being built from Bunkie, La., to Eunice, has been finished to Ville Platte, 16 miles from Eunice.

Toledo & Indiana Traction.—An officer writes that part of the right of way has been secured for the proposed extension from Bryan, Ohio, to Waterloo, Ind. It is uncertain when contracts for the work will be let, as litigation is necessary in Indiana to secure the balance of the right of way. (April 26, p. 600.)

Wagner, Lake Shore & Armour.—Incorporated in South Dakota with $1,000,000 capital and office at Wagner to build an electric line from Wagner, S. Dak., on the Chicago, Milwaukee & St. Paul north 65 miles, to Mitchell, which is on the same road and also on the Chicago, St. Paul, Minneapolis & Omaha; with a branch in Charles Mix County, west to the shore of Lake Andes. The incorporators include: A. H. Pease, J. Abasher and J. Steransky, of Wagner; A. Ammidson, of Lake Andes, and E. P. Wanzer, of Armour.

West End Terminal.—Under this name, a company has been organized in Missouri with a capital of $5,000,000 to build two bridges and a terminal belt line at St. Louis and East St. Louis. The plans include a bridge over the Mississippi river at a point south of the Missouri river; also a bridge over the same river at a point north of Jefferson Barracks, each to carry four tracks. A belt line is to be built paralleling the city limits and connecting the bridges. Negotiations are pending between this company, the Manufacturers' Railway and the St. Louis & Illinois Belt to merge the three companies. The Manufacturers' Railway is already planning extensive improvements in this section. The St. Louis & Illinois Belt has a large part of the right of way secured for its proposed line from Alton to Thebes, and eventually to Cairo, and it expects to begin the work shortly. The officers of the West End Terminal are: J. M. Denning, President, Des Moines, Iowa; W. L. Kennedy, Vice-President, St. Louis, Mo., and J. H. Hamilton, St. Louis, Mo., Secretary and Treasurer.

Western Allegheny.—See Bessemer & Lake Erie.

Wolcottville & Coldwater.—An officer writes that this company, which projected a line from Wolcottville, Ind., northeast to Coldwater, Mich., 35 miles, proposes to build the section from Wolcottville via Panama to Mongo, 18 miles, this year, and from that point to Coldwater next year. Surveys not yet made. O. G. Wales, President, Kansas City, Mo. (April 26, p. 600.)

RAILROAD CORPORATION NEWS.

Baltimore & Ohio.—See Chicago Terminal Transfer.

Brooklyn Rapid Transit.—See Coney Island & Brooklyn.

Chicago, Lake Shore & Eastern.—The capital stock of this company has been increased from $250,000 to $2,760,000. The increase is to retire $2,510,000 of its $4,620,000 bonds.

Chicago, Milwaukee & St. Paul.—See Wisconsin Central.

Chicago Terminal Transfer.—The Baltimore & Ohio has provided the United States Trust Company with funds to pay off the $15,100,000 first mortgage 4 per cent. bonds of the Chicago Terminal Transfer at par and interest. The property was to have been sold under foreclosure on May 3, but the action of the Baltimore & Ohio means an indefinite postponement of any such sale. The trust company began paying off the bonds on May 3. The principal and accrued interest on the bonds amounts to over $17,000,000. It is understood that the Baltimore & Ohio borrowed about $10,000,000 from New York bankers on 30 or 60-day notes. The company had on hand about $25,000,000 surplus, but it was so scattered that it was more convenient to borrow part of the money necessary for the retirement of the Chicago Terminal Transfer bonds. (Apr. 19, p. 566.)

Coney Island & Brooklyn (Electric).—This company has passed the current quarterly dividend on the $2,000,000 outstanding common stock. It is announced that earnings are to be spent in improvements. The company paid 2 per cent. in February, 1907; 8 per cent. in the year 1906; 10 per cent. in 1905, and 16 per cent. in each of the three preceding years. It owns 23 miles of road from Brooklyn to Coney Island, including branches, and is controlled by the Brooklyn Rapid Transit.

Havana Central (Electric).—See United of Havana.

Maine Central.—The stockholders have ratified the lease by the Maine Central of the Portland & Rumford Falls Railroad. The last named company has leased the Portland & Rumford Falls Railway and the Rumford Falls & Rangeley Lakes Railroad, and these leases and other interests are covered by the lease of the Portland & Rumford Falls Railroad to the Maine Central. The Portland & Rumford Falls Railway owns a line from Rumford Junction, Me., on the Maine Central, to Rumford Falls, 54 miles, and also a 10-mile branch to Otis Falls. The Rumford Falls & Rangeley Lakes runs from Rumford Falls north to Oquossoc, 36 miles. The Portland & Rumford Falls Railroad was recently incorporated to build from Poland, on the P. & R. F. Railway, south to the coast at Portland and Falmouth. The stockholders of the Maine Central have also ratified the purchase of the Somerset Railway, which runs from Oakland, on the Maine Central, to Bingham, 42 miles. (April 12, p. 532.)

Merchants' & Miners' Transportation Company.—The stockholders have authorized an issue of $3,250,000 4 per cent. 25-year debenture bonds and an increase of $3,000,000 in capital stock. The bonds are to be given to the New York, New Haven & Hartford to pay for the Boston & Philadelphia Steamship Co., and $2,500,000 of the new stock will be paid to the New England Navigation Company in exchange for $2,000,000 capital stock of the New York, New Haven & Hartford. The last named securities, together with the remaining $500,000 new Merchants' & Miners' Transportation stock, will be distributed to present shareholders as a stock dividend. (Mar. 29, p. 468.)

New York Central Lines.—Gross earnings for April were as follows:

	1907.	Inc. or dec.
New York Central & Hudson River	$8,039,260	Inc. $1,352,176
Lake Shore & Michigan Southern	3,598,636	" 224,201
Lake Erie & Western	402,123	" 2,700
Chicago, Indiana & Southern	265,881	" 78,681
New York, Chicago & St. Louis	925,155	" 121,199
Michigan Central	2,367,877	" 325,408
Cleve., Cincinnati, Chicago & St. Louis	2,158,884	" 342,359
Peoria & Eastern	223,232	Dec. 3,170
Cincinnati Northern	88,527	Inc. 6,975
Pittsburg & Lake Erie	1,163,836	" 40,716
Rutland	251,189	" 43,495

New York, New Haven & Hartford.—See Merchants' & Miners' Transportation Company.

Portland & Rumford Falls.—See Maine Central.

St. Louis, Iron Mountain & Southern.—Bioren & Co., Philadelphia, are offering at a price to yield 5¼ per cent. $3,660,000 5 per cent. equipment trust notes. They are secured on 4,500 box cars costing $4,065,300, and mature in 10 equal annual instalments, beginning June 1, 1908.

Somerset Railway.—See Maine Central.

United of Havana.—This company proposes to exchange for each $100 common stock of the Havana Central, $35 in United of Havana deferred ordinary stock; and for each $1,000 5 per cent. first mortgage bond of the Havana Central, $1,000 in United of Havana 4 per cent. debentures, and also cash equal to the interest on the 4 per cent. debentures for certain short periods because of the difference between the interest dates of the debentures and the first mortgage bonds. The Havana Central is building 120 miles of road to be operated by electric locomotives. The lines radiate from Havana, and will carry both freight and passengers. The company has outstanding $8,500,000 common stock and $8,162,500 first mortgage bonds.

United Railroads of San Francisco.—See United Railways Investment Company.

United Railways Investment Company.—The directors have voted to buy at par $1,500,000 of the $5,000,000 first mortgage preferred cumulative 6 per cent. stock of the United Railroads of San Francisco, recently authorized. The investment company controls the railroad company. The new issue is for new construction and improvements.

Wisconsin Central.—According to press despatches, the Chicago, Milwaukee & St. Paul has announced that it will not renew the agreement, expiring in 1910, whereby the Wisconsin Central uses the C., M. & St. P. tracks from Rugby Junction into Milwaukee, 28 miles. It is said that the arrangement congests the Milwaukee terminals.

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EDITORIAL ANNOUNCEMENTS.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:

A Side Light on Government by Agitation 665
Prof. F. H. Dixon on Accidents. 665
Influence of Labor Unions on Discipline.. 665
New Railroad Laws in Kansas 665
A Revised Catechism of the Locomotive.. 666
New Haven-Boston & Maine Combination 666
For Better Rails. 667
Train Accidents in April 668
General Electric Company 668
New Publications 669

ILLUSTRATED:

Defective Rails 674
Track Deformations and Their Prevention 681
The Mallet Compound Locomotives on the Great Northern 684
New Passenger Station for the Yazoo & M. V. at Vicksburg. 685
Charles Haynes Haswell 686
P., B. & W. Improvements at Havre de Grace 688

CONTRIBUTIONS:

Superelevation. 669
The Profitable Weight and Speed of Freight Trains 670

MISCELLANEOUS:

The Rehabilitation of the Brooklyn Rapid Transit Company. 670
Railway Signal Association 673
Comparative Summary of Freight Cars in Service on Railroads of the U. S. 682
Suspension of Service on European Railroads 686
Kansas Railroad Laws. 687
Foreign Railroad Notes:
Pay of Swiss Employees. 680
Prussian Tax on River Freight. 684
African Railroads 687
New French Car Works. 687
Railroads on Sagbalin. 687
The Henschel Works. 688

GENERAL NEWS SECTION:

Notes 689
Obituary 692
Meetings and Announcements 692
Elections and Appointments 692
Locomotive Building 693
Car Building 693
Railroad Structures 694
Railroad Construction 694
Railroad Corporation News 695

VOL. XLII., No. 20. FRIDAY, MAY 17, 1907.

The monthly bulletins of the Department of Commerce and Labor, dealing with exports, furnish an interesting and instructive commentary on government by agitation. Those who have followed the American provision business know, with Congressman Wadsworth, how excellent our practice has been for many years, and how relatively trivial the imperfections were upon which the 12-in. guns of the administration were unmasked last spring. With cannon fire and blast of trumpet, our beneficent government announced to all the world that American food products were not fit to eat, and the world was duly impressed. Consequently, although our sausages are now canned by internes in white canvas coats, and our corned beef is certified once when it walks up the cattle ramp and again when it goes forth to all nations, protected by a highly discriminating label, our exports of canned beef have fallen off from 56,730,873 lbs. for the 10 months ending with April, 1906, to 13,032,703 lbs., for the 10 months ending with April, 1907. Even bacon, most unsusceptible of deceitful treatment at the hands of a packer, has fallen off 6½ million dollars in export value during the same period, while the normal increases may be gaged by the exports of tallow—not considered a food product except in the far north and hence unassailed—which went up from 78 million pounds to 102 million pounds. Those who can see an analogy between the effect of government by agitation on the provision industry and on the transportation industry are welcome to it.

The month of May is marked by the publication of articles on railroad operation in three of the big magazines, the *Atlantic Monthly*, the *Century* and *Scribner's*. The last two have been noticed in these columns already. That in the *Atlantic* is by Professor Dixon, of Dartmouth. Its subject is accidents, and it is thorough, painstaking and comprehensive, but it has little or nothing that is new for readers of the *Railroad Gazette*. In fact, its author appears to have been a careful reader of this paper. But from the standpoint of the publicist Professor Dixon's article is the most elaborate and discriminating study of this subject that we have seen, and we recommend it to those who have neglected the *Railroad Gazette's* teachings for fear the editors were prejudiced in favor of the railroads and against the general public.

One editor, praising Professor Dixon's article, and quoting his conclusion that lack of good discipline is the fundamental fault in railroading, wants to know why he did not explain the evil influence of the labor unions on railroad discipline, a question which "is in pressing need of immediate and unbiassed investigation." This criticism is, no doubt, sincere; but that word "unbiassed" indicates that the statements of railroad officers, to the effect that the labor leaders are insufferably overbearing, are not fully accepted by the public. We pass along the hint to those of our readers who are interested. Of evidence of this evil we have had much, at many times and places. A prominent trait of grievance committees is to grieve much louder over a brother's loss of his job than over the danger to other brothers, and to passengers, which results from an incompetent brother's keeping his job. But it is time that some superintendent led off in emblazoning a few such cases on the outer walls where all may see. The superintendent who is doing everything in his power to make his discipline perfect is in duty bound to expose everybody who persistently seeks to undermine his work.

Of the 12 or 15 new railroad laws passed in Kansas this year, abstracted on another page, there are three, or possibly four, that have a worthy purpose; all the rest are vicious or foolish. Of the three tolerable ones all have bad features, and one or two that are mostly harmless in effect are really useless—for their purposes, so far as they are good, could be accomplished as well without the statutes. A dozen states have this year passed a variety of useless or unjust railroad laws, but we notice Kansas in particular because of its pre-eminence in variety and wantonness. Putting a railroad man in jail for not properly accommodating stray passengers by carrying them in a freight caboose, and making a criminal of the jailer for failing to abuse the railroad when a car of coal is delayed, seem close to the limit of absurdity. Some of these laws are incomprehensible to one at a distance; as, for example, that for establishing freight terminals. A concealed purpose to punish somebody, presumably, is the explanation of it. The 16-hour labor law (one of those which we class as right in purpose), contains an exception which may largely nullify the good it might do; show-

ing that the main motive of its promoters was not so much to enhance the safety of passengers and trainmen, as to carry out the ignorant or selfish wishes of the labor unions. For special legislation disguised as general, the requirement that car-repairers shall have sheds to protect them from the hot summer suns of the Great American desert is a rare gem. Next we shall have a state appropriation (to be taken out of the railroads' treasuries) to buy umbrellas for all Italian workmen in gravel pits. For a miniature anti-trust law the prohibition of demurrage associations is a cute little model. We fear that local freight agents will evade it by corrupt presents to one another of five-cent cigars. But time would fail us to point out all the funny things in these laws—funny if they were not such sad commentaries on popular government—and we will leave the reader to guess which of these laws we have meant to refer to as possibly useful. The reciprocal demurrage law *may* do some good in spots, but this will be in spite of its wrong principle. For a proper characterization of this kind of a law legislators should read what Hon. Judson Harmon says about it, in another column of this paper.

All who are interested in the literature of the locomotive, and especially the many old friends of Matthias N. Forney, will be glad to know that he has undertaken to produce a revised edition of his well-known book, "The Catechism of the Locomotive." The first edition was published in 1874, and nearly 36,000 copies of it were sold. These went largely to locomotive firemen and locomotive engineers and to those who were ambitious to attain those positions. The simplicity and the completeness of this remarkable book so accurately adapted it to the understanding of these men, and gave them so nearly all of the actual information needed in running a locomotive, that its value was recognized early by superintendents of motive power and other general officers, with the result that on an increasing number of railroads enginemen were notified that examinations for promotion would consist of questions from Forney's Catechism of the Locomotive. In 1890 Mr. Forney was induced, by reason of changes and improvements in the locomotive and an evolution in its construction, and by the results of investigations which had been made of working and theory of the wonderful machine, to prepare and issue a revised and much enlarged edition. This new book was invaluable to the student, but evidently less available to the enginemen, and less than 16,000 copies of it were sold, being only three-tenths of the number sold of the original edition of about one-half size. At the present time this 1890 edition is, in many respects, out of date. It preceded the period of the discovery of the uses of extension front and of compounding, of many attachments and, in addition, there have been changes in proportion, in wheel base, etc. It would seem to be well that Mr. Forney should complete his work, and his plan for doing this is skilful and will interest those who know the needs of enginemen as well as of locomotive engineers and students. The new edition will consist of two parts, each separate and complete in itself. Part I. will be an elementary treatise similar in scope to the first edition. Thousands of boys acquired their basis knowledge of the steam engine from the wonderful first three chapters of this book on the steam engine; the forces of air and steam; and work, energy and the mechanical equivalent of heat. Although this Part I. of the new edition will be elementary and simple, so as to make easy reading for untrained men, nevertheless, it will be thorough and complete in itself in giving to those who read and study it a full knowledge of the principles and details of working of the locomotive engine. Part II. will go much farther. Its chapters will have like headings and there will be some additional chapters, but there will be a description of those features of construction and principles of operation which are more difficult of comprehension. For example, Part II. will include the results of laboratory tests such as have been made at Purdue and at St. Louis. Mr. M. N. Forney's address is at No. 501 Fifth avenue, New York, and he will welcome suggestions from all who are interested.

THE NEW HAVEN—BOSTON & MAINE COMBINATION.

In the course of railroad events, just at that time following each other in rapid sequence, there came in 1893 the territorial division of New England dubbed then the "Partition of Poland." The partition was threefold with the Boston & Maine allotted the North, the Boston & Albany the Center—albeit somewhat circumscribed—and the New York, New Haven & Hartford given well nigh complete possession of the South. It looks now, if the paradox may be pardoned, as though the New England Poland were to be repartitioned into solidity and the earlier distribution reversed. Not absolutely precise, as yet, are the reports that tell of the absorption of the Boston & Maine system by the New Haven. But all the omens nod toward it; the "official" denials are of the strict construction order that play upon the exactitudes of words rather than the exposure of facts; and one can see without abnormally keen eyesight prudential reasons why official announcements should be deemed premature. Any railroad deal where the controlling securities are not actually in hand or the controlling agencies under compact, has its margin of uncertainty. But in this case the margin of conjecture is so small that the combination of the two systems need hardly be treated as a hypothesis.

The immediate causes leading up to the presumptive combination do not have to be sought far away. The untiring energy of President Mellen has supplied the personal force major. Step by step his policy has been pushing its way into rival territory of both the Boston & Maine and the New York Central. The treaty in the "Partition of Poland" has not technically been violated. But the Ontario & Western purchase, the lodgment in trolley systems at Pittsfield, Springfield and Worcester—with intermediate extensions—and the voluntary two cents a mile fares which forced the Boston & Maine—operating in territory with passenger traffic less condensed—to reduce fares also, illustrate the flanking movements and pressures. Closer contacts and collisions running into losing antagonisms have seemed near; and the inert policy of the Boston & Maine has also played into the Mellen hand. From the New Haven viewpoint there has been the constant and, of late, increasing danger that the New York Central by reaching for the Boston & Maine might imperil northern business; and, later still, there has been added some danger that Canadian railroad interests also might extend down and expand in northern New England. The upshot—we repeat, presumptively—is warfare declined and a new treaty in which the Boston & Maine yields itself into the stronger hand with share for share exchange and a 1 per cent. increase in dividend; while, as to the New York Central, it will hardly be surprising if, as the price of non-resistance and cession of sundry vantages like minor trackage rights, one of Mr. Mellen's "clubs," the Ontario & Western, is turned into the Central's arsenal. Mr. Mellen's offer, at the time of the O. & W. purchase, to exchange it for the Boston & Albany will, in this connection, be recalled.

The taking over of the Boston & Maine will front Mr. Mellen with a group of problems some of them new or, at least, different from those faced during the swift four years' advance of the New Haven President. The probable addition of 1 per cent. or some $300,000 to the Boston & Maine annual dividend requirement may be brushed aside as almost trivial in so large a future railroad organization with total gross earnings from all sources of say $130,000,000 a year. Not so trivial are such matters as the new public responsibilities to be assumed as a greater monopoly in five states instead of three, and one of them—New Hampshire—in an "anti-corporation" mood. Nor are the physical problems minor with the New Haven's track mileage of about 2,000 miles more than doubled. There is the great cost of reconstruction and of new equipment; the harmonizing of traffic arrangements; the unifying of terminals at Boston, possibly by subway; such special matters as the digestion of the old Fitchburg system which may be regarded, in a sense, as a kind of long bridge carrying low class through freight traffic; and, beyond, is the question of consolidating the component and subsidiary lines. In many respects President Mellen must repeat, on a system differently located, his policy in developing the New Haven, one branch of which, the acquisition of street railways, will have peculiar interest, not to say obstacles, in its application to the new territory. To the solution of all these problems the New Haven's President will bring some great vantages, besides his own aptitudes and training. He is thoroughly familiar with a region in which he once served as a railroad officer; he has considerable opportunities for operating economies by knitting the two systems together and increasing traffic by continuities of train service, especially between New York and northern New England and Canada; the Canadian lines afford him a new western outlet and inlet; and the New Haven's recently acquired coast lines of steamships have considerable potencies for taking traffic hitherto dissevered from the Mellen system of roads.

The immediate fiscal elements of the presumptive combination are not of very grave moment. It may be noted, however, that the great fixed charge of the Boston & Maine is in rentals ($5,074,554), its debt carrying the relatively low interest charge of $1,474,670, and its present dividend requirement is but $1,834,646, the latter

to be increased probably by about 1 per cent. on the $28,265,500 of outstanding stock, common and preferred, or $282,655, by the union with the New Haven. The system, however, with its large gross earnings from operation—last year $39,214,200—and considerable outside income—has pressed its dividends hard and the first nine months of the present fiscal year show a decrease in net surplus for dividends of $501,549. Like other roads it faces increased cost of operation, particularly from labor, offsetting increase of gross earnings; and its reductions of fares will, it is likely, tell a different story from those of the New Haven with its high density of passenger traffic. But, with normal traffic conditions, it looks nevertheless as though the Boston & Maine system would take care of itself fiscally. Its taking over is, in fact, far less bold than the New Haven's recent assumption together of the Rhode Island street railway system and the Connecticut Railway & Lighting properties. In that great trolley purchase the New Haven absorbed some $35,000,000 of water; in the Boston & Maine the New Haven gets solid stuff throughout.

In the glance ahead into the vistas of the New England railroad situation, as affected by the Boston & Maine absorption, the future of the Boston & Albany must excite acute speculation. Outwardly that line, with its ultra-conservative record and traditions, appears crowded by the New Haven's rushing policy harder than ever. The Mellen strategy has already invaded its territory by electric roads and now it is compassed by the New Haven's steam system also. On its face it seems as though manifest destiny pointed to the New Haven control of the Boston & Albany, and that final act round up New England railroad monopoly. But this is a mere detail. The impressive fact of the present is the vastness as well as the pace of the Mellen policy which in four short years has spread centralized ownership of steam, electric and marine properties over so large an area; the transmutation of what was but lately the most conservative railroad corporation in New England into one of the most venturesome and aggressive in the land; and the size, intricacy and novelty of the new problems in transportation to be worked out under centralized conditions in a territory like New England which, industrially, is both intense and complex. In such a region, quick to reflect both good times and hard times, a Napoleonic policy may lead either to Austerlitz or Waterloo; just now it looks like Austerlitz. But whatever the event, needing now but a few more years to disclose it, the results of the Mellen policy, steam and electric, will be a distinct contribution to the science and methods of American transportation.

FOR BETTER RAILS.

It is perhaps safe to say that there is no more striking example in this country of the dangerous and harmful possibilities of a great corporation than that which is now being afforded by the United States Steel Corporation in its attitude toward demands for sound rails. There is no individual, or combination of individuals, which knows better how to make good rails than does the United States Steel Corporation, with its splendid army of experts. Nevertheless, it knowingly makes rails which break and kill people. The top of ingots are not being cropped off below the point where high phosphorus and impurities are found; specifications, as furnished by railroad companies, are totally disregarded, and rails, especially in the new and heavier sections, are furnished with spots in them so full of impurities and so brittle that they must of necessity break when subjected to the strain of traffic. The Steel Company knows this quite well. The railroad companies also know it quite well. The Steel Company declines to take cognizance of the fact, because this would mean considerable reduction of output although no important loss of material. The railroad companies fail to take a firm stand because, in the interests of the tremendous traffic, which they derive directly and indirectly from the steel companies, they have not yet dared to do so.

Two points here are specially noteworthy: first, the criminal willingness of the Steel Corporation and the companies allied with it to manufacture rails that cost human life; second, the attitude, almost equally criminal, on the part of many high railroad officers, to ignore the plain truths that are being brought before them by their superintendents and chief engineers. At the recent meeting of the American Railway Association in Chicago it was asked by G. L. Peck, General Manager of the Pennsylvania Lines West, that any representative of the 230,000-odd miles of railroads in the United States present at the meeting who was satisfied with the rails he was receiving, should get up; nobody got up. The representatives of the steel manufacturers who were asked to defend their processes of manufacture had nothing to say.

It is obvious that such a state of affairs as this cannot continue, for public safety is involved. Since the year 1901, it has been impossible for railroad companies to have their specifications adhered to. The tremendous increases in rail breakages during these five years, when the Steel Corporation has had the matter in its own hands, are well shown in the tables of rails broken and taken from track in New York State, which are shown in another column. During January, February and March, 1907, 836 rails, rolled in the previous year, were broken and taken from track in the state of New York as against 29 rails, rolled in the year 1901, which broke during the same period. This record may be directly characterized as disgraceful—a disgrace to the reputation of the rail manufacturers, who are fully able to remedy the known defects if they wish to do so. The only answer which the rail manufacturers have brought against the charge is that traffic has grown materially heavier in the last few years, and that track structures, ballast, etc., are insufficient for the strain which is put upon them, with the result that high spots and low spots occur in the track, causing breakages which cannot be avoided. They suggest as a remedy the use of a still heavier rail section, weighing perhaps 150 lbs. to the yard. But it has been conclusively shown that the 100-lb. rails of 1905, 1906 and 1907 have made a far worse record in breakages than the 80-lb. rails rolled five years ago; therefore, it is evident that no help is to come from increased weight of section until better processes of manufacture are co-ordinately employed. The exact details of specification, already quite generally agreed on, and the proper shape of the cross-section, not so fully agreed to, need not be discussed at present. The trouble at the root of the present situation does not lie here. Heavy rails of the present day are materially deficient owing to three causes, capable of considerable subdivision, which can be outlined roughly as below:

(1) Phosphorus and impurities which collect in the top of the ingot during cooling require that about one-third of the ingot should be cut off before the rails are rolled. Present practice in the steel mills cuts off a much smaller amount than this, leaving the ingot full of impurities, and with its phosphorus much higher than that allowed by the best specifications.

(2) With the Bessemer process and the ores now used, it is extremely difficult to keep down the phosphorus. A high phosphorus content with high carbon added to give hardness and wearing qualities makes brittle steel. Open hearth rails, of course, furnish the solution of this difficulty.

(3) In the efforts for output, rails are being finished at too high a temperature, and are not receiving enough work in the rolls. Before this can be completely remedied, it is probable that some change in the form of the cross-section will be necessary, but many of the gravest defects arising from rolling can be remedied while the section remains in its present shape.

The recent action of Mr. Harriman in ordering 150,000 tons of open hearth rails from the Tennessee Coal & Iron Company and in throwing down the gage to the Bessemer steel makers adds much interest to the present situation. Mr. Harriman and his system are both big enough to be above the necessity of the traffic diplomacy that ties most of the railroads hand and foot, in a crisis like this. He reported 449 rails broken on his lines during February, of which 179 were 90-lb. rails that had been in the track only five or six months, and accepted Mr. Kruttschnitt's suggestion that damage claims should be instituted against the steel companies for the preventable harm thus done. By taking this position, he has greatly strengthened the hands of the committee of the American Railway Association.

A collection of letters, bearing on this subject, which we regret we must print unsigned and unidentified, will be found in another column accompanied by a series of photographs of broken rails, which constitute a terrible document of the utter lack of responsibility which has characterized the steel companies within the last few years in supplying such a product, upon the strength of which human lives depend. The United States Steel Corporation definitely refuses to make rails according to specifications of chemical composition and details of rolling, while at the same time it is selling rails to the Japanese government for ten dollars a ton less than the price in this country, and is adhering to the required Japanese specifications.

A careful reading of these letters from railroad officers makes it apparent that the roads which have suffered have been those combining heavy rails and heavy axle loads; that is to say, that the rails now made to carry maximum traffic are not capable of always performing their task. The need for a better and more scientifically unified railroad superstructure to carry great train

loads is admitted by all. Mr. Cuenot, the French engineer, discusses some of these superstructure problems in the serial papers which we are now printing. But defects in superstructure do not excuse gross imperfections in 100-lb. rails! How gross these imperfections have become, a glance at the photographs on another page will show.

Train Accidents in April.[1]

Our record of train accidents occurring on the railroads of the United States in April includes 15 collisions, 15 derailments and three other accidents, 33 accidents in all. This record is not published in full, as was formerly done, except in the cases of the few accidents which are especially prominent—in the present instance four collisions and two derailments. The record of "ordinary" accidents—which term includes, for our present purpose, only those which result in fatal injury to a passenger or an employee or which are of special interest to operating officers—will henceforth be given as below, in the shape of one line items, for each accident, showing date, location, class and number of deaths and injuries.

This record is based on accounts published in local daily newspapers, except in the cases of accidents of such magnitude that it seems proper to send a letter of inquiry to the railroad manager. The official accident record published quarterly by the Interstate Commerce Commission is regularly reprinted in the *Railroad Gazette*. The six prominent accidents in April are distinguished in the list by printing the name of the road in italics. Following are condensed accounts of the circumstances of these six accidents.

The derailment at Bartlett, N. Dak., on the 15th, is reported as unexplained. The westbound Oriental Limited express, running at about 40 miles an hour, was derailed on a low embankment and the first three cars were completely wrecked. The track was straight and in good condition. The wreck took fire from the firebox (not from the gas tanks under the passenger cars, though some of these exploded later) and seven passenger cars were burned up. Four passengers and one mail clerk were killed and 27 passengers and five trainmen were injured.

The collision at Mableton, Ga., on the 6th, was due to a misplaced switch, the switch having been left misplaced by a freight train at end of double track. The operator failed to throw the switch to the proper main track. Three engines and five cars were wrecked. Six trespassers were killed and three trainmen and five trespassers were injured.

The collision at Bethel, Tex., on the 2d, was between a northbound and a southbound freight train. Both engines and eight cars were wrecked and both enginemen, both firemen and two brakemen riding in the engines were killed. The collision was caused by an operator accepting an order for the northbound train after it had passed his station. The wreck took fire and was burnt up. The bodies of the two brakemen and of many cattle were cremated.

The rear collision of freight trains near Knoxville, Tenn., on the 21st, occurred in a tunnel, and the fire which broke out in the wreck destroyed a locomotive, a caboose and three coal cars, and badly damaged 1,000 ft. of the timber lining of the tunnel.

The derailment near Kennewick, Wash., on the 23d, resulted in the wrecking of 21 cars loaded with lumber, most of them falling through a trestle bridge over which the train was running when the car with the broken wheel finally was wrecked. Of the men killed three were trainmen and the fourth apparently was a trespasser.

The collision at Cajon Pass, Cal., on the 23d, was due to a cause which appears frequently in the records of freight train accidents but rarely in connection with passenger trains—the leaving of a train unattended on a grade with nothing but the air-brakes to keep it from running away. The engine of a passenger train having to be detached to assist a freight which had run off the track, the passenger cars were left standing on the grade a half mile above the obstruction, and after standing there some time, these cars moved down the grade and ran violently into the passenger engine. A section foreman was instantly killed. A brakeman was injured and several passengers were slightly hurt.

[1]Abbreviations used in Accident List:
rc.....Rear collision.
bc.....Butting collision.
xc.....Other collisions; as at crossings or in yards. Where only one train is mentioned, it is usually a case of a train running into a standing car or cars, or a collision due to a train breaking in two on a descending grade.
b.....Broken.
d.....Defective.
dr.....Defect of roadway.
eq.....Defect in car or engine.
n.....Negligence.
unf.....Unforseen obstruction.
unx.....Unexplained.
derail.....Open derailing switch (negligence of engineman or signalman).
mis.....Misplaced switch.
acc. obst..Accidental obstruction.
malice....Malicious obstruction of track or misplacement of switch.
boiler....Explosion of boiler of locomotive on road.
fire.....Cars burned while running.
Pass.....Passenger train.
Ft.....Freight train (includes empty, engines, work trains, etc.).
*Wreck wholly or partly destroyed by fire.
†One or more passengers killed.

Train Accidents in the United States—April, 1907.

Collisions.

Date.	Road.	Place.	Kind of Accident.	Kind of Train.	No. persons reported—Kil'd.	Inj'd.
*2.	*Mo., Kan. & Texas*	Bethel.	bc.	Ft. & Ft.	6	0
4.	Atch., Top. & S. F.	Los Angeles.	rc.	Ft. & Ft.	1	2
4.	Illinois Central	Duquoin.	rc.	P. & Ft.	1	0
6.	*Southern*	Mableton.	xc.	Ft. & Ft.	7	2
8.	Cin., N. O. & T. P.	Chattanooga.	bc.	Ft. & Ft.	0	1
*11.	Boston & Albany	E. Chatham.	rc.	P. & Ft.	1	1
15.	Denver & Rio Grande	Larkspur.	bc.	Ft. & Ft.	0	3
15.	Wabash	High Hill.	rc.	Ft. & Ft.	2	4
16.	Atlanta, B. & A.	Augilla.	bc.	P. & Ft.	1	0
21.	Southern	Woodlawn.	rc.	P. & Ft.	2	3
*21.	*Louisville & Nashvle.*	Knoxville.	rc.	Ft. & Ft.	0	2
23.	*Atch., T. & S. Fe*	Cajon Pass.	xc.	Pass.	1	4
24.	Chicago & Alton	Dwight.	xc.	Ft. & Ft.	2	3
24.	Phila. & Reading	Wilmington.	xc.	Ft. & Ft.	1	0
26.	N. Y., Phil. & N.	Eden.	bc.	P. & Ft.	1	2

Derailments.

Date.	Road.	Place.	Kind of train.	Cause of derlmt.	No. persons reported—Kil'd.	Inj'd.
5.	St. L. & San Fran.	Catoosa.	Pass.	unx.	0	3
6.	Pennsylvania.	Hudson.	Pass.	malice.	0	1
8.	Southern Pacific	Brown's.	Pass.	d. switch.	1	6
†10.	St. Johnsbury & L. C.	Hardwick.	Pass.	unx.	1	15
*13.	Central of Georgia.	Cataula.	Ft.	burn. bdge.	1	0
10.	Oregon R. R. & Nav.	Cayuse.	Pass.	washout.	4	4
14.	Balt. & Ohio	Sullivan.	Pass.	unx.	1	1
*14.	Texas & Pacific	Cheneyville.	Pass.	mal. m. s.	3	1
*15.	*Great Northern*	Bartlett.	Pass.	unx.	5	32
15.	N. Y. Central	Blossvale.	Ft.	unf.	1	1
17.	Southern	Choccolocco.	Ft.	unx.	1	2
22.	Great Northern	Blaisdell.	Pass.	b. rail.	0	12
23.	*Northern Pacific*	Kennewick.	Ft.	b. wheel.	4	0
26.	Hous. & Texas Cent.	Burnett.	Pass.	b. bridge.	0	7
28.	Wabash-Pittsburg	Bridgeville.	Pass.	unx.	2	0

Other Accidents.

14.	N. Y. Central.	Canandaigua.	Ft.	boiler.	0	4
27.	Wabash.	O'Fallon.	Ft.	boiler.	3	2
29.	Cranberry Lake	Wanakena, N.Y.	Pass.	boiler.	2	5

General Electric Company.

The fifteenth annual report of the General Electric Company records the results of by far the most prosperous year in its history. Total sales (amount billed to customers) for the year ended January 31, 1907, were $60,000,000 as against $43,100,000 for the year ended January 31, 1906, which was the previous record figure. Last year's profits, after deducting all general and miscellaneous expenses, all expenditures in connection with patents and patent litigation, $2,834,124 written off from the book value of factory plants, and other allowances for depreciation and loss, were $8,427,843 against $7,319,161 in the previous year. Dividend payments were $480,000 larger than in 1906, in spite of which net income after dividends was over $600,000 more than in that year.

Ten years ago, on January 31, 1897, patents, franchises and good will stood on the company's books at $8,000,000. Eight years later this had been reduced by successively writing off sums out of earnings to $2,000,000. In 1906, $1,000,000, and in 1907, $999,999 were written off, so that this account on the balance sheet is now carried at the nominal sum of $1. After deducting the amount written off last year from the net income after dividends, the balance, $3,083,502, was carried to profit and loss, bringing up the profit and loss surplus to over $15,100,000.

Sales during the past year were almost $17,000,000 more than in 1906, an increase of about 40 per cent. This is much better even than the General Electric Company's record for the previous 10 years, during which the average increase in sales was 13 per cent. a year. Total sales in 1907 were over twice as much as in 1901. In this connection it is interesting to know that the sales for the first two months of the present fiscal year (February and March) were over 50 per cent. greater than for the corresponding months of 1906. President Coffin remarks that if this growth in business continues new capital will soon be required. The physical growth of the company within the last few years can be seen from the fact that the floor space in factories was over twice as great in 1907 as in 1901, and the employees two and one-third times as many.

Of the expenditures during the year on the factory plants at Schenectady, N. Y.; Lynn, Mass., and Harrison, N. J., including real estate, machinery, patterns and sundries, 74 per cent. has been written off, the remainder, $1,000,000, having been added to this account on the books. This brings up "factory plants" to $9,000,000, which covers a book value on January 31, 1893, of $4,000,000 and an expenditure during the 14 years since that time of $23,200,000, a total of $27,200,000. Of this total, $18,200,000 has been written off during the 14 years.

To provide for the new capital which is likely to be needed the company has $14,800,000 stock authorized but not issued. The total authorized is $80,000,000, of which $54,286,750 was outstanding on January 1, 1906, and $10,847,600 has since been issued.

Under the head of engineering, the successful working of electric traction on the New York Central and on the West Jersey & Sea Shore line of the Pennsylvania from Camden to Atlantic City is mentioned. During the year Curtis steam turbo-generators of an aggregate capacity of 350,000 h.p. were sold, of which 37 were for Japan and others for other foreign countries. The first of the

company's great 8,000-k.w. turbine machines was put in service during the year by the Chicago Edison Company and has been in daily operation since September, 1906, with loads sometimes as high as 14,000 k.w. Five similar machines have since been installed. The size and voltage of transformers for use in long distance transmission work continues to increase. There have lately been ordered a number of transformers of 7,500-k.w. capacity for operation at 104,000 volts. A notable instance of development of high tension switching apparatus has been the successful design and testing of a switching device for 100,000-volt operation.

Except in the fact that the report does not give detailed information about securities held which make up over $20,000,000, or nearly one-fourth of the assets, it gives useful details of the company's operation during the year. The exact figures of sales, collections and unsettled or unmatured balances at both January 31, 1906 and 1907, as well as the allowance made at each date for losses on notes and accounts receivable, are especially valuable in assuring the sound financial position of the company. The amounts written off for depreciation show that, besides making large profits, the company is conservatively maintaining and improving its property.

NEW PUBLICATIONS.

Concrete and Reinforced Concrete Construction. By Homer A. Reid. New York: The Myron C. Clark Publishing Co. 884 pages; 6 in. x 9 in.; 715 illustrations. Cloth; Price, $5.00.

The advance that reinforced concrete has been making by leaps and bounds during the past few years makes books of this character of particular interest and value to engineers, especially when the work is as well done as it is in this instance. As will be seen from the outline this is a large volume copiously illustrated not only with examples from the best practice, but, with what is of equal value, examples of occasional failures by which a warning is raised against certain methods of construction that should be avoided.

So much has been published regarding cements and cement testing that the author touches upon this branch of the subject but briefly. There is a short review of the history of cements, the materials of which they are made, the methods of inspection and testing, and the facts that must be taken into consideration in working for strength and durability. In this especial attention is paid to the general methods of mixing and placing and the effects on the physical properties which are discussed in a chapter by themselves. Then comes the styles of reinforcement and the principles that underlie the use of the various shapes, together with the physical properties of the metals that are used, showing how the concrete and its reinforcement must be made to act and work together in order to produce satisfactory results. In this especial emphasis is put upon the fact that where all tension stresses are to be carried by the reinforcement, the yield under the maximum stress must not exceed .001 of the linear dimensions if the integrity of the structure is to be preserved. In the treatment of this portion of the subject the theory of beams is given a chapter by itself and in it the several formulae that are used are worked out with copious explanations, with especial attention to monolithic floor construction where the ribbed method is used. Columns are treated with the same thoroughness, and so it is not until the middle of the book and the chapter on foundations is reached that we enter upon the discussions of the details of reinforced concrete, and by this time the reader who has carefully followed what has gone before is prepared to understand the reasons why certain types of construction are used. In what follows, foundations are treated in detail, and the forms of piles and footings discussed, together with styles of building and practical construction, retaining walls, dams, conduits, sewers, tanks, reservoirs, chimneys, tunnels and bridges. This portion of the book not only gives copious illustrations of successful examples of construction, but analyzes the interaction of the concrete and the reinforcement and shows the service that each can be depended upon to render and the manner in which that service is rendered.

In his preface the author states that it has been his aim to make the book "a complete treatise on the properties of concrete and reinforced concrete, as applied to construction," and it is only fair to say that he has met with a large measure of success. The subject is so extensive that a smaller volume would have necessitated undesirable condensation, and it is only after a careful review of the book that the engineer, who has not been in the thick of the fight of its introduction can realize the extent to which this new combination has come and is coming into use. It apparently embodies the desirable features of steel construction and masonry, and by this happy union is invading the fields of both to such an extent that, as Mr. Reid says, we are in danger of going concrete mad, and against this he voices the word of caution that we are to remember "that reinforced concrete does not possess wonderful and mysterious properties such that it may be unscientifically and recklessly used. On the contrary, it should be used with the same care and judgment that has made other and older kinds of construction both safe and satisfactory." The author has evidently used the opportunities afforded by his position as engineer on the Bureau of Buildings to good purpose in gathering the materials by observation and practice from which the book is made up, and has succeeded in so putting them together as to make it a valuable work, and while he is evidently an enthusiastic believer in this type of construction, he also believes that its use should be "tempered with good judgment," for unless this is done "the ethics of good engineering will be violated."

North American Railroads: Their Administration and Economic Policy. By A. W. Hoff, Superior Privy Councillor, and F. Schwabach, Privy Councillor. The Germania Press, 5 Beekman street, New York City. Special expert private translation. Heavy paper; 447 pages, 8½x11 in. Full leather. Price, $25.

Readers of the *Railroad Gazette* are already familiar with the scope of this voluminous report, parts of which we published last fall. The two German councillors, sent by their government to see and describe American transportation conditions, reported in the greatest detail upon a wide range of topics, and now show us our own railroad system as viewed by German eyes, and add much that is curious and interesting in their comment upon differences in practice and the differences in racial temperament which have occasioned them. The *de luxe* edition at hand is a faithful and intelligent translation of the original, well adapted for presentation purposes, and a desirable addition to a railroad library. So far as we know, it is the only complete translation which has been made of this valuable report.

Facts About the South. By Richard H. Edmonds, Editor of the *Manufacturers' Record*, Baltimore, Md.; *Manufacturers' Record* Publishing Co. 72 pages. Price 50 cents, cloth; 25 cents, paper.

This is a summary of articles which have appeared in the Manufacturers' Record showing the growth and magnitude of the South as a commercial and industrial region, particularly with regard to its material progress during the past 10 years. It contains many tables of statistics, considerable historical matter and much optimism as to the future of the South. It is a record of large achievement and a forecast of larger growth.

CONTRIBUTIONS

Superelevation.

Pittsburg, Pa., May 10, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to the communications by Mr. John A. Fulton, in your issues of April 12 and May 3, on the subject of Superelevation, the writer of these articles has so far failed to grasp the simple elementary principles involved, that some notice of his error seems to be called for, lest the young engineers of the country be led astray.

First.—He used the term centripetal force after the manner of certain text books of past generations, not realizing that in the field of mechanics there is no such force. There may be resistance to centrifugal force producing radial stress; but the term centripetal force can have no application outside of the law of gravitation, and of magnetic attraction.

Second.—Mr. Fulton seems to have studied the case solely from the point of view of the friction of car wheels on steel rails, forgetting that car wheels have flanges having a certain function which they perform admirably.

Third.—The question of superelevation involves only a simple elementary problem in the composition and resolution of forces.

In Fig. 1, let g W represent the weight of the locomotive, and g F the centrifugal force due to the velocity and weight of the moving mass, and the radius of curvature, both acting through the center of gravity g. Then g R will be the resultant of these two forces.

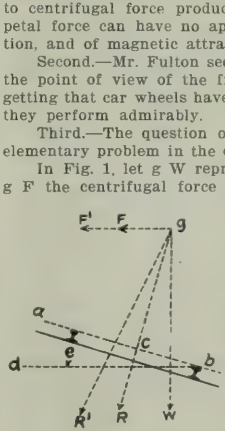


Fig. 1.

If the angle a b d of the superelevation is equal to the angle R g W then the resultant g R will cut the plane of the rail heads at the center of gage C; consequently the pressure of the load will be equally divided between the two rails, and its direction will be normal to that plane. In this case there can be no tendency to lateral movement.

If the speed exceeds that for which the elevation e has been determined, then the centrifugal force g F' will be greater than g F, and the resultant g R' will cut the plane of the rail heads at some point between the center c and the outer rail. In this case the pressure will be unequally divided between the two rails, the outer one bearing the larger proportion.

The difference F F' between g F and g F' will then be a disturbing force against the head of the outer rail, tending to cause it to slide or overturn as the case may be. The resistance to sliding depends on the details of the fastenings by which the rail is se-

cured. The overturning force may be readily analyzed after computing, for any given case, the difference F F' of the centrifugal forces, and the portion of the load borne by the outer rail, which counteracts the overturning tendency. The method of treatment is so elementary that it will readily occur to every competent engineer, and need not be elucidated here.

This does not take note of the guiding pressure of the flange against the rail head, which is a different problem.

THOS. H. JOHNSON.

The Profitable Weight and Speed of Freight Trains.

Union Pacific System,
Chicago, April 17.

To the Editor of the Railroad Gazette:

Concerning Mr. M. B. Wild's criticism of my previous letter: In order to arrive at a clear understanding of the question at issue, we will refer back to Mr. Wild's first statement, which showed that for moving 2,000,000 loaded car-miles the cost per loaded car-mile at varying speeds in miles per hour between terminals would be as follows:

10 miles	1.9 cents.
15 "	2.0 "
20 "	2.3 "
25 "	2.4 "
30 "	3.0 "

In other words, that for this amount of traffic the low speeds were cheaper. An additional computation provided that, since because of alleged greater rapidity of car movement locomotives at higher speeds could handle more ton mileage in a given number of hours, the net earnings on this additional ton mileage should be added to the net earnings on the original 2,000,000 loaded car-miles to show that more net revenue was produced by the same number of locomotives at higher speeds. The conclusion is obvious, even using his figures, that had the roads sufficient locomotives to move the additional traffic referred to at lower speeds, the cost of movement would be much in favor of such speeds; in other words, in making his comparison of net earnings at different speeds he compares the returns on moving 2,000,000 loaded car-miles at low speeds with the returns on a considerably larger volume of traffic at high speeds.

Now, the question naturally arises as to why Mr. Wild takes 2,000,000 loaded car-miles as the point below which it is cheaper to move traffic at low speeds and beyond which it is cheaper to move traffic at high speeds. Why could not another statistician with equal consistency take 5,000,000 or 10,000,000 as the limiting point, or even go further and take the entire ton-mileage of the railroads in the United States? In this connection it is interesting to note that, as shown by statistics of railroads of the United States published by the Interstate Commerce Commission for 1905 as compared with 1902 (the first year for which information is published), the ton-mileage of freight handled has increased only 18 per cent. and passenger-mileage 21 per cent., yet the tractive power of locomotives provided to move it increased 36 per cent., indicating that there has been considerably more available motive power to move traffic than in previous years when there was no question of congestion.

A review of the statistics published by the Interstate Commerce Commission will show that with but little change in traffic rates the effect of an increase in the past 10 years in prices of material (in many cases from 50 to 75 per cent.), and a general increase in the price of labor, has been just about neutralized by economies due to heavier loading of trains, which have provided greater revenue for each train-mile run. Therefore, it would seem equally evident that had the current traffic of the roads of the United States been handled in smaller train loads as suggested by Mr. Wild because of increases in speed, the expense of its conduct would be vastly increased because of the increased train mileage that would have to be run on account of the loss of locomotive tractive power wasted as a result of faster speed requirements, to say nothing of increased liability to accident because of greater speed.

It seems to me perhaps the greatest objection to Mr. Wild's computation is that it is physically impossible to carry the relative loads shown in his table at the speeds he mentioned, inclusive of delays. Even if the speeds were *exclusive* of delays, the reduction of load in accordance with speed is not great enough according to accepted resistance curves. For example, comparing speeds of 10, 15 and 25 m.p.h., Mr. Wild estimates the cars per train would be respectively 40, 35 and 24. According to the curve of the Master Mechanics' Association, if 40 cars can be handled at 10 m.p.h. on say a four-tenths of 1 per cent. grade, which is a fair one to take, only 32 cars could be moved at 15 and 20 cars at 25 m.p.h. However, the fact seems to have been lost sight of that to make a speed of 25 m.p.h. inclusive of delays, which he calls the most economical one, vastly higher speed must be made when actually running between stations than for lower speeds per hour inclusive of delays, as the delay item is constant and is certainly as great for the higher speeds as for the lower on account of the greater number of meeting points because of increased train mileage to move an equivalent traffic, whilst the total running time from which delays must be deducted to get the allowance for actual running time is much smaller in the case of higher speeds. For example, let us take speeds of 10, 15 and 25 m.p.h. for a division say 120 miles long, allowing, say, a minute to the mile for delays en route, taking water, meeting trains, etc., which is none too much. We have then the following:

Speed per hour between terminals, including delays	10	15	25	
Length of run, miles	120	120	120	
Running time between terminals, including delays	12 hrs.	8 hrs.	4 hrs.	48 min.
Allowance for delays, 1 min. per mile	2 hrs.	2 hrs.	2 hrs.	
Running time, excluding delays	10 hrs.	6 hrs.	2 hrs.	48 min.
Speed per hour, excluding delays, miles	12	20	43	
Estimated loaded cars per train that could be hauled at these speeds	36	25	8	
Estimated loaded car-miles per eng.-hr.	360	375	200	

The above indicates that 25 m.p.h. *including delays* is not only an impracticable freight train speed on account of excessive speed necessary between stations, which reduces the train load to extremely small proportions, but that little more than half as many cars can be gotten over the road per engine hour as at speeds of 10 to 15 m.p.h., including delays, to say nothing of less safety in operation and enormous increase in the number of trains run to handle a given traffic.

Speeds of between 10 and 15 m.p.h., such as found in existing railroad practice, fit in well with employees' wage schedules, do not require overtime, and require about the right speed between stations to handle the maximum traffic to the best advantage.

W. A. WORTHINGTON.

The Rehabilitation of the Brooklyn Rapid Transit Company.

(*Concluded.*)

The previous article outlined the history of the Brooklyn Rapid Transit Company and the condition of the property in 1902, when Mr. Winter was made President and began the work of rehabilitation, concluding with a description of the new elevated shops and yards at East New York and at Thirty-sixth street. This article describes the many other physical improvements recently made, including surface car barns, terminals, reconstruction of tracks and elevated structures, new rolling stock and power house equipment.

At Ninth avenue and Twentieth street a new and modern surface car barn and shop has been built during the last year. This plant, like the two new elevated terminals, is notable as an example of the most approved construction and arrangement. It was designed to be as nearly fireproof as possible, not only to reduce the insurance rate, but more especially to protect the company against a severe crippling of its service in the event of the destruction by fire of the cars stored there. The new buildings occupy the whole block between Ninth and Tenth avenues and Nineteenth and Twentieth streets. The old depot of the Nassau Electric Railway formerly stood at the corner of Ninth avenue and Nineteenth street and an open storage yard had been built in the rear. The old building was torn down and the open storage yard covered with fireproof sheds. The storage tracks were occupied during the entire rebuilding.

Back from Ninth avenue the ground slopes away and this contour was taken advantage of by making the building fronting on Ninth avenue two stories high, the lower level being below the street and reached from the Tenth avenue end. The building is of brick and reinforced concrete throughout. At the north end, on the Ninth avenue level, are 10 stub-end storage tracks in five bays, each separated by a firewall. The floors are reinforced concrete with vault lights for lighting the storage tracks on the level below. The roof is of the saw-tooth type. The south end of the building contains, on the street level floor, offices for the operating department, wash and locker rooms and a large recreation room with pool tables and bowling alley for motormen and conductors. On the floor below are the boiler room, store room and repair shop.

The track entrance to the low level is from Tenth avenue. There are 14 tracks in bays of two tracks each, separated by firewalls which are carried up 3 ft. above the roof as an additional precaution. The storage shed, covering the greater part of the tracks on the low level, is one story and of fireproof construction throughout. It is separated from the building facing on Ninth avenue by a clear space of 50 ft., but the tracks are continued into the lower floor of the other building. The four tracks on the south side are used for inspection only. Such cars as need repairs are run on through to the shop in the adjoining building which is served with an overhead traveling crane for dismantling. All cars using this terminal are regularly inspected every three days and overhauled every 30 days, as on the elevated lines. For convenience in running cars in and out of the depot without interfering with operations of cars continuing on beyond, two tracks have been laid completely around the block. The inside track connects with all the storage tracks; the outside track is used as a through running track. This saves much wear and tear on the special work connecting the storage tracks. From the corner of Tenth avenue and Twentieth street connection is made by a double-track line down Gravesend avenue, with the Culver line to Coney Island, which

turns into Gravesend avenue at Thirty-sixth street. This depot thus affords a convenient starting point for extra cars during the rush hours. The cost of these car barns and shops was $445,000.

The old terminal station of the South Brooklyn Railway at Thirty-eighth street and Second avenue was rebuilt in 1903-1904 and new machinery installed for a general repair and paint shop for surface cars. This improvement cost $100,000, and while not to be classed with the Ninth avenue depot, affords the needed facilities for carrying on this class of work. A new surface car depot is now in course of construction at Maspeth to replace the old depot at that point, and a storage and inspection shed for the Myrtle avenue elevated line is building at Fresh Pond road on the Lutheran cemetery extension. Large amounts of money have been spent on surface car storage yards at other points.

In order to provide for more efficient and convenient distribution of traffic between elevated and surface lines important changes were made in most of the outlying terminals to facilitate the transfer of passengers. Because of the failure of the city to make suitable arrangements for improvements at the Brooklyn Bridge little has been accomplished in that direction to relieve the crush during the rush hours in the morning and at night. At other times, however, through service to the New York end has been provided by making connections (in 1904) with the bridge tracks from Fulton street and Adams street. The present switching tracks and platforms at the New York end can accommodate only five-car trains, and, as the shuttle cars running over the bridge are wider and will hold from 20 to 25 per cent. more passengers than the standard elevated cars, no through elevated service is attempted during the rush hours, when the capacity of the bridge is taxed to its utmost. The changes at the Brooklyn end afford only a small measure of the needed relief, but until an entire rearrangement of the bridge terminals at both ends and the method of operating is carried out, little more can be done. Work is now under way on the subway loop connection between the Williamsburgh and Brooklyn bridges which, when completed, should afford much better operating conditions.

At the Williamsburgh plaza in Brooklyn a well designed system of surface car loops and connections has been built at a cost of about $80,000. Ample space was available here but the temporary terminal at the New York end supplied by the city is unsatisfactory and entirely inadequate. No physical connection has yet been made between the elevated tracks on the bridge and the Broadway line of the Brooklyn Rapid Transit. In 1904 also, four additional loop tracks for surface cars were built at the New York end of the Brooklyn Bridge at a cost of $100,000, doubling the capacity of the surface terminal.

The surface lines converging at the terminals of the elevated lines in the outlying districts collect and distribute large numbers of through passengers bound for New York. As an extension of the free transfer privilege the company made arrangements at these points for transferring through passengers from the surface lines to the elevated lines and vice versa, thereby relieving the surface lines as far as possible of the unavoidable congestion in the downtown district and greatly reducing the total car mileage.

At Thirty-sixth street and Fifth avenue, in connection with the new shop built at that point, the station was entirely rearranged. The Bay Ridge and West End elevated lines come in from the south and west and the Culver and Sea Beach lines from the east. These lines converge into two northbound and two southbound station tracks which can be occupied by trains from either division. The station tracks extend about 500 ft. beyond the platforms before entering the double-track Fifth avenue structure leading into the city. With this arrangement eight trains may be standing in the station at one time and when necessary one train can pass another on the adjoining track. Free transfers are issued to passengers leaving elevated trains and likewise by conductors of surface cars to passengers taking trains. The station is operated with an all-electric interlocking plant controlling train movements in both directions, and, during the rush hours of the summer time, when large crowds to Coney Island are being handled, it is very busy, but seldom congested.

Similar but less elaborate terminal arrangements have been established at Ridgewood, East New York, Cypress Hills and Bay Ridge. At Prospect Park station on the Brighton Beach line at Sterling place, the elevated trains run in an open cut. Surface cars formerly ran over the same tracks to the beaches, but now the surface car lines centering at this point run around an overhead loop and transfer all passengers to the trains below.

The terminals at Coney Island have been completely rebuilt to meet the rush of the enormous summer traffic. The most important is the Culver terminal, which is used by all surface cars running to Coney Island proper, and by the elevated trains of the Culver and Brighton Beach lines. It is on Surf avenue, the principal thoroughfare, in the heart of the amusement parks. There are four stub-end tracks for elevated trains which will accommodate six-car trains and on which 42 trains an hour can be handled in and out. Five surface car loops under a shed to the west can handle 300 cars an hour. All the tracks are protected by a mechanical interlocking machine with 54 levers. In connection with the terminal are an inspection pit and shop for light repairs, a sub-station, trainmaster's office and employees' waiting room and restaurant. A large storage yard was also built in which to hold the cars necessary for the rush of homewardbound traffic in the evening.

West of the Culver terminal on Surf avenue is the terminal of the Sea Beach line over which express trains are run to New York. Only minor changes have been made here. Still further west is the terminal of the West End elevated line, which skirts the shore of New York bay through Bensonhurst, Fort Hamilton and Bay Ridge to Thirty-sixth street depot. The storage yards and interlocking plants in connection with these two smaller terminals have been remodeled and enlarged.

The total expenditures from October, 1902, up to and including December, 1906, for shops, car barns and new terminals were a little more than $1,800,000.

The amount spent on tracks and structures during the same period was $4,300,000. The largest single item in this list is $675,000 already spent on the improvement of the Brighton Beach line, which will cost, when finished, about $2,500,000. This improvement will eliminate all grade crossings between Franklin avenue, where the line leaves the Fulton street elevated structure, and Brighton Beach. Between Church avenue and Brighton Beach the line is being four-tracked and a through express service will be run with a local service on the outside tracks.

The double-track line turns south from the Fulton street elevated at Franklin avenue on an elevated structure over private right of way. This is to be abandoned. A solid earth fill between concrete retaining walls is being built to Park place, where the tracks enter an open cut. This fill is being made wide enough for four tracks, if they are eventually needed, and will materially improve the alinement. From Park place to Sterling place, where a transfer terminal has been built, the line is depressed in an open cut without retaining walls. The arrangement of two tracks in the cut will be left unchanged for the present as far south as Church avenue, about one-half mile beyond this station, where the heavy work begins.

From Church avenue south the old line, the Brighton Beach Railroad and later the trolley line, ran on the surface. It is now being depressed in a four-track cut with heavy concrete retaining walls as far as Fiske terrace, just beyond which it crosses the Bay Ridge line of the Long Island Railroad, which is also being depressed as part of the New York Connecting Railroad improvement. Formerly the trolley line crossed the steam road under grade but the relative position is to be changed, the Brighton Beach tracks coming up to grade at this point and running on a fill beyond. This fill, which will be wide enough for four tracks and from 16 to 25 ft. high, extends to Sheepshead bay, about 3½ miles. All road crossings will be undergrade. The Manhattan Beach line of the Long Island Railroad, from Fiske terrace, south, is to be relocated parallel to the Brighton Beach line and on an extension of the same earth fill.

Express stations on the new line will be at Foster avenue, Kings highway and Sheepshead bay. At the street level these are being built of vitrified brick finished with ornamental tile and will have stairways leading up to island platforms above. All of the stations are being designed so as to collect fares from passengers before entering the trains instead of collecting on the trains as at present. Third-rail operation will eventually be installed in place of overhead trolley. This Brighton Beach improvement is heavier work than much of the reconstruction which steam railroads have to make, yet the Brooklyn Rapid Transit Company cannot charge anything like the steam road rates for its long distance travel and even has to fight to charge 10 cents to Coney Island, which is 11½ miles by the shortest of the B. R. T.'s lines from New York. When the improvement is completed the express running time over the Brighton Beach line will be reduced to 28 minutes.

The next largest item of expense under the general heading of track and structures is the rebuilding of the Canarsie Railroad, formerly the Brooklyn & Rockaway Beach, a steam dummy railroad from Atlantic avenue, East New York, to Canarsie Landing, three miles. This was rebuilt last year, one mile of the line in Vesta avenue having been placed on a steel double-track elevated structure which connects with the Fulton street line at Eastern Parkway, East New York. The right-of-way of the Brooklyn & Rockaway Beach on Vesta avenue is side by side with the right-of-way of the Long Island's Bay Ridge line, which is being rebuilt in connection with the extensive terminal improvements of that road in Brooklyn and Long Island City. The Long Island line will be depressed and the street raised, but the new elevated road has been built high enough so that there will still be head room. The steel pillars of the elevated structure rest on concrete foundations which will form part of the retaining wall on one side of the Long Island's depressed tracks. The construction and reconstruction of this line cost $363,000.

The Myrtle avenue elevated line used to end at Ridgewood. From this point the Bushwick steam dummy railroad, about one

mile long, ran to the Lutheran cemetery. This was another of the steam roads bought by the Brooklyn Rapid Transit. It has been connected with the Myrtle avenue line by an incline at Ridgewood. The elevated trains now run through to the Lutheran cemetery, the terminus being at Metropolitan avenue in the borough of Queens. At Fresh Pond road, as already mentioned, a storage and inspection yard holding 150 cars is being built. The cost of these improvements up to the end of 1906 was $276,000.

Various other surface lines have been reconstructed and extended and other improvements made at a total cost of $950,000.

With the exception of the Fifth avenue elevated line, most of the elevated structures were in bad condition in 1902. More than $500,000 has been spent to date in rebuilding and repainting them. The old latticed truss cross girders have been replaced by heavy plate girders and the stringers reinforced. In some places this was done with great difficulty owing to the limited space between the structure and the buildings, which prevented insertion of the cross girders in one piece. Where this condition existed, the girders were cut in two at the center, erected in halves and riveted together in place. The entire structure has been bonded for return power circuits at a cost of $42,000. Hand railings have been built along the foot walks. Many of the station platforms had to be lengthened to accommodate the six-car trains introduced with electric operation, and this item alone amounted to over $70,000.

On the surface lines, large amounts have been expended each year in repairing and improving tracks. In one year alone 75 miles of track were electrically welded to prevent leakage of return current and in four years $750,000 was spent for paving between tracks and repairs to pavements made necessary by changes and repairs to tracks, special work, etc.

The interlocking plants have all been thoroughly overhauled and 15 new ones installed. Most of these are mechanical plants, but those at Cypress Hills and East New York are modern electro-pneumatic plants, while that at Thirty-sixth street and Fifth avenue is all-electric. The total cost of these improvements and additions was $155,000.

With the change from steam to electricity on the elevated lines and the enormous increases in surface traffic the company has with difficulty kept pace with the demand for power. In 1901 it operated its surface lines with approximately 30,000 h.p., at times buying extra current from some of the lighting companies. It had six power houses, the three largest being at Kent avenue and Division avenue in Williamsburgh, at Third avenue and Fourth street, and at the foot of Thirty-eighth street. These plants generated direct current with reciprocating engines which was distributed at 600 to 650 volts over wide areas with consequent large transmission losses. Before the elevated lines were changed to electric operation, contracts were let for the construction of a new Central power house adjoining the old Third avenue plant. Plans were made for installing eight 4,000-h.p. reciprocating units which generate alternating current at 6,600 volts and distribute it to six sub-stations, where it is converted into direct-current at 500 volts. This plant was completed and put into full operation in 1904 and approximately doubled the company's available power. Before it was finished, however, an additional 4,000-h.p. unit was added to the Eastern power station in Williamsburgh, and plans were made to build an entirely new station adjoining that plant in which high-tension alternating-current generators with a capacity of 112,500 h.p. were ultimately to be installed. Work was begun on the first section of the addition early in 1904 and $2,200,000 has already been spent.

The new Williamsburgh station when completed will be the largest electric generating station in the world. It will have an overload capacity of 150,000 h.p., or 30,000 h.p. more than the present total requirements of the Brooklyn Rapid Transit Company during the hours of heaviest travel. The completed part of the new station contains one 7,500-h.p. and three 10,000-h.p. direct-connected horizontal turbine units generating high tension alternating current. The arrangement of coal handling machinery, coal storage, boiler rooms and all accessory apparatus is in accordance with the most modern practice. Coal is delivered in barges alongside a hoisting tower 135 ft. high. Clam shell bucket hoists raise it to feed pockets over crushers through which it is delivered to bucket conveyors and carried up to the top of the tower, thence across to the top floor of the boiler house and dumped in storage pockets. Two hoists each with a capacity of 100 tons an hour have been installed. The 72 water tube boilers which are to be installed are arranged in 18 batteries of four boilers each on each of the two floors. Only 34 boilers are now in commision. They are hand fired, coal being delivered by gravity to the floor in front of the fire doors from storage pockets above. Ashes are removed in metal dump cars handled by an electric locomotive running on an industrial track and are dumped into a conveyor which discharges them into reinforced concrete cinder pockets built in the hoisting tower. They can be dumped from here into barges alongside or into the company's ash-collection cars. Boiler feed-water is obtained from the city mains and from wells sunk nearby; condenser water is drawn through an intake tunnel from the river. All high tension switches, bus bars and feeder connections are built in fireproof brick niches on the gallery floor overlooking the generator room and the main switchboard and instrument panels are also on this floor. In the addition now under construction there will ultimately be installed four 15,000-h.p. turbine units. There is room in the present building for one more 15,000-h.p. unit, which has been contracted for.

The system of distributing current from the power houses has been entirely rearranged. All feeders, both high and low tension, leading to substations and other points have been, with few exceptions, removed from overhead pole lines and laid in underground conduits. A complete system of negative return feeder cables has been put in to save power losses. This work alone has cost nearly $2,000,000. Fifteen new substations have been or are being built at a cost of $1,260,000. Twelve of these are already in operation. They are in general of similar construction, of brick or reinforced concrete, one story and basement. The oil switches and feeder connections are in the basement and the transformers, rotary converters and switchboard on the ground floor. The high-tension current at 6,600 volts is stepped down through air-cooled transformers to 300 volts and fed to rotary converters which deliver direct-current at 550 to 600 volts. The converters are all 1,000-k.w. capacity. The largest stations are designed to contain six such units. The total amount spent for new power equipment and improvements during the four years ended with 1906 is about $8,250,000, and when the Williamsburgh station is finished the amount will be $11,500,000. The company is now in a position to meet the demands of the future for power for some time to come, even allowing for an excessively large increase over present requirements.

The evidence of the far reaching policy of improvement adopted by the company most visible to the traveling public is the condition of the rolling stock. More than $10,000,000 has been spent in four years for new elevated and surface equipment and in rebuilding old steam equipment, in addition to heavy annual expenses for maintenance of equipment in service. On the elevated lines 628 old steam cars were rebuilt, wired and the motor cars equipped with multiple unit control and motor trucks. When turned out of the shops these cars were practically new. The motor cars were equipped with two 150-h.p. motors each, and all cars had automatic air-brakes applied. For new equipment the company adopted a standard design of convertible motor cars with steel underframes and metal sheathed sides. These cars seat 60 passengers, have a center aisle and reversible seats and are quickly converted from open cars to closed winter cars with suitable heating arrangements. There have been bought and placed in service 320 new cars of this general type.

For the surface lines 650 new double truck motor cars have been bought. The newest cars are large and modern in every respect. They have steel underframes and sides, are convertible for summer and winter service and will seat 48 passengers. They are mounted on high-speed trucks carrying four 40-h.p. motors and are fitted with air-brakes. With a total of 3,454 cars available for service the company operates an average of 2,021 cars a day.

The following is a summary of the principal expenditures charged to capital account between October, 1902, and December, 1906:

Shops, car barns and terminals	$1,808,500
Power houses and power equipment	8,122,000
Tracks and structures	4,763,500
Rolling stock	10,300,000
Right of way	8,000,000
	$25,804,000

Of this sum $7,450,000 was spent in 1906. About the same amount will be spent in 1907 on improvements planned or under way.

With the consolidation of the various surface and elevated lines there have come large extensions of the transfer privilege. One cause of the great crowding of the Brooklyn Bridge in the rush hours is that passengers from points outlying from terminal and junction points on the elevated lines such as Thirty-sixth street, Fifth avenue and Ridgewood can come to those points by trolley and transfer without paying another fare to the elevated lines, which lead directly across the Brooklyn Bridge to New York. Thus thousands of people can live remote from the city and the through lines and yet have the use of the elevated lines as cheaply as those who use them direct. Last year also the transfer privilege between surface lines was greatly extended by issuing in most cases a transfer on a transfer as long as desired, so that it is generally possible to go from any point on the surface lines to any other point.* These are instances where the company has granted unusually favorable concessions to the public. The first has resulted in a great deal of extra traffic over the already heavily burdened Brooklyn Bridge (in 1882, the first year the bridge was open for traffic, 8,000,000 passengers were carried on the shuttle trains as against 150,000,000 on trains and surface cars last year), and the second in great abuse of the transfer privilege by passengers. Immediately following the extension of the transfer privilege on the surface cars, the number of passengers carried and the number

*This, of course, does not apply to the lines owned by the Coney Island & Brooklyn Railroad, which is not owned by the Brooklyn Rapid Transit Co., and which operates the DeKalb avenue, Smith street and Franklin avenue lines, the last two of which go to Coney Island.

of car miles run considerably increased, while gross earnings fell off sharply and have continued to do so since. A new system was put in operation on May 9 under which a passenger is limited to two, or in the case of "feeder" lines like the short Montague street cable line, which runs from the Borough Hall to the Wall street ferry, on which continuing trip tickets are issued, three transfers. A white transfer is issued for a continuing trip from a feeder line and also in emergencies. In all other cases a yellow transfer is issued for a cash fare and a green transfer for a yellow transfer. The holder of a green transfer is not entitled to another transfer. On the green transfer the name of the line which originally issued the yellow transfer for which it is given in exchange, is punched, to prevent the passenger from transferring back to the line on which he first rode. Although the company is anxious to be as liberal as possible in this relation to the public, the transfer system has been so grossly abused that this limitation is necessary. With unlimited transfers given for the asking there has been a regular exchange of transfers between employees of many of the large department stores and factories in spite of the State law prohibiting the sale or exchange of a transfer by the original holder. More than this, many people found it possible to secure what amounted to a round trip for a single fare. Like all problems which the company has to face where the public is immediately concerned, this is a difficult one.

A future measure of relief for the great congestion of surface cars on Fulton street during both the morning and evening rush hours lies in the law enacted by the Legislature during the present session providing for the adjustment of the cost of widening Livingston street, which parallels Fulton street for about a mile. This is to be paid by the whole city of New York on the ground that the diversion of traffic through that street, thus relieving the great delays on Fulton street, will be of benefit to the city as a whole. The franchise for this parallel route is pending, and if granted the company is to at once build the new line. As indicating the difficulty of carrying out any plan which involves the consent of the city, the Brooklyn Rapid Transit has for two years been trying to get this permission to occupy the street in order to relieve conditions which daily cause immense inconveniences to the traveling public.

Directly connected with the Livingston street improvement is a fresh problem of great importance with which the company is now face to face. The subway from the Battery, Manhattan, to Brooklyn is to be in operation before the end of the year. Anyone who stands in the Brooklyn Bridge station of the New York subway during the rush hour can get an idea of the very large number of people who, instead of crossing the Brooklyn Bridge, as they do now, will continue on the subway to the Battery, and thence go under the river to Brooklyn. This subway is to run only as far as Fulton street and Flatbush avenue, about half a mile beyond the Borough Hall. The first station is to be at the Borough Hall, and here most of the passengers will leave the subway to take different surface lines which center there. This is, of course, some of the most valuable land in Brooklyn, much of it belonging to the city, yet some arrangement must be made by the Brooklyn Rapid Transit for a station to handle the immense crowds which will leave the subway at this point to take the surface lines. Plans for this station are under consideration but no definite decision has been reached.

In 1906 367,567,567 cash passengers and 126,924,245 transfer passengers were carried, a total of 494,491,812 for the year. An average of 2,021 cars are operated daily on 488 miles of surface track and 69 miles of elevated track, a total of 557 miles (including first track, second track and sidings), yet in a single day more passengers are carried on this 260 miles of line (231.5 miles on city streets, old steam railroad rights of way and East river bridges and 28.5 miles on elevated structures) than on the thousands of miles of line of all the railroads west of the Mississippi combined. This gives a hint of the tremendous problems which the company must meet.

The work outlined above which has been going on for the last four years has accomplished much, but the rehabilitation is not yet entirely finished and cannot be for some years to come. The large and steady growth in the outlying districts of Brooklyn and Queens alone will require each year corresponding expansion of transit facilities. In the end, however, the Brooklyn Rapid Transit will undoubtedly reap the benefit of increased earnings, which are already beginning to show. Some of its most serious problems cannot be avoided. The geographical limitations to expansion in the congested business district, the heavy summer traffic to seaside resorts—which requires an enormous outlay in plant, bringing in little or no return during half the year—and the rush-hour traffic at night and morning to and from Manhattan Island are difficulties which are inherent to the system. On the other hand, within the next few years better arrangements will undoubtedly be made for collecting and distributing through traffic at the Manhattan terminals of the two bridges now completed and the third bridge soon to be begun. This is the crux of the whole situation. Not until all the parties in interest, the city, the citizens and the company, resolutely co-operate in carrying through with all speed the long delayed plans for a comprehensive scheme of bridge terminals and connections in Manhattan, can the Brooklyn Rapid Transit best serve the interests of both its patrons and its owners.

Railway Signal Association.

The May meeting of the Railway Signal Association was held in New York City on Tuesday of this week, Vice-President A. H. Rudd in the chair. About 100 members were present. The meeting place has been changed to the spacious and elegant hall of the American Society of Civil Engineers, in the society's building at 220 West 57th street.

The first discussion was on a progress report of Committee No. 15. This committee has taken the specifications for mechanical interlocking, which were adopted last year, and made such additions and changes as were thought necessary to adapt them for drawbridge interlocking. The meeting spent an hour or more on the various details. The principal paragraphs on which definite action was taken were Nos. 29, 48, 49, 71 and 180. No. 29, "a separate lever must be provided for each set of locks," was referred back to the committee because the meeting was at sea as to the meaning of the word "set." No one knew whether it meant the locks for one track or two or more tracks. Paragraph 48, prescribing the use of pipe lines for all connections except distant signals, was discussed at length, and finally it was voted to recommend to the committee that pipe lines be used for connections to switches and locks within 700 ft. of the cabin and to signals within 1,200 ft. of the cabin; the understanding being that switches and signals at distances greater than those here specified should be worked by power and not manually. This motion was carried by a vote of 19 to 12.

Paragraph 49 was referred back to the committee with the recommendation that the committee consider specifications for the weight and composition of pipe for interlocking connections. There was some discussion as to the desirability of using parallel or tapered threads in pipe couplings. No definite recommendations were referred to the committee. The committee was also instructed to report on specifications for signal posts and foundations, which do not form a part of these specifications. In accordance with the recommendation of the committee the meeting approved the reinsertion of paragraph 71, requiring cranks with arms 11¾ in. long. At the Washington meeting this paragraph was stricken out, and it is now proposed to reinsert it. Paragraph 84 was amended by striking out the word "separately," so that it reads, "Compensation shall be provided for each pipe line," and was adopted with the amendment. Paragraph 180, which proposed a method of mounting compensators, pipe carriers and other parts on a continuous timber fastened at the center of the draw span, and running the full length of the structure, was rejected. The object of the proposed construction was to overcome the difficulty due to the unequal expansion in the bridge structure and in the pipe lines. As none of the members had ever tried such construction it was deemed inadvisable to embody it in the standard specifications.

A paper on "How to Reclaim Storage Batteries After Having Been Improperly Used," by Mr. J. E. Hackman, Supervisor of Signals, Lehigh Valley, was the next subject considered. The author described the methods to be employed in restoring to their normal condition storage batteries which have been repeatedly overdischarged and the plates badly sulphated. The method described was used by the author in reclaiming two well-known types of batteries, and the results were very satisfactory. Following the reading of the paper, Mr. L. H. Flanders, of the storage battery department of the Westinghouse Machine Company, gave a short talk on some of the principal difficulties encountered in maintaining storage batteries, the methods to be employed in testing for failures and in remedying some of the most common defects. The morning session adjourned at 1 o'clock.

The first thing in the afternoon was the reading of a paper by Mr. Byron E. Eldred on copper-clad steel wire for electric purposes. Mr. Eldred gave a description of the "Monnot wire," recently invented by J. Ferreol Monnot. This substance is made from billets which have a steel center, with a copper coating. In a billet of say 4 in. diameter, one-tenth, more or less, will be copper, the steel being in the center. This billet is drawn down to make a wire of any desired diameter without causing any trace of separation between the two metals, and while still maintaining the copper coating at a uniform thickness throughout the circumference of the wire. Copper-clad steel billets have been heated with a blow pipe to such an extent that the copper began to melt, and then chilled by immersion in ice water, yet the weld was not weakened. Attempts to separate the two metals in a billet by the use of a cold chisel cause breaks either in the steel or in the copper, but do not weaken the weld. The weld between the two metals is such that when strains are produced in the copper by reason of the difference in the rate of expansion of the two metals under heat, they appear to cause expansion at right angles to the axis of the wire or

rod. The steel appears to take up the longitudinal strains without appreciable deformation.

Figures were given showing the saving in cost of a copper and steel wire, as compared with a pure copper wire, when used for the same electrical purposes. The Westinghouse Machine Company uses copper-clad steel for turbine blading. Summing up the advantages of the new wire as regards greater tensile strength than copper, equally satisfactory conductivity and freedom from corrosion the author says:

It is considered good practice by signal engineers to use No. 10 B. & S. gage copper for overhead construction, either bare or in double or triple braid, while in five and seven pair cable No. 14 B. & S. gage copper is considered the standard of practice. It would thus appear that the conductivity of No. 14 B. & S. gage copper satisfies the electrical requirements while the tensile strength of a No. 10 B. & S. wire is desired. In other words the erection of No. 10 B. & S. copper lines in overhead construction necessitates the use of 32 lbs. of copper for each 1,000 ft. to secure required tensile strength. At present prices the copper for such a line costs $8.77 per 1,000 ft. Consider a No. 11 B. & S., 50 per cent, conductivity (Grade "C") copper-clad wire to displace the No. 10 pure copper. The No. 11 copper-clad wire affords the required conductivity while its breaking weight is greater by 156 lbs. The weight per 1,000 ft. is less by 8.7 lbs., and safety factor is greater. The cost per 1,000 ft. of such a high conductivity copper-clad wire would be $6.78, showing a saving in metal cost alone of $1.99 per 1,000 ft. in favor of the copper-clad wire, not to mention the other attendant advantages in cost of stringing a lighter, stronger, more durable wire, allowing of much longer spans.

In most instances signal engineers will probably prefer to use Grade "A," 30 per cent. conductivity, copper-clad wire, having greater electrical resistance but allowing of the use of a much smaller conductor of higher tensile strength. Where possible to make such applications of copper-clad wire, a No. 13 B. & S. gage Grade "A" wire with electrical resistance at 60 deg. F., of 6.543 ohms and breaking weight of 488 lbs., affords a considerably greater safety factor than No. 10 B. & S. gage copper. Such a copper-clad wire weighs but 14 lbs. per 1,000 ft. and costs less per pound than Grade "C," so that to-day's prices per 1,000 ft. would be $3.44, or a saving over No. 10 B. & S. gage copper of $5.58 per 1,000 ft., or a metal cost saving over pure copper now used in open-line construction of nearly 60 per cent.

Defective Rails.

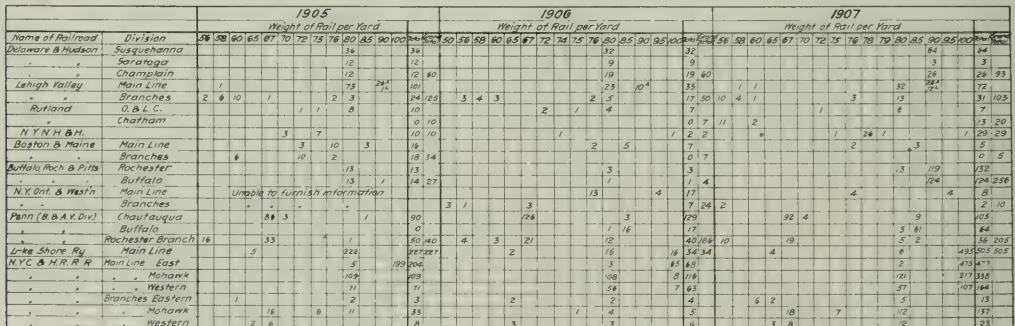
The rails furnished by the steel companies in this country have become so bad within the last five years, especially rails of 100-lb. and other heavy sections, that the American Railway Association is now investigating the matter, and proposes to ask the United States Steel Corporation to furnish specifications of chemical composition and manufacture, and then adhere to those specifications. We have collected a number of letters bearing on this subject from railroad officers, whose names we are not at liberty to disclose, and print extracts from them herewith. We also show the radical results found in the recent investigation by the New York Railroad Commission. It will be observed that 495 rails of 100-lb. section were broken and removed from the main line of the Lake Shore & Michigan Southern in New York State during the first three months of the current year, out of a total of 505 rails broken. Also that 475 100-lb. rails broke on the New York Central main lines east in New York within the same period, out of a total breakage of 477 rails. On the main line of the Mohawk division, 217 100-lb. rails broke in three months; on the western main lines (within New York State) 107 100-lb. rails broke. The total number of 100-lb. rails broken within the state in January, February and March was 1,295; a disgraceful record, for which the Steel Corporation is mainly responsible, as proved by the much lesser breakage of older rails, rolled according to specification. As pointed out in the editorial column, the companies have been unable to insist on their specifications since 1901, but have been forced to take what was given them. The kind of rails they receive are shown in the accompanying photographs.

Letters from railroad officers follow:

I regret to say that the records of our maintenance of way department have not, until quite recently, been kept in such shape as to render statistics on the question of the breakage of rails accurate or reliable, and consequently in speaking of this matter, I can only give you impressions and not substantiated facts. These impressions, however, are confirmed to a very large extent by conversations with the officers of other railroads, who, as a general rule, agreed that the breakages of steel rails during the last four or five years have become much more numerous than formerly, and may be properly described as excessive.

I do not think these breakages can be ascribed to any one cause, but rather to the cumulative effect of a number of causes acting together. Prominent among these, perhaps, is the modern tendency to insist upon constantly increasing the output of tonnage from a given plant. This involves, of course, higher speed being attained in the various processes of manufacture. This means, of course, that less time is consumed in the transformation of the steel from the ingot to the bloom and from the bloom to the rail, which is practically now one continuous process, where it used to consist of two or three separate processes. It also has the effect of increasing considerably the temperature at which the metal is worked, and this in turn is apt to produce somewhat less dense and homogeneous product. Forging steel at temperatures over red heat, as well known to steel experts, is ineffective.

Another cause which tends to help along these same results is the increase in the size and weight of the rail sections. It is manifest that in starting from the ingot or bloom of a given size less time and less pressure, or, in other words, less work upon the metal, is necessary to produce a section weighing 90 lbs. or 100 lbs. per yard than would be required to produce a section weighing 50 lbs. or 60 lbs. per yard, and in this way also the density and solidity of the metal in the finished rail is apt to be less in the heavier section which we are using to-day than in the lighter section used years ago. I believe that the section of the heavier rail is just as safe as the lighter section in relation to the loads carried, provided the density of the metal is the same in both



Rails Broken and Taken from Track During January, February and March, 1905, 1906 and 1907, in New York State.

Compiled by New York State Railroad Commissioners.

cases, and I do not think the section of the heavier rails *per se* is at fault.

It has been found that a considerable number of the breakages are due to what is technically known as "piped" rails.

This is a hidden defect which it is impossible to detect by the most careful surface inspection, and I believe can be attributed largely to the desire on the part of manufacturers for increased tonnage product. The process of casting the ingots from which rails are finally made, results necessarily in the upper portion of the ingot being more or less defective by reason of the contraction cavity and the occluded gases contained in small pockets on account of the molten metal being poured into the mould more rapidly than the gases can escape. This is common to all forms of steel castings, and it can be overcome by cutting off and discarding the

upper end of the ingot before rolling it into rails. This necessarily involves the wasting of a considerable amount of material, and I think it is very likely that in order to increase the tonnage and decrease the cost of production, the mills are discarding less of this metal than formerly, with the result that a larger per cent. of the finished product contains these defects, which it is impossible to detect until the rails have been subjected to considerable service, and which has the effect of eventually producing a broken rail.

From what I have said above, I think it will be apparent that an increase in the section of the rail is not likely to cure the difficulty, nor is it necessary as a measure of safety, nor do I believe that the chemical composition of the steel from which rails are made is subject to just criticism.

There are some measures which I believe could be adopted by the rolling mills which would improve the quality of their product:

First: A somewhat slower manipulation of the metal, resulting in the finishing of the rails at a lower temperature than is common at present, and to that extent increasing the amount of work or pressure which is applied to the metal, and consequently increasing its density and solidity.

Second: The discarding of a somewhat larger percentage of metal from the original ingot, which would have the effect of lessening the liability of hidden defects in the finished product.

This whole matter was gone into very carefully in two papers which I wrote a number of years ago. While I was a good deal less experienced as a railroad man then than I am now, I was fresh from a very close study of the methods of manufacture, which have not materially changed in respect to rails in the last fifteen or eighteen years. The conditions which I cited as bad when I wrote the papers I refer to have grown somewhat more accentuated, and because a heavier weight of rail is being used, there is actually less mechanical work being done on the steel than formerly.

—PRESIDENT.

We have had more or less broken rail this winter, but we did not seem to have as serious a time as some of the other roads. We have taken no steps to try to get different rail because the steel companies have been unwilling to change specifications, and the railroad companies have been obliged to take the rail as furnished by the steel companies or not get it.

My own notion is that the breakages are due to two principal causes: First, that the demand on the steel companies for rail is does not seem surprising to me that the roads should have many broken rails. On our road we are not having any trouble, because we have stopped at a 45,000-lb. axle load and a moderate speed.

—VICE-PRESIDENT.

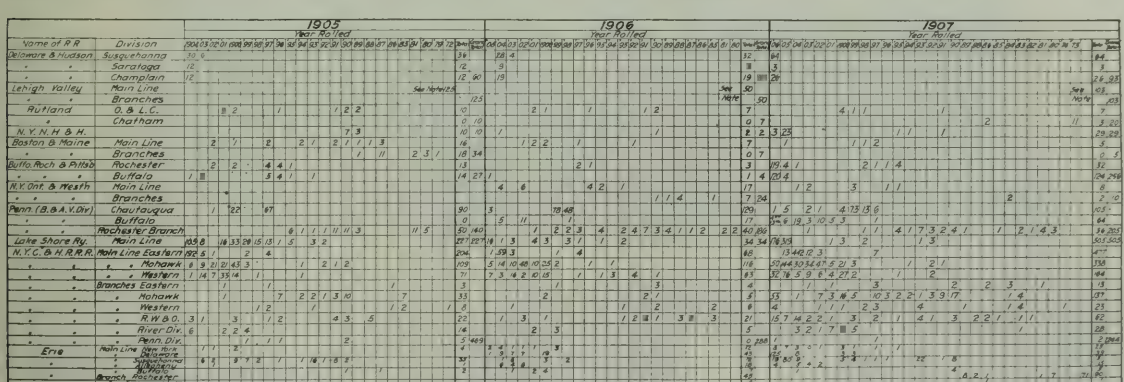
Personally, I think a good deal of the trouble with the wearing qualities of the present rails is due to a process of manufacture so rapid that the metal never cools and the minimum amount of work placed on them until they are turned into finished sections, and think that with concerted action on the part of the railroads and in conjunction with the rail manufacturers that the rail specifications should be made to govern the process of manufacture so as to accomplish a tougher rail and one that is free from pipes. We get rails that stand our specified drop tests and that are in composition according to our specification, but we do not get the wearing properties we should. It has also become a question in connection with the larger rail sections and the heavier loads whether the time has not arrived when the section of the A. S. C. E. should not be revised so as to distribute the thickness of the flange, web and head to be more uniformly the same throughout so that the heating and cooling would also be more uniform. I believe that the open hearth process is the one that should be generally adopted in the United States as rapidly as possible on account of the possibilities of reducing the phosphorus and sulphur.

—RESIDENT ENGINEER.

Your favor of the 6th duly received, and I have taken some pains to gather the information you desire from our Chief Engineer, who states substantially as follows:

I beg to advise that we have had more trouble during the past three months by rails breaking than at any other time in the past, and our trouble has all been with rails rolled in the summer and fall of 1906.

One mill furnished us with 3,000 tons of 90-lb. A. S. C. E. section on which we have had only three broken rails. Another mill furnished us during the same period 4,000 tons of the same section rail and we have had several hundred rails broken, the rails breaking principally in the flange. In taking the rail out in some cases we found the flange broken out at six different places. We have been investigating the matter, but have been unable to arrive at satisfactory conclusions as to the cause. We are still carrying on our investigations.



Rails Broken and Taken from Track During January, Ferbuary and March, 1905, 1906 and 1907, in New York State.

Compiled by New York State Railroad Commissioners.

so great that there is not the same care used to-day in making the rail that there used to be ten or twenty years ago; second, that the volume of business passing over the railroads has been so great in the last eighteen months that in spots the track is not as good as it used to be, due to this volume of business and to scarcity of common labor, and the poor quality of common labor.

As you know, many of the railroads throughout the country are overtaxed as to business, and the result of that is a strain on all departments, which increases the danger of poor work and risk of accident.

—PRESIDENT.

Your letter of April 6. I should say the quality of the rails furnished is gradually getting worse and the axle load of engines and their speed is gradually increasing. Under these conditions it

We are of the opinion that these breakages are not caused on account of the loads to which these rails have been subjected being carried to extremes. We have used this same rail section and same class of power with 50-ton steel cars for the past three years and have had but few rails break until the past three months of rails received last summer and fall. We are of the opinion that the trouble lies with the class of Lake Superior ore that is now being used in the manufacture of Bessemer steel for rails, there being too much phosphorus in the same, as by using the Bessemer process too much phosphorus is left in the steel. From indications the rails have been too severely gagged in straightening at the mills.

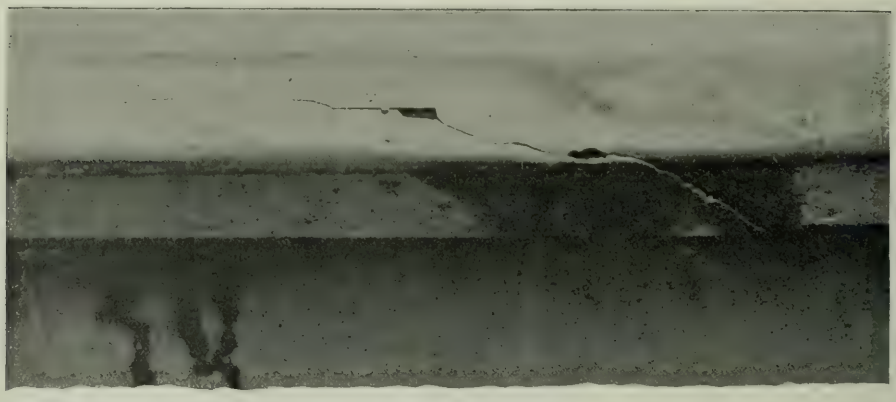
The principal railroads in this neighborhood have had the same trouble with last year's rolling of rails. Increasing the section I do not think would remedy it, as we have had 60 miles of 100-lb.



Fig. 1.



Fig. 2.



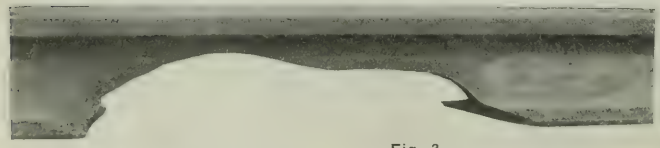


Fig. 3.

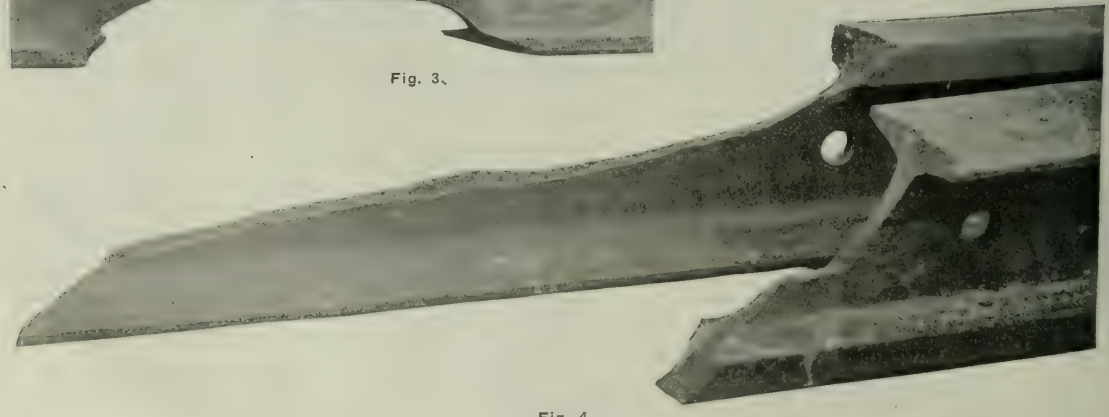


Fig. 4.
Defective 100-lb. Rails.



Fig. 5.

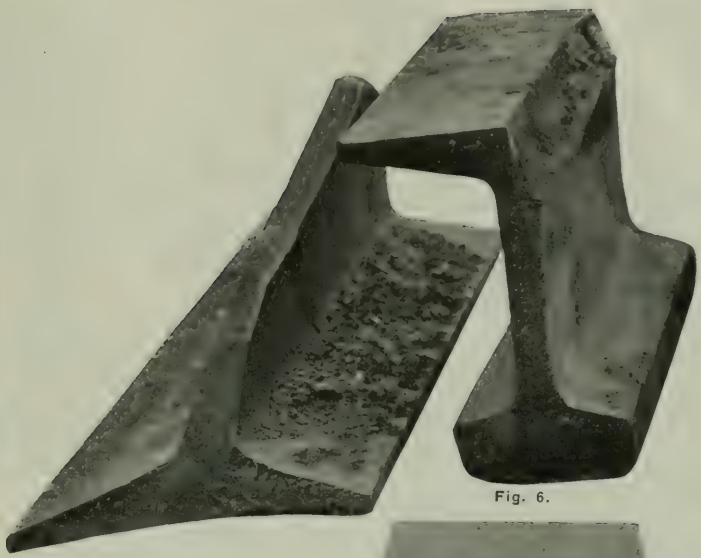


Fig. 6.

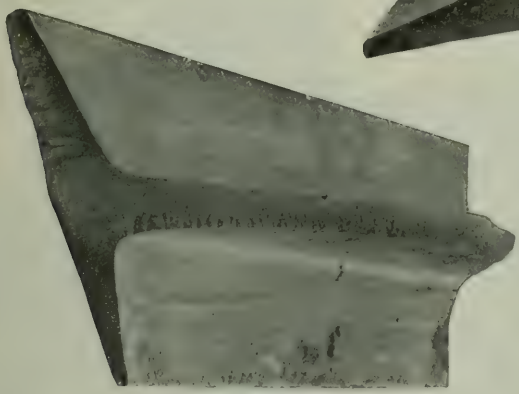


Fig. 7.



Fig. 8.



Fig. 9.



Fig. 10.

Defective 100-lb. Rails.

steel, rolled in 1898, which is to-day in the track and giving good service and on which we have very few broken rails.

—PRESIDENT.

Referring to your communication of April 13 in regard to breakages of steel rails:

I attach for your information a memo. showing our record of broken rails during 1906. This statement shows weight of the rail, temperature at time of break, and the date it was laid.

Our greatest trouble seems to be with the 90-lb. rail which was laid in 1898, 1899 and 1900, and the chemical analysis of this rail shows improper material used in the making of the rail.

We have had these matters up with the manufacturers, however, and naturally there is a dispute about it.

I hope this statement will be of use to you in reaching conclusions on this important matter. —PRESIDENT.

RECORD OF BROKEN RAIL.

Date—1906.	Weight of rail.	Temperature at time of break.	Date laid.
Main Line.			
Apr. 14	90 lbs.	.....	1898
May 1	90 "	.....	1900
July 17	90 "	80 above.	1898
July 21	100 "	.....	1903
Oct. 16	100 "	60 above.	1903
Dec. 4	80 "	40 "	1895
1907.			
Feb. 4	100 "	4 "	1900
" 4	100 "	4 "	1900
" 7	100 "	35 "	1905
" 8	100 "	.....	1902
" 8	100 "	.....	1903
" 8	100 "	.....	1902
" 17	100 "	.....	1902
Apr. 11	76 "	.....	1893
" 11	56 "	.....	1897
" 14	75 "	46 above.	1892
"A" Division.			
1906.			
Apr. 30	90 lbs.	.....	1899
May 21	90 "	70 above.	1900
July 6	90 "	65 "	1900
" 6	90 "	65 "	1900
" 20	90 "	75 "	1905
Aug. 27	90 "	65 "	1900
Sept. 15	90 "	60 "	1900
" 19	90 "	75 "	1900
Oct. 16	90 "	60 "	1898
" 25	90 "	65 "	1900
" 27	90 "	65 "	1900
" 30	90 "	60 "	1902
Nov. 1	90 "	50 "	1900
" 2	90 "	60 "	1898
" 6	90 "	60 "	1900
Dec. 4	80 "	8 "	1893
" 4	90 "	10 "	1900
" 11	90 "	45 "	1900
1907.			
Jan. 6	90 "	50 "	1899
" 7	90 "	60 "	1899
Feb. 9	90 "	30 "	1900
" 9	90 "	30 "	1900
" 16	90 "	35 "	1900
" 20	90 "	40 "	1900
" 20	90 "	40 "	1900
" 23	90 "	25 "	1900
" 26	100 "	30 "	1901
" 27	90 "	40 "	1900
Mar. 5	90 "	35 "	1900
" 14	90 "	45 "	1900
" 16	90 "	55 "	1900
" 18	90 "	50 "	1905
" 19	62½ "	40 "	1895
" 19	62½ "	.....	1895
" 19	70 "	.....	....
" 19	56 "	.....	Old.
" 21	90 "	50 above.	1905
" 23	56 "	70 "	Old.
" 23	56 "	70 "	Old.
" 31	90 "	50 "	1899
Apr. 2	62½ "	.....	Old.
" 11	90 "	50 above.	1900
Main Line.			
1906.			
Jun. 11	80 "	50 above.	1906
"A" Division.			
1906.			
Jun. 5	100 lbs.	75 above.	1903
Nov. 2	90 "	55 "	1900
" 16	100 "	70 "	1903
Dec. 10	100 "	40 "	1903
"B" Division.			
1906.			
Aug. 6	80 lbs.	88 above.	1905
Nov. 17	80 "	50 "	1905
"C" Branch.			
1907.			
Feb. 8	80 lbs.	.....	1905.
" 23	80 "	.....	1905
Mar. 12	80 "	.....	1898
Apr. 4	80 "	45 above.	1905
"D" Branch.			
1907.			
Mar. 1	80 lbs.	10 above.	4 days.
Apr. 11	80 "	50 "	1905
Miscellaneous.			
1907.			
Mar. 19	56 "	.....	Old.
" 24	80 "	35 above.	12 hrs.
" 25	80 "	60 "	1906

Reference to our records discloses the following cases of broken rail occurring on this line during the year 1906:

On 190 miles of 60-lb. steel laid between 1890 and 1893, and 16 miles laid in 1898, there were 38 rails broken during the first six months of the year, thirty-two being in cold weather and six in warm weather.

On 38 miles of 75-lb. rail laid in 1899 there were 45 rails broken during the year. Twelve of these were broken in warm weather and thirty-two in cold weather, and one on account of having been kinked by fire.

On 70 miles of 80-lb. rail laid between 1902 and 1905, there were seven rails broken during the year; one during cold weather and six during warm weather.

On 248 miles of 85-lb. rail laid during 1906, there were seventeen (17) rails broken during the year, five during cold weather and twelve during warm weather.

The above is summarized as follows:

Weight.		Age.	Broken rails, pr mile pr yr.
60-lb.	190 miles	15 years.	....
	16 "	9 "	0.37
75-lb.	38 "	7 "	1.18
80-lb.	70 "	1.5 "	0.10
85-lb.	248 "	6 mos.	0.20

Considering the number of years the 60-lb. rail has been laid, the broken rails per mile per year seems to average much less than in any of the heavier sections, disproving the theory that the rails are subjected to heavier tonnage than they can carry with safety, and would seem to give strength to the contention that the rails which are now being furnished are of an inferior quality compared with those rolled 12 or 15 years ago.

The cause of the inferior modern rail has been the subject of a great deal of discussion—two theories being advanced: one—which is generally accepted as correct—being that in the process of manufacture the rails leave the rolls at too high a temperature. The other theory is that interior strains are developed in the larger sections, which do not occur to as great an extent in the rolling of lighter rails.



Fig. 11—Defective 100-lb. Rail.

We are inclined to agree that the high temperature theory is the correct one. A number of the roads are endeavoring to limit the temperature of the rails as they leave the rolls, but I am without any definite knowledge as to in what degree this has been effectual in preventing breakages. —PRESIDENT.

I beg to say that the experience of this company is that we have had more broken rails during the past winter than heretofore.

I am inclined to think that rails rolled during the last few years are not so good in quality as those rolled ten or more years ago. We have had breakages of rails made by many different manufacturers, and of many different dates or ages. Possibly a considerable part of the increased breakage is due to heavier traffic and greater proportion of heavy engines than heretofore. On one line

upon which heavier engines were placed about two years ago, the breakages were very numerous. Piped rails, which did not show up the defects under the lighter engines, were quickly discovered after the new and heavy engines were placed in service. Negotiations are pending for some change in specifications, but mills seem to be very averse to meeting the wishes of purchasers in this respect. —CHIEF ENGINEER.

We seem to be immune in a measure from the general complaint relative to broken rail. During the past season we had 148 90-lb. rails break on approximately 1,500 miles of track laid with this type of rail; only eleven of these rails were rolled in 1905 and 1906, the balance run from 1898 and so on up. The great majority of these breakages were due to flaws and a few of them, in my judgment, to improper care. As you probably know, our freight power is comparatively light, the maximum being 128,000 lbs. on the drivers.

We can scarcely hazard an opinion as to the underlying cause of the trouble on other lines, because we are not acquainted with the conditions and the difficulty on our own road is no greater this year than it has been for a long period of years with lighter rail.

—VICE-PRESIDENT.

There was an increase during 1906 in both the total of defective and broken rails removed from track, and in the number of defective and broken rails removed per 100 miles of track. The ratio of increase of defects and breakages in 100-lb. rail was greatly in excess of that of the 85-lb. rail.

Our engineers have been giving the question much investigation and consideration, but do not feel prepared at present to express their conclusions as to the underlying cause of the trouble. We understand the whole subject will be a matter of discussion at the coming meeting of the American Railway Association, when no doubt much additional light will be thrown on it.

—PRESIDENT.



Fig. 12—Defective 100-lb. Rail.

Our investigations in connection with rail failures indicate that the cause of 90 per cent. of the failures is due to mechanical defects or lines of weakness in the flange, which become apparent after the break occurs in the form of a slight fold in the base of the rail.

We are receiving rails from one mill in which 80-lb. rails pass through the rolls 28 times. The breakages in this class of rail are very much less than those of any other brand of 80-lb. rails, and the phosphorus in these rails does not exceed .085 per cent. and the carbon averages .57 per cent. to .59 per cent. This result leads us to think that the proper remedy for rail breakages is to reduce the phosphorus and other impurities and to give a larger number of passes through the rolls, with the carbon high enough to prevent the ends of the rails from flattening. —VICE-PRESIDENT.

We certainly have had the same experience as other roads, and have been troubled especially with defects in the ball of the rail appearing suddenly after the rail has been in service but a short time. In some cases these flaws are so bad that it is necessary to change the rail very promptly to avoid serious danger.

Our idea is that in the haste to increase product and the good market which has prevailed that the former care is not exercised and that the ends of blooms are not as conscientiously cut off as formerly, thus causing the piping in the interior of the rail, which develops under road conditions. —GENERAL MANAGER.

Our figures show, eliminating breakages that were due to the broken rail being practically worn out, we have had but 307 broken rails in the main tracks of our line during the four months ending March 31 last.

We have on our lines equal to 1,470 miles of single main track, which would show that we have had to remove but one broken rail from every $4^3/_5$ miles of single track, which with the very large traffic we have over the greater portion of our lines is, as we think, not an unduly large number of broken rails to have had on our lines.

The chief trouble we find with the rails we have been getting in recent years is that we are not getting the wear out of them we should. We have endeavored to correct this trouble by asking the steel company from whom we buy most of our rails to furnish us a rail higher in carbon, but they have been unwilling to do this, apparently fearing that the rails would be made more brittle should they use a greater percentage of carbon in them.

As to the rail we are getting for 1907 delivery, we have arranged through our rail inspector to have the rails held a little longer before they go through the rolls on their final passage, the idea being by this means to get better wear out of them and a somewhat tougher rail, due to the last rolling being at a lower temperature.

We have been experimenting in a small way with some open hearth rail we got several years ago from the Tennessee Coal & Iron Company and we are quite favorably impressed with the comparative results we have gotten from the use of this open hearth rail as compared with the Bessemer of the same weight, laid where it has had the same wear as the open hearth rail. As soon as we can get concerns here in the East to furnish us any quantity of open hearth rail we are going to use it more extensively.

The opinion of our people seems to be that the inferior quality of Bessemer rail which we have been getting recently has been due to two causes: One is that the ores which can be manufactured by the Bessemer process and have given a good wearing rail are growing scarcer and the ore is of a poorer quality and that with these ores a better rail can be produced by treatment with the open hearth process than by the Bessemer. We think, furthermore, that to some extent the poor quality of rail we are now getting is due to the fabrication of it and that the great endeavor of the rail makers of recent years has been to turn out a large tonnage and that in doing this the rail is rolled hotter and without as many passes through the rolls as in former years, and, as result, the metal in the finished rail is not as tough or strong as that in the rails formerly furnished by the steel rail makers.

Prior to about 1901 the different companies making rails in the United States gave certain guarantees as to the quality and wear of their rails. Since about that time no contracts can be obtained with any of the rail makers of this country giving any guarantees whatever as to the wearing qualities of the rail furnished. As a rule they will not go further than to replace such rails as in service are broken and show actual flaws in the individual rails. There can be no question but what since the provisions referred to in the old rail contracts have been eliminated, the quality of rail furnished has deteriorated.

Several years ago we increased our standard rail from 80 to 90 lbs. per yard. This with a view of better providing for our increased traffic and the increased weight of our motive power and equipment. At the time we decided to increase our standard weight of rail from 80 to 90 lbs. we investigated the question of whether we would go from 80 to 100 lb. rails, but as result of our investigation of the matter and a trial of some 100-lb. rails, we found that the lines using this heavier rail were not getting sufficient additional wear from it to warrant the increased cost of same. We also found that as a result of our trial of the 100-lb. rail laid right alongside 90-lb. rail, the 100-lb. gave no better wear under the same traffic condition than the 90-lb. In fact, the 100-lb. rail showed greater wear than the 90. This seemed to demonstrate that the heavier the rail, the poorer the material in it. I think this is the result of the

experience of other companies so far as we have been able to ascertain. —PRESIDENT.

There is no question that breakages of rails, rolled in the last few years, have been more numerous than those previously rolled. We have had a great many 80-lb. rails broken that have been rolled in the past five years. In 1904 we had removed 778 broken rails that had failed in track, manufactured by the X mill and the Z mill. Most of the X rails failed through what is known as piping and the Z rails through flange breaking. We have also had a very large amount of broken rails manufactured by the B Steel Company. These have broken in different manners; some being badly piped while others have just broken square off, through some defects.

In the fall of 1903 we started to buy 100-lb. rails. The records of the B Steel Company show quite badly, as to breaking of their 100-lb. rail that we got in the early rolling, but in the last rolling, that is to say in 1905, the record is not so bad. The rails they furnished us in 1904 seem to be the worst.

The rails we received from the Q Steel Company, previous to 1906, gave very good results, in fact, were the best rails we have purchased in recent years. But, we have had a great many broken rails from their 1906 rolling. It is my opinion that one of the greatest troubles with rails we receive to-day is that the demand is so great that every particle of steel is used that will make a rail, without showing any defects on the surface. This seems to be especially true with the Q Steel Company's rail of 1906 rolling. Previous to that time the demand for their rails was not so great. They have small converters that will only convert about 4½ tons of iron into steel at one blow. Their ingots being large and converters being small, it gives them a better chance to pour more slowly with an opportunity for the gases to escape during the pouring. Last year they began to press their output, and it is a marked coincidence that as soon as they started to shove their mill and advertised their increased output their rails became more defective.

I think one of the greatest troubles with rails to-day is that too much steel is tried to be forced into the rail; in other words, they do not crop their ingots sufficiently to insure that all silicon and other impurities, which are lighter and rise to the top of the ingot, are cut off before the ingots are sent to the blooming and rolling mills. The chemical composition of our rails seems to be rather satisfactory. We do not have any trouble from excessive wear of flange in the head, which shows that our rails are not too soft. Of course, our curvature is light on the main line, and we have not been troubled nearly as much as some roads with heavier curvature as regards flange wearing.

In the fall of 1903 we laid B rails on a 6 deg. curve, and last year had to replace them owing to their having been badly worn in the side of the head from flange wearing. That gives a life of about three years to that rail in main track. At no other point has it been necessary to replace rails, on account of the flange wear, although some of our curves are 3 deg., and one or two of them 4½.

I am sure that if the mills would agree to crop their ingots more we would have very much better results. I know there are a great many people that argue that 100 lbs. is too large a section out of which to make a perfect rail, as compared with the 80-lb., but our experience has been that 80-lb. rails of recent manufacture, that is to say within the last four or five years, have failed just as readily as 100-lb. rails. It is the practice to give 100-lb. rails almost as many passes as 80-lb. rails get.

We are now tabulating our list of broken rails, with the object of taking it up with the manufacturers to see whether we cannot make some arrangements by which they will give us a better quality of rail, and incidentally to have replaced the broken rails. The only manufacturers that we have a written guarantee from is the Q Steel Company, although the mills that we have taken the matter up with have always been willing to replace broken and defective rails.

—CHIEF ENGINEER.

I beg to attach hereto a statement of the 85-lb. rails broken from January 1, 1906, to April 1, 1907, inclusive. The breakage of rails which we have sustained does not seem to have been caused by severe weather conditions or defective output of any particular mill.

It is the opinion of our engineering department that the rails as manufactured at the present time are of inferior quality to those which were rolled several years ago, and that they are subjected to such heavy loads that the least flaw or defect of any kind in the rail will cause it to break—the result of the continual hammering that it receives under our heavy traffic.

The manufacturers in all cases replace the broken rails with new rail where any flaws are found in the section. We believe that our present rail is too light for the heavy wear to which it is subjected, especially where we do not have sufficient ballast to hold the track to perfect line and surface. If the ballast conditions were perfect, 85-lb. rail would probably answer all purposes, but this condition exists on very few roads. —GENERAL MANAGER.

Statement of 85-Lb. Broken Rail, Jan. 1, 1906, to Apr. 1, 1907.—All Divisions.

Track.	Weight of rail.	Age Yrs.	Age Mons.	Cause.
Main.	85 lb.		7	Flaw in center of rail.
"	85 "		7	Flaw in center of rail.
"	85 "		7	Unknown.
"	85 "	Not known.		"
"	85 "	Not known.		"
"	85 "	1	5	Cracked in flange.
"	85 "	3	10	Flaw in rail.
"	85 "	4	..	Unknown.
"	85 "	2	4	"
"	85 "	3	2	"
"	85 "	1	6	"
"	85 "	3	6	"
"	85 "	2	..	"
"	85 "	..	2	Split in center of ball.
"	85 "	1	5	Rail cracked admitting frost.
"	85 "	2	5	Soft ties.
"	85 "	1	6	Cold weather.
"	85 "	3	5	Flaw in rail.
"	85 "	2	2	" " "
"	85 "	1	4	" " "
"	85 "	3	3	Unknown.
"	85 "	2	3	Unknown.
"	85 "	..	2	Flaw in rail.
"	85 "	Not known.		" in ball.
"	85 "	..	2	" in rail.
"	85 "	..	2	" in ball and web.
"	85 "	..	2	" in base of rail.
"	85 "	2	6	" in flange.
"	85 "	Not known.		Unknown.
"	85 "	2	10	Poor quality of rail.
"	85 "	3	1	Flaw in rail.
"	85 "	2	..	Unknown.
"	85 "	2	1	"
"	85 "	2	8	Flaw in rail.
"	85 "	3	7	Worn.

Our experience has been that of other lines, that during the past year rails recently put in track have broken in unusual numbers and we are still investigating with a view to ascertaining the cause and applying a remedy. The fact that the breakage occurs most frequently in the rail recently rolled which on our line is of a heavier section than we heretofore laid, indicates that it is not caused by heavy traffic or large engines. On the other hand, when these rails were rolled they were inspected carefully and the analysis indicated the metal to be of first quality.

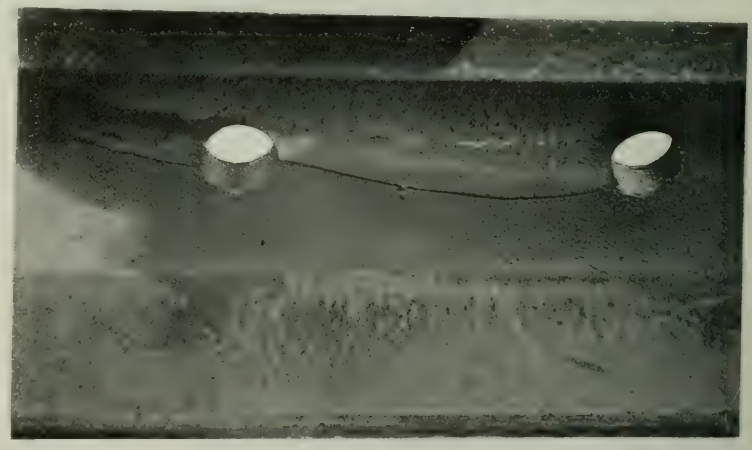


Fig. 13—Defective 100-lb. Rail.

The conclusion to which all of this points is that they were not properly worked at the mills, but put on the market with too few rollings.

I do not state this as a fact, but merely suggest that our experience and investigations up to this time tend to show that such is the case. —VICE-PRESIDENT.

The Swiss railroad employees who asked 120 francs apiece because rents and prices went up last year have been given by the Congress 100 francs for each married employee and 50 francs for each unmarried one; but this gratuity is limited to employees whose pay is less than 4,000 francs ($776) per year. The management says that expenditures will largely increase this year, more certainly than earnings.

Track Deformations and Their Prevention.*†

BY G. CUENOT,
Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway.

X.

STUDY OF WOOD USED FOR TIES (CONTINUED).

In all the ties studied, the decay followed the same course. There is first produced the heating or the spotting of the wood not creosoted, situated immediately under the superficial crust penetrated with creosote, and that over the upper part of the tie, which is not covered up and is placed in the interior of the track. The spotted wood is that which has heated before seasoning by the fermentation of the sap moisture; in the beginning, the color, generally clear yellow for beech wood, commences to be spotted with characteristic white points, then to be marbleized with yellowish spots; the fibrous contexture disappears, the wood becomes spongy, becomes yellow colored,‡ and the shavings which are cut have no body and crumble. (Fig. 27.)

The next process is that the heating gains in depth and reaches all wood not creosoted, which affects the shape of a spindle on the longitudinal section of the cross tie, and is terminated in a fish tail towards the fastenings; the wood which is spotted and has first become yellow under the creosote crust of the surface, still intact, assumes a brown color, of touch-wood, and seems to be calcined. The tie preserves a very good appearance on the exterior, and the wood under the fastenings remains quite sound. (Fig. 28.)

A very conclusive experiment was tried on this subject, which is easy to repeat; there was available in the spring a half tie of very sound beech of recent felling, containing 35 to 40 per cent. of sap water. Two pieces, each 27½ in. long, were taken from it; after having tarred the first, it was buried in the ballast, leaving the upper face uncovered, exposed to the air, and the other piece, not tarred, was preserved as a witness, exposed to the air but not buried. At the end of six months the first piece was unburied, and it was observed while cutting it that it was heated and entirely spotted in the interior, but particularly under the uncovered face exposed to the sun, where the decomposition was remarkably much more advanced. The proof piece remained perfectly sound, and was dry; the other, on the contrary, had kept all of its moisture. That is what takes place in ties whose injection is only superficial.

INFLUENCE OF ADZING FOR THE PLATES AND BORING THE CROSS TIES BEFORE INJECTION, ON THE PENETRATION OF THE CREOSOTE.

In order to make the creosote penetrate better into that part of the tie which receives the screw spikes, the cutting and the boring are performed before injection, and this practice has been followed in France, in a general way, since 1894.

By comparing, by means of longitudinal sections and samples, previously taken from different points of their length, the ties injected after this procedure with those injected without holes, it is observed that the first are impregnated with creosote under the mortise and in the region of the holes; but the second are injected only at a distance from the extremities, which varies with the degree of humidity of the ties at the moment of injection, which often

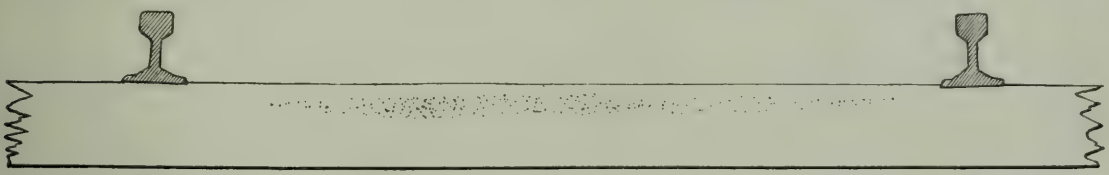


Fig. 27.

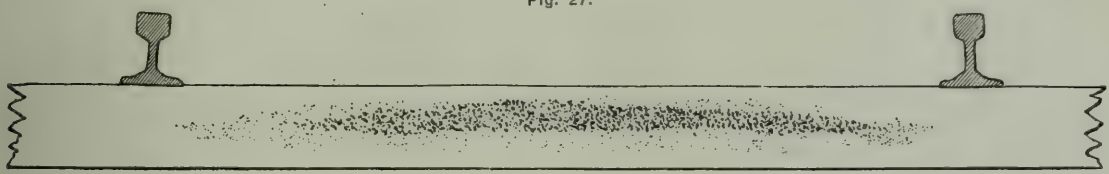


Fig. 28.

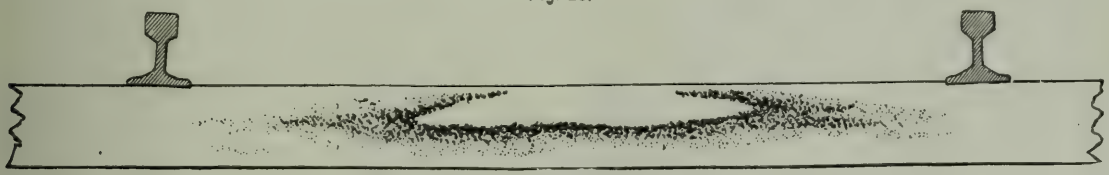


Fig. 29.

The creosoted superficial crust of the top next yields and is broken towards the middle of the inter-rail space; it forms a trough in the decayed wood, where water accumulates, and promotes decomposition. The decay reaches the fastenings more or less rapidly, which often hold sufficiently well, above all those of the exterior, but the tie is out of service. (Fig. 29.)

Some hundreds of decayed ties taken out of the track have been examined, and samples were taken from more than 10,000 ties in service, commencing to decompose; the same process of decomposition has always been observed in ties injected with 35 lbs. Beech wood very sound, but moist with sap, not injected, imprisoned in the superficial bed of creosoted wood, which prevents that sap from evaporating, becomes heated and decays rapidly by commencing at the part contiguous to the face free from ballast, exposed to the sun, which first becomes spotted.

does not reach the mortise. And as the creosoted wood is not reached by decay, and as a single fiber of injected wood remains unimpaired in a center of decomposition, we are assured that boring the ties before injection increases their durability, and that it is a good practice.

Independently of the experiments related above, Mr. Ferry has made others on thousands of ties, developing the same facts. We will cite only one to show the influence of creosoting to refusal.

Of 1,152 beech ties, injected after this manner, and placed in 1877 on the line from Mouchard to Bourg, between kilometers 492,024 and 493,000, all were as sound in 1896, that is to say, 19 years after placing them, as on the first day, while 1,204 ties placed in 1889 on the same line, which were only injected with 37½ lbs. per tie, were entirely decayed, in the proportion of 35 per cent., at the end of six years.

The conclusion to be drawn from these experiments is that ties are generally creosoted very superficially, for the reason that it is not possible to obtain a complete drying for the extraction of all the water which they contain. Even by stove drying, the operation cannot be pushed sufficiently far to remove all the sap; we must therefore be contented with allowing the ties to dry naturally, which always shuts up a certain quantity of water, particularly in their center.

Injection practiced after an imperfect drying has also the effect of concentrating the water in that part, which becomes consequently a center of decomposition for the tie. Each tie then commences to decay in its center, which is the part exposed to the alternatives

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†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.

‡When the natural beech wood (not creosoted) becomes spotted it loses its clear yellow color and passes to straw yellow or citron yellow, and its fibrous texture disappears. It becomes spongy and in planing the shavings have no body and crumble away. It breaks with the least effort. "like a radish," that is to say, the fracture does not present drawn out fibers as are produced with sound wood; to use a local expression, it is "cooked." In this state, which is always the prelude of the red decay, the screw spikes no longer hold well in the tie, but turn without effort.

The yellow wood in question contains no trace of creosote, as the analysis of the shavings shows. However diluted the creosote may be, the traces are easily observed, even in wood very lightly tinted, or by compressing the wood in a press between two leaves of white blotting paper, or better, by treating it with benzine.

Both yellow wood and "cooked" wood are stages of decay.

of heat and dryness, while the extremities, better creosoted and under protection of the ballast, resist for a longer time.

TREATMENT OF PINE AND OAK.

The same process which has been found for beech is applicable for pine; the latter ought even to absorb a greater quantity of creosote. The same thing does not hold true with oak; the heart of the oak only takes traces of creosote, only the sap being penetrated by the injection. But this hard fiber is sometimes a disadvantage instead of an advantage; for if the heart of the oak is not dry (and it is hard to tell whether it is or not), the envelope of creosote prevents the slow evaporation of the sap, which finishes by being decomposed, and attacks in its depth the wood of most sound appearance. That is the cause of decay of the greatest number of ties, every piece of wood having more than 20 per cent. moisture, and covered over with a superficial bed, rapidly deteriorates, the beech at the end of three months, the oak at the end of a longer period.

The heart of the oak, which only absorbs a very small quantity of creosote because of its persistent state of moisture, is, however, susceptible of decay from a cause other than that of its superficial envelope preventing the slow and gradual evaporation of the sap. The wood is, in fact, generally very much cracked; under the action of atmospheric variations, these fissures open gradually wider and form a kind of trough, where the water enters vertically. At the end of a certain time this succession of moisture and of dryness favors the development of fungi, and produces work of decomposition in the wood, which always perishes in its central part, generally not covered over. It is worth while remembering that the simple bed of ballast placed on the breech of the tie, the plate placed under the rail, protects the wood in an efficient manner against this kind of decomposition. This evidently arises from the fact that, in the case of ties drying rapidly, like those of beech, the creosoting is more complete; but in the case of oak, which is only made superficially antiseptic, the fissures do not form as in the uncovered central part, and the decomposition of the wood is not produced.

AMOUNT OF CREOSOTE TO USE.

The preparation of wood before injection, and the proper drying of it, are very important. The amount of the injection ought equally to enter into the computation, for if it is insufficient, it prolongs but little the durability of the piece of wood. Results from actual experiment explain why, in spite of the expense which it induces, the amount of creosote used has tended constantly to be increased.*

In order to obtain satisfactory results, it was necessary to reach refusal; a point which is not absolute, and depends even upon the dimension of the piece submitted to injection. Thus, the beech ties, 8.86 ft. long and of ordinary dimensions, scarcely take 55 lbs., even to saturation; the pieces of more restricted dimensions, like the blocks of composite ties, absorb a greater quantity of creosote —20 per cent. more—because the water of sap is more completely eliminated. These pieces can then become indestructible and invariable in volume, as has been stated, whatever may be the agents to which they are submitted. The sap water having been replaced or surrounded by an antiseptic substance, the body is as though mummified, without undergoing any alteration in the future. This is what explains that, in spite of the variations in temperature, the blocks are maintained for nearly four years in the metallic skeletons without undergoing any modifications.

Experiments permit us to state these general points precisely; two pieces of beech were taken, one from a tree felled in the month of December, 1902, whose dimensions were: Length, 27½ in.; width, 9.8 in.; depth, 5.9 in., and they were placed under observation. When they had attained the degree of seasoning of 20 per cent., presenting then at their extremities important longitudinal clefts, they were submitted to two successive injections of creosote in such a manner that they absorbed the greatest possible quantity of it. The four faces of each of the blocks on three different sections were previously referenced to the tenth of a millimeter; they were referenced anew after the creosoting. The absorption of the creosote, at the rate of 18.7 lbs. per piece of wood, produced a mean elongation of each face of 0.04 in. and the fissures were completely closed. The void existing in a piece as dry as possible is then very small, scarcely 0.04 in. on each of its faces; it is the maximum play which can take place in the wood when it passes from the dry to the humid state, or inversely. But with an injection to refusal there is no play to fear, since the pores of the wood are filled up and can absorb no more, and since, on the other hand, the block protected by the metallic skeleton will not give up any part of the liquid absorbed.

I treated, like the beech, four blocks of heart oak; these pieces of wood did not absorb any appreciable weight of creosote, scarcely 0.44 lbs. each; that is to say, a quantity scarcely sufficient to coat them superficially.

Finally the wood, dried to an amount inferior to 20 per cent. by means of stove drying, for example, and replaced in air, regained moisture in a short time so as to reach the amount of 20 per cent. That which we will designate as dry wood will, then, be wood containing 20 per cent. of its weight of water.

INFLUENCE OF CREOSOTING ON THE RESISTANCE TO COMPRESSION.

But if creosoting has given favorable results from the point of view of the preservation of the wood, it acts, on the contrary, in an injurious way, to diminish the resistance of the piece submitted to compression. Mr. Ferry has made a series of very interesting experiments on the resistance to compression of pieces of wood submitted or not to an injection of creosote, and placed either in the direction of the fibers or perpendicular to that direction. An apparatus constructed by Mr. Collet was employed to produce this compression, and which permitted a pressure of 8.8 net tons to be reached; the wood was experimented with under the form of cubes of 2¾ in. each way. The results of the experiments are summarized in the table below:

	Load, lbs. per sq. in.	Deformation when load is applied perpendicular to the fibers: Following the Medullary rays.	Deformation when load is applied perpendicular to the fibers: Perpendicular to those rays.	Deformation of wood on end.
Dry oak	1,741	0.00290 m.	0.00380 m.	0.00117 m.
Dry beech	1,741	0.00160 m.	0.00350 m.	.....
Creosoted beech	1,741	0.00287 m.	0.00334 m.*	0.00105 m.
Spruce	508	0.00314 m.	.....	.....
Spruce	1,741	.....	0.000875 m.	.....

*Deformation obtained with 1,306 lbs. per sq. in.

These figures have not an absolute value, but a relative value, for it would be necessary, to obtain the former, to take account of the deformation of the apparatus itself, which has an influence on the results. What we should keep in mind, nevertheless, is that the deformation varies within sufficiently large limits, according to whether the force is exerted perpendicular to the fibers of the wood, to the medullary rays, or else in a perpendicular direction to those rays; finally, according as it is produced on the wood on end. Spruce resisted the best, at least in the perpendicular direction. The deformation in this direction would be about once and a half greater than it is in the perpendicular direction, that is to say, following the medullary rays. The deformation is accentuated when the wood is injected by about double; the liquid injected exudes at the same time that the increase of pressure is produced. In every case the deformation of the piece of wood takes a particular form: the spring layers, which are the most tender, crush, and the autumn layers, which are the hardest, slide over the first, giving the aspect of a series of checks.

These phenomena are manifested when the wood is in a free state; it does not seem that it should be thus when the wood, submitted to compression following the medullary rays, is prevented from being deformed, whether it be shut up in a skeleton which sustains it, or whether it be maintained in the transverse direction by a counter pressure. In this case it acquires a superior resistance and does not allow itself to be easily deformed because it is sustained.

That is what I have observed on composite ties by comparison with ordinary ties. It is recalled that the blocks of the composite tie are pressed between the walls of the skeleton by means of cross bars, and that the skeleton is thus shut up on these pieces of wood in order to compress them. It is thus possible to appreciate the influence of the compression of the wood in default of direct experiments.

(To be continued.)

*Amount of creosoting reported:

Oak	11 to 15.4 lbs. per cross tie. (Refusal.)	
Beech	28.6 lbs.	The Northern Co.
	33 to 33 lbs.	The Western Co.
	35 lbs.	The P. L. M. Co.
	52.8 lbs. (Refusal.)	The Eastern Co.
Pine	26.4 "	The Midland Co.
	30.8 "	The Orleans Co.
	26.4 "	The P. L. M. Co.

Comparative Summary of Freight Cars in Service on the Railroads of the United States.

There has recently been much haphazard guess work as to the number of freight cars in service and the increase during the year 1906. In order to get accurate figures on which to base an estimate for all the railroads in the United States, we have prepared the following table from data contained in the annual reports of all the railroads in the United States operating over 500 miles of roads with two or three minor exceptions. The 64 roads considered are divided into five groups comprising the New England roads, the roads in trunk line territory, the roads included in the southern freight classification, the roads included in the central freight classification and the roads included in the western freight classification. The first column gives the number of revenue freight cars in service in 1905, and the second column gives the number of cars in service at the corresponding date in 1906. No attempt has been made to distinguish between the roads reporting operations for the fiscal year ending June 30 and roads reporting operations for the calendar year ending December 31, as it is not believed that the overlap between the two periods affects the figures for comparative purposes. The third and fourth columns give the increase or decrease

COMPARATIVE SUMMARY OF FREIGHT CARS IN SERVICE ON THE RAILROADS OF THE UNITED STATES.

Road.	Freight equipment owned. 1905.	1906.	Increase.	Decrease.	Pr cent. of change.	Frt. cars per mile of road. 1905.	1906.	Average length of haul 1905.	1906.	Freight cars Per 1,000 frt. car miles 1905.	1906.	Per 1,000 rev. ton miles 1905.	1906.	Rate per ton mile, dollars. 1905.	1906.	Frt. cars per $1,000 frt earnings 1905	1906
New England Roads.																	
Boston & Maine	17,401	18,321	920	..	5.3	7.6	8.0	90.24	89.16	.091	.089	.0094	.0091	.01152	.01162	0.82	0.79
Central Vermont	2,747	2,660†	.....	87	3.2	5.1	5.0	85.10	84.85	.089	.082	.0103	.0095	.00880	.00920	1.16	1.03
Maine Central	5,162	5,773	611	..	11.8	6.3	7.1	83.85	87.68	.133	.138	.0109	.0113	.01074	.01033	1.21	1.25
N. Y., N. H. & Hartford	17,188	19,595*	2,407	..	14.0	8.2	9.5	95.13	93.22	.088	.096	.0099	.0103	.01408	.01407	0.70	0.74
Total	42,498	46,349	3,851	..	9.1	6.8	7.4	88.58	88.73	.100	.101	.0101	.0101	.01128	.01131	1.00	0.95
Trunk Line Roads.																	
Baltimore & Ohio	75,340	81,821*	6,481	..	8.6	19.9	20.3	188.93	193.72	.119	.115	.0084	.0076	.00566	.00569	1.49	1.36
Buffalo, Roch. & Pitts.	12,748	12,697*	.....	51	0.4	23.4	22.2	144.20	148.20	.162	.175	.0096	.0102	.00510	.00508	1.87	2.02
Cent. R. R. of N. Jersey	19,212	19,005*	.....	207	1.0	32.0	31.2	81.10	75.61	.152	.150	.0104	.0099	.00828	.00839	1.25	1.18
Chesapeake & Ohio	24,486	27,676	3,190	..	13.0	16.5	15.4	282.00	282.00	.124	.104	.0074	.0060	.00427	.00420	1.72	1.43
Delaware & Hudson	12,770	13,783	1,013	..	7.9	15.1	16.3	116.94	117.90	.100	.108	.0061	.0064	.00625	.00633	0.96	1.01
Del., Lack. & West'n	23,881	26,593*	2,712	..	11.3	25.0	27.8	169.80	165.00	.103	.115	.0081	.0089	.00788	.00782	1.03	1.14
Erie	51,843	53,364	1,521	..	3.0	24.1	24.8	163.60	163.51	.122	.117	.0100	.0090	.00623	.00598	1.61	1.50
Lehigh Valley	35,769	37,161*	1,392	..	3.9	25.6	26.0	172.61	169.85	.120	.118	.0087	.0086	.00633	.00626	1.38	1.37
New York Central	65,410	69,070	3,660	..	5.6	17.4	18.2	197.00	190.00	.085	.090	.0078	.0082	.00613	.00642	1.25	1.26
Pennsylvania	105,832	119,036	13,204	..	12.5	27.6	30.6	107.87	107.47	.096	.104	.0063	.0065	.00593	.00595	1.05	1.08
Phila. & Reading	38,597	41,048*	2,451	..	6.4	38.0	41.1	93.50	91.89	.142	.145	.0103	.0099	.00870	.00790	1.28	1.27
Western Maryland	4,439	5,920*	1,481	..	33.5	9.1	10.9	58.93	65.96	.174	.174	.0123	.0119	.00762	.00728	1.61	1.64
Total	470,327	507,174	36,847	..	7.8	22.8	23.7	148.04	147.59	.125	.126	.0088	.0086	.00653	.00643	1.38	1.36
Southern Classification.																	
Atlantic Coast Line	15,272	17,850†	2,578	..	16.9	3.6	4.1	140.09	143.16	.092	.100	.0130	.0133	.01313	.01292	0.99	1.03
Central of Georgia	8,015	9,207	1,192	..	14.9	4.3	4.9	148.51	149.94	.123	.126	.0134	.0131	.01144	.01104	1.18	1.19
Louisville & Nashville	34,306	36,386*	2,080	..	6.1	9.0	8.8	167.00	159.88	.113	.114	.0098	.0093	.00791	.00803	1.24	1.15
Mobile & Ohio	8,761	10,014	1,253	..	14.6	9.4	10.8	239.40	234.93	....	....	.0097	.0090	.00668	.00639	1.45	1.40
Nash., Chatt. & St. L.	8,049	8,508	459	..	5.7	6.6	6.9	162.00	161.00	.098	.129	.0101	.0094	.00900	.00900	1.12	1.05
Norfolk & Western	26,598	31,393	4,795	..	18.0	14.8	16.9	269.38	260.11	.093	.099	.0063	.0063	.00474	.00481	1.25	1.29
Seaboard Air Line	10,332	9,860	.....	472	4.6	4.0	3.8	152.13	158.55	.124	.098	.0127	.0103	.01180	.01121	1.08	0.91
Southern	41,055	47,816†	6,761	..	16.5	5.7	6.5	160.46	165.25	.115	.125	.0122	.0123	.00944	.00930	1.29	1.32
Total	152,388	171,034	18,646	..	12.2	7.2	7.1	179.87	179.12	.108	.113	.0109	.0104	.00927	.00909	1.20	1.17
Central Classification.																	
Chic., Ind. & Louis.	6,030	5,728	.....	302	5.0	10.2	9.7	157.00	152.60	.137	.134	.0119	.0110	.00790	.00796	1.51	1.38
Cin., Ham. & Dayton	13,938	13,692*	.....	246	1.8	13.4	13.2	118.75	115.86	.212	.209	.0166	.0146	.00677	.00638	2.45	2.29
C., C., C. & St. Louis	21,902	23,574*	1,672	..	7.6	11.0	11.9	147.90	152.60	.114	.116	.0096	.0093	.00598	.00592	1.53	1.50
Grand Rap. & Indiana	3,227	3,225	.....	2	0.1	5.6	5.6	95.55	102.20	.107	.102	.0086	.0076	.00740	.00700	1.15	1.08
Lake Erie & Western	4,765	4,603*	.....	162	3.4	5.4	5.3	145.41	140.07	.109	.101	.0086	.0078	.00681	.00675	1.25	1.15
Lake Shore & M. South.	27,938	35,167*	7,229	..	25.8	18.5	23.3	153.00	159.00	.079	.090	.0055	.0063	.00520	.00521	1.04	1.18
Michigan Central	16,109	18,600*	2,491	..	15.5	9.2	10.7	169.00	173.00	.069	.075	.0062	.0064	.00615	.00628	0.99	1.00
N. Y., Chic. & St. Louis	8,023	7,827	.....	196	2.4	15.3	14.9	236.00	210.00	.061	.058	.0055	.0049	.00513	.00520	1.06	0.94
Penn. Company	46,699	50,090	3,391	..	7.3	34.9	35.5	66.42	73.59	.145	.143	.0090	.0083	.00600	.00600	1.49	1.38
P., C., C. & St. L.	22,693	22,942	249	..	1.1	15.9	16.1	99.43	97.64	.080	.076	.0065	.0060	.00630	.00650	1.02	0.91
Pere Marquette	17,661	17,362	.....	299	1.7	7.6	7.4	157.08	170.86	.152	.138	.0135	.0107	.00689	.00597	1.95	1.81
Vandalia	6,446	6,950	504	..	7.8	9.8	10.2	88.04	103.95	....	....	.0102	.0090	.00740	.00700	1.38	1.28
Total	195,431	209,760	14,329	..	7.3	13.1	13.6	136.13	136.45	.116	.113	.0093	.0086	.00649	.00636	1.40	1.33
Western Classification.																	
Atch., Top. & S. Fe.	39,172	44,204	5,032	..	12.8	4.7	5.7	394.99	366.83	.083	.080	.0083	.0076	.01002	.00935	0.83	0.81
Chicago & Alton	9,699	10,061	362	..	3.7	10.6	10.4	165.76	172.43	.113	.108	.0096	.0086	.00689	.00639	1.59	1.34
Chic. & Eastern Illinois	16,385	18,161	1,776	..	10.9	18.6	19.2	158.44	159.60	.176	.177	.0110	.0105	.00460	.00470	2.38	2.25
Chic. & North-Western	52,231	55,816	3,585	..	6.9	7.1	7.5	137.89	144.07	....	....	.0122	.0108	.00920	.00890	1.33	1.22
Chic., Burl. & Quincy	48,414	50,360*†	1,946	..	4.0	5.8	5.9	250.75	268.15	.102	.093	.0092	.0079	.00840	.00810	1.10	0.99
Chic. Great Western	7,235	7,265	30	..	0.4	8.8	8.9	257.13	265.17	.103	.086	.0100	.0083	.00700	.00690	1.42	1.21
Chic., Mil. & St. Paul	41,805	39,821	.....	1,984	4.8	6.6	5.7	175.14	177.99	.098	.087	.0102	.0085	.00881	.00862	1.16	0.99
Chic., R. I. & Pacific	38,571	38,426*	.....	145	0.4	5.3	5.3	234.66	241.36	.120	.107	.0122	.0103	.00940	.00930	1.30	1.12
Chic., St. P., M. & O.	11,446	11,887*	441	..	3.8	6.8	7.0	155.94	146.07	....	....	.0131	.0127	.00930	.00931	1.41	1.36
Colorado & Southern	6,173	7,058†	885	..	14.3	4.5	4.2	129.00	134.00	.141	.109	.0116	.0088	.01072	.01025	1.11	0.86
Denver & Rio Grande	9,688	10,159†	471	..	4.9	6.2	6.3	124.48	126.28	.154	.150	.0150	.0129	.01340	.01290	1.12	0.99
Duluth, S. S. & A.	2,555	2,842	287	..	1.1	4.4	4.8	104.07	110.78	....	....	.0143	.0125	.00939	.00850	1.50	1.46
Great Northern	32,495	34,514	2,019	..	6.2	5.7	5.8	237.80	256.25	.109	.100	.0078	.0070	.00792	.00791	0.97	0.87
Illinois Central	54,764	56,227*	1,463	..	2.7	12.5	12.7	240.15	242.99	.120	.117	.0098	.0090	.00587	.00556	1.68	1.62
Iowa Central	3,197	3,154*	.....	43	1.3	5.7	5.7	172.48	164.23	.107	.117	.0079	.0094	.00591	.00598	1.34	1.57
Kan. City Southern	5,997	6,979*	982	..	16.4	7.2	8.4	300.98	316.03	.104	.111	.0081	.0080	.00729	.00679	1.10	1.17
Minn. & St. Louis	3,420	3,199	.....	221	6.5	4.8	4.0	93.59	93.52	.202	.160	.0186	.0145	.01098	.01153	1.69	1.29
M., St. P. & S. Ste. M.	10,438	11,912	1,474	..	14.1	5.9	5.8	225.51	221.87	.138	.137	.0148	.0110	.00724	.00781	1.63	1.41
Missouri Pacific	39,491	39,379*	.....	121	0.3	6.4	6.3	228.10	237.33	.130	.119	.0109	.0094	.00825	.00776	1.33	1.21
Mo., Kan. & Texas	14,961	15,924	963	..	6.1	4.9	5.2	232.46	240.13	.101	.106	.0118	.0114	.01110	.01069	1.06	1.06
Northern Pacific	35,135	36,097	962	..	2.7	6.6	6.7	334.40	341.60	.092	.087	.0081	.0069	.00832	.00828	0.95	0.82
St. Louis & S. Francisco	24,800	24,963	163	..	0.7	4.9	4.9	156.31	166.52	.136	.124	.0124	.0108	.01005	.00952	1.14	1.23
St. Louis South-Western	10,281	10,131	.....	150	1.6	7.2	7.0	219.08	239.29	.182	.172	.0168	.0148	.01070	.00980	1.66	1.51
San. Ant. & Aran. Pass	1,723	1,702	.....	21	1.2	2.4	2.4	156.80	156.19	.104	.100	.0135	.0123	.01439	.01672	0.90	0.74
Southern Pacific	44,050	43,567*†	.....	483	1.1	4.8	4.7	268.20	262.31	.091	.086	.0080	.0070	.01052	.01025	0.75	0.68
Texas & Pacific	8,926	8,656*	.....	270	3.2	4.9	4.7	195.90	203.04	.105	.086	.0110	.0090	.01010	.01030	1.08	0.88
Wabash	18,822	18,692	.....	130	0.7	7.5	7.4	228.15	247.30	.093	.078	.0081	.0063	.00583	.00544	1.38	1.16
Wisconsin Central	8,640	8,548	.....	92	1.1	8.8	8.7	175.77	185.12	....	....	.0116	.0106	.00666	.00661	1.75	1.61
Total	600,514	619,695	19,181	..	3.2	6.8	6.8	205.28	210.26	.121	.112	.0112	.0090	.00887	.00872	1.31	1.19
Total, all roads	1,461,158	1,554,012	92,854	..	6.35	11.0	11.3	171.11	173.18	.118	.114	.0103	.0091	.00819	.00806	1.31	1.23

*Does not include ballast cars.
†Standard gage cars only.

in number of cars in service and the fifth column shows the per cent. of change. Columns 6 to 11 are self-explanatory and are useful as indicating the character of the traffic on the different roads.

The 64 roads included in the table had a total of 1,554,012 cars available for service in 1906, an increase of 92,854 cars, or 6.35 per cent., over 1905. These 64 roads operate approximately 163,511 miles, or 75 per cent. of the total mileage in the United States, and own 90 per cent. of all the freight cars in the United States. The increase over 1905 is equivalent to an increase of 103,000 cars for all the railroads in the United States. Our record of the cars built in the United States in 1906 for domestic use shows a total of 229,189, which does not include a large number of cars built by the railroads in their own shops. The difference between these two figures (116,000 cars) should represent approximately the number of cars destroyed during the year. The best evidence that large numbers of cars are destroyed each year is shown by the total net decrease, which is 5,684. The Chicago, Milwaukee & St. Paul alone decreased its equipment by 1,984 cars during the year, due chiefly to the destruction of large numbers of old, light capacity cars, which were replaced in part by new cars of larger carrying capacity; in fact, most of the decreases shown may be attributed to this cause, and the only proper method of comparing the equipment of such roads would be a comparison of the total tonnage capacity of all cars. These figures, however, are not available in the majority of cases. The largest increase in per cent. was in the Southern group with the New England roads next. The largest increase in numbers was in the trunk line roads with the western roads next. The Pennsylvania Railroad increased its equipment by 13,204 cars, or 12½ per cent., while the Lake Shore showed the next largest individual increase, with 7,229 cars, or 25.8 per cent. The Western Maryland increased 33.5 per cent., but it owns a comparatively small number of cars per mile of road. The Philadelphia & Reading owns 41.1 cars per mile of road, while the Pennsylvania Company owns 35.5 cars per mile of road. The Pennsylvania Railroad, with 119,083 cars, is the only road owning over 100,000 freight cars, the Baltimore & Ohio, with 81,821, coming next in the list.

Of course, the most interesting use of this table lies in the opportunity it affords to compare equipment with needs, and to show which roads are likely to be enforced lenders and which borrowers in a period of car shortage. The column showing freight cars per thousand revenue ton miles casts the most light on this. It will be seen that the Buffalo, Rochester & Pittsburg and the Western Maryland have equipment nearer in line with their maximum needs than any other roads in trunk line territory (though, being originating lines, they have plenty of trouble in getting their cars home!). The Chesapeake & Ohio, Delaware & Hudson and Pennsylvania have the least equipment per thousand revenue ton miles of any roads in trunk line territory, although the Pennsylvania is notably well equipped per mile of line. In this case, the tremendous tonnage which passes over Pennsylvania lines in transit from foreign lines tends to keep the figure down; the company is primarily an intermediary and an agent, rather than a borrower. This is true to a much less degree in the case of the Chesapeake & Ohio, and is not true in the case of the Delaware & Hudson.

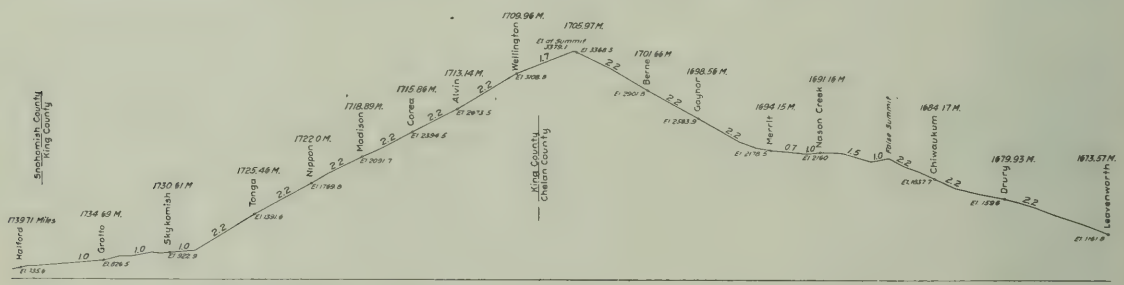
Per mile of road, the Reading and Pennsylvania lines stand pre-eminently at the head of the list, all classifications. Per thousand revenue ton miles, the smaller roads and systems lead, especially in the South and Southwest. Originating roads need more cars per unit of traffic comparison than intermediary roads do. For effective use of the table, it is necessary to compare roads operating under similar conditions and doing the same general kind of business. With this caution in mind, it can be made very valuable.

The Prussian authorities propose to impose a toll of 0.04 pfennig per ton per kilometer on all freight shipped on rivers, the navigation of which has been improved by government works. This would amount for an Erie canal boat carrying 200 tons to 1⅛ cents per mile, or about $4.10 from Buffalo to Troy. Prussia has about 3,350 miles of improved rivers, on some 900 miles of which tolls are already levied. The tolls are urged as a matter of justice to shippers by rail, who have to pay not only the cost of carriage, but a good deal more for interest on the investment, and at the same time help pay the taxes for the improvement and maintenance of rivers.

The Mallet Compound Locomotives on the Great Northern.

The Mallet compound locomotives that were built by the Baldwin Locomotive Works for the Great Northern Railway, and which were illustrated in detail in the *Railroad Gazette* for August 17 and October 12, 1906, have now been in service long enough to give some indication of their efficiency. They are used as pushers over the grades of the Cascade range, and tests show that they are capable of hauling an average train load of 1,265.6 tons from Leavenworth to the Cascade tunnel, a distance of 32.2 miles, where the maximum grade is 2.2 per cent., and where it averages 1.3 per cent. for the whole distance. It will be remembered that the Mallet engine weighs 355,000 lbs., of which 316,000 lbs. are upon the driving wheels, and that it has a tractive power of 71,600 lbs. The figures given above are averages of nine trains in which the tonnage hauled ranged from 1,015 to 1,391 tons, and the coal burned from 19,000 to 27,000 lbs., with an average of 23,100 lbs., or 0.896 lb. per ton-mile, or 2.8 train-miles per ton of coal, from which it appears that the average evaporation was 4.44 lbs. of water per pound of coal. This low rate of evaporation is probably due to the quality of the coal used, which was from the Gilman mines.

In comparing this with the consolidation engine No. 1,152 it appears that the latter could haul but 454 tons over the same grades, burning 24,000 lbs. of coal and evaporating water at a rate of 4.03 lbs. per pound of fuel. Further, it burned 1.64 lbs. of coal per ton-mile, or 2.68 train-miles per ton of coal. Finally the water used per ton-mile of train was 3.96 lbs. on the Mallet and 6.65 on the consolidation. By comparing these two sets of figures it will be seen that the Mallet showed a saving in fuel of 43.8 per cent. per ton-mile, and in water of 40.8 per cent.



Condensed Profile of Cascade Division, Great Northern, from Leavenworth to Seattle.

The following is a detailed statement of the particulars of these runs between Leavenworth and the Cascade tunnel:

Distance	32.2 miles
Running time	4 hrs.
Time lost by stops	3 hrs. 4 mins.
Total time	7 hrs. 4 mins.
Average speed (miles per hour.)	8.05 miles
Grade coal used	Gilman, Crow's Nest, Const and Sand Coulee
Pounds of coal per trip	23,100 lbs.
Coal per sq. ft. of grate per hour	74.03 "
Coal per mile	717 "
Coal per 100 ton-miles	89.6"
Average tonnage handled	810 tons
Average No. cars per train (all loaded)	21
Temperature of atmosphere	40 degs. Fahr.
Temperature of feed water	40 degs. Fahr.
Maximum boiler pressure	205 lbs.
Minimum boiler pressure	195 "
Average boiler pressure	200 "
Water evaporated per lb. of coal	4.44 "
Water evaporated from and at 212 degs.	5.08 "
Maximum grade	2.2 per cent.
Minimum grade	Level
Water rate or steam consumption per h.p. hour from indicator cards)	21.79 lbs.
Indicated tractive power	60,000 "

The following are some of the principal dimensions of the consolidation locomotives with which this comparison is made:

Cylinders, diameter	20 in.
Piston, stroke	32 "
Steam pressure	210 lbs.
Weight on drivers	180,000 "
" of engine	195,000 "
" of engine and tender	318,000 "
Tank capacity, coal	12 tons
Tank capacity, water	6,000 gals.
Heating surface, tubes	2,572.0 sq. ft.
" firebox	195.4 "
" total	2,767.4 "
Grate area	59.2 "
Tubes, diameter	2 in.
" length	14 ft. 8 "
Firebox, length	118 "
Firebox width	121 "
Tractive power at 80 per cent. of boiler pressure	39,090 lbs.

$$\frac{\text{Weight on drivers}}{\text{Tractive power}} = 4.6$$

$$\frac{\text{Total weight}}{\text{Tractive power}} = 5.0$$

$$\frac{\text{Tractive power} \times \text{diameter drivers}}{\text{Heating surface}} = 164.24$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 46.74$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 0.076$$

$$\frac{\text{Weight on drivers}}{\text{Heating surface}} = 65.04$$

$$\frac{\text{Total weight}}{\text{Heating surface}} = 70.46$$

Volume of 2 cylinders = 11.47 cu. ft.

$$\frac{\text{Heating surface}}{\text{Volume of 2 cylinders}} = 241.21$$

$$\frac{\text{Grate area}}{\text{Volume of 2 cylinders}} = 5.16$$

Equated tube to firebox heating surface (Vaughan's formula) ..... 722.56 sq. ft.
Total equated firebox heating surface ..... 917.96 "

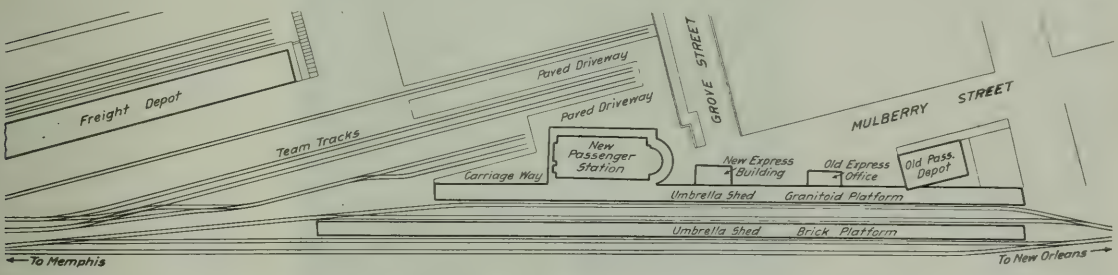
New Passenger Station for the Y. & M. V. at Vicksburg.

The Illinois Central Railroad has begun building a new passenger station at Vicksburg, Miss., for the Yazoo & Mississippi Valley. The railroad skirts the Mississippi river front the entire length of the city and the present passenger station is at the foot of China street. It is a two-story frame building, the second story containing the division operating offices. The site of the new station is one block north of the old station, at the foot of Grove street. Ground space in addition to what was already owned was obtained from the city through the vacation of Mulberry street, in exchange for which the railroad company will provide a paved 30-ft. driveway approach from Jackson street to the station through the property lying east of same, which it owns. An approach of this character from Jackson street is a necessity from the fact that, as Vicksburg stands on the river bluffs, all streets leading down from the business part of the city are on a steep incline, the grade of Grove street, for instance, being 13.3 per cent.

The presence at Vicksburg of a National Military Park brings to the city a great many visitors, and this was one reason for wanting to have a handsome station there. A favorite type of residential architecture in the city, and throughout the South in fact, is the colonial, and this type was therefore chosen for the station. The accompanying engraving is made from the architect's drawing of the accepted design.

The building has three stories and a basement, with a central tower 72½ ft. high. It is 100 ft. long, exclusive of the porch at the south end, and 40 ft. wide. The foundation is concrete on piling, the soil being silt deposited by the river. The walls are red paving brick, except that every fourth course has black headers, these courses being laid alternately stretcher and header. The trimmings are buff Bedford stone and the columns of the loggia and porch are wood. The roof is slate, except the flat portion, which is composition, and the dome of the tower is covered with copper.

The east or main entrance is through a loggia 50 ft. long and 9 ft. 6 in. wide, with five doorways leading to the interior—two to each waiting room and one to the hall for the second story stairway. The main section of the general waiting room is 33 ft. x 25 ft., with an alcove 17 ft. 8 in. x 17 ft. 6 in. at the south end lying between the smoking room and the women's room. There is a large fireplace at the south end of this alcove, with a doorway each side opening on to a semi-circular porch of 13 ft. 5 in. radius. It is the intention to keep palms on this porch in the mild seasons, adding to the attractiveness of the station and in making it as comfortable and pleasant as possible for waiting passengers. The negroes' waiting room is practically the same size as the main portion



Track Plan; Vicksburg Station.



Architect's Sketch of Vicksburg Station.

of the general waiting room, with a fireplace in the north wall, and toilet facilities, as shown on the plan. The ceilings of the waiting rooms are 12 ft. high. Both rooms have plaster walls above a wooden base, the walls being divided into upper and lower panels by a wooden chair rail. The ceilings are plaster also. The floors are maple except in the toilet rooms, which are mosaic. The floors of the loggia and porch are cement. At the north end of the building is the baggage room, extending entirely across the end and 16 ft. 7 in. wide inside.

The second floor of the building will contain the offices of the division superintendent and his staff. The partitions between the offices are to be glass, with movable sash or transoms in upper part to permit all possible circulation of air during the hot months. The transoms will be clear glass and the remainder of the partition maze glass. The third or attic floor will have space finished for the claim agent and the traveling auditor. The remainder will not be finished until needed. The heating plant will be located in the basement.

As the general plan shows, there will be four station tracks, with umbrella sheds. The station platform will be granitoid and the intertrack platform brick. Paved driveways and grass plots will surround the

building, and Mulberry and Grove streets also are to be paved. D. H. Burnham & Co., Chicago, are the architects for the station, and the George B. Swift Co., Chicago, the contractor. The station and improvements will cost about $75,000. It is expected to have it ready the latter part of the summer. We are indebted to Mr. A. S. Baldwin, Chief Engineer of the Illinois Central, for data.

Charles Haynes Haswell.

BY NELSON P. LEWIS.

Through the death of Charles Haynes Haswell on May 12, at his home in New York City, the engineering profession has lost one of its most conspicuous members. Mr. Haswell was undoubtedly the oldest engineer in the world, and had he lived 10 days longer he would have entered upon his 99th year. Those with whom he was actively associated have long since passed away; he belonged to another day and generation, and as he rarely spoke of his personal achievements it is very difficult to secure details concerning his professional career.

He was born on May 22, 1809, in a house still standing on North Moore street in New York City, and was a son of Charles Haswell, who was a native of Dublin and was in the diplomatic service of England, and of Dorthea Haynes, whose family was prominent in the Barbadoes. After a liberal training in the best schools of New York City and Long Island, he entered the service of James P. Allaire, the owner of what was then the largest steam engine works in the United States. Here he acquired a practical and thorough knowledge of mechanical and marine engineering. His excellent work soon attracted the attention of the United States Navy Department, and he was commissioned to design the machinery of the United States steam frigate "Fulton," the construction of whose engines and boilers he superintended as Chief Engineer, his commission having been signed by President Jackson. He subsequently designed or supervised the construction of the warships "Missouri," "Mississippi," "Michigan" and "Allegheny" and several revenue cutters. In 1843 Mr. Haswell was appointed the first Engineer-in-Chief of the United States navy, which position he held for eight years. Into this important office he carried his high professional ideas, and his fidelity to duty as interpreted by those ideals—qualities which were not always appreciated by his superior officers—and in 1851 he resigned from the naval service and engaged in private practice in New York City.



Charles Haynes Haswell.
Courtesy of The Knickerbocker Pub. Co.

While Mr. Haswell's work has covered nearly all branches of civil and mechanical engineering, and while he was the author of kind for 64 years and has passed through more than 70 editions, he was best known in connection with marine and steam engineering. He has been called the creator of the modern steam yacht; the "Sweetheart," probably the first vessel of this type, was designed and built by him in Brooklyn some time before 1840.

When the Civil War came, Mr. Haswell showed a fervent patriotism, and was not only assigned by the "Committee of Citizens of New York" to a mission requiring much tact and discretion, but rendered important service in the navy, which was recognized by General Burnside in his reports to the Secretary of War.

Appreciation of his professional work has not been confined to his own country. More than half a century ago the Czar of Russia sent him a diamond ring with an expression of his thanks for services rendered to the Imperial Government in sending to it a number of plans and drawings.

British engineers and naval architects have given frequent expression to their high regard for and deep obligations to him, and on the occasion of the visit of the Institution of Civil Engineers to this country in 1904, he was the recipient of conspicuous attention from them and their president, Sir William White.

[At that time, an excursion was made to West Point, and the officers of the Institution of Civil Engineers reviewed the cadets. Mr. Haswell, in his ninety-sixth year, walked with them down the line unaided, except for a friendly hand upon his arm. His firm and erect attitude and his picturesque appearance, intensified by the battered old silk hat he wore, greatly impressed the writer.—EDITOR.]

As a citizen of New York he has always been active and public spirited. From 1855 to 1858 he was a member of the City Board of Councilmen, of which body he was the presiding officer in 1858. He also served for some years as one of the trustees of the Brooklyn bridge.

With advancing years Mr. Haswell's professional activities had naturally become limited, but for the last decade he served the city of New York as Consulting Engineer to the Board of Public Improvements and the Board of Estimate and Apportionment, and those who have enjoyed the privilege of association with him have not only revered and honored him as an engineer, but have been impressed with his rare personal qualities.

His early education, as already noted, was obtained in the classical schools of the early part of the last century, and there was a refinement in his manner and conversation which showed the influence of that training. While used without a suggestion of pedantry, his Latin quotations frequently gave force and charm to his conversation. His gentleness and uniform courtesy toward those many years his junior made him a delightful companion and a welcome visitor. His tall, erect figure made him conspicuous in any assembly, while his great modesty and unwillingness to speak of himself made it difficult to realize the important service which he had rendered to his profession and his country.

His anecdotes covering the New York of his youth, of his going out to the neighborhood of Canal street with an older relative for pistol practice, where there was no danger of injuring anyone, and of his shooting woodcock in 23d street made one realize how recent a thing is the physical greatness of this city. His "Reminiscences of an Octogenarian," published in 1897, while lacking continuity of narrative, gives some admirable and interesting sketches of New York between the years 1816 and 1860, and affords evidence of the refined tastes and admirable public spirit of the author.

Mr. Haswell was a member of the American Society of Civil Engineers, the British Institution of Civil Engineers, the Institution of Naval Engineers of Great Britain and of the Naval Engineers of the United States, the Municipal Engineers of the City of New York, the American Institution of Architects, the New York Academy of Science, the New York Microscopical Society and the Society of Authors. He was also a member of the Engineers' Club of New York and the Engineers' Club of Philadelphia, and was the oldest member of the Union Club of New York City.

Suspension of Service on European Railroads.

A note was published in the *Railroad Gazette* of March 8, 1907, regarding the suspension of service on the Hungarian state roads owing to a congestion of terminal and station facilities. It appears from the *Journal des Transports* that this suspension of service is not entirely unknown in other European countries. On the 29th of January there was promulgated from Brussels the following order affecting the state railroads of Belgium: "In consequence of the extraordinary amount of traffic that has been received the acceptance of carload lots of merchandise, intended for the frontier towns of Sterpenich, Athus, Renonchamps and Lamorteau will be sus-

pended for 48 hours." Thus, under a pretext of an embarrassment caused by the legitimate claims of its shippers, the administrations of the State Railroads of Belgium calmly suspended the acceptance of slow-speed merchandise for a period of 48 hours in carload lots that were intended for exportation. This is certainly an expeditious manner of simplifying railroad service.

In the case of the Hungarian roads, in the order already alluded to, of suspending the acceptance of freight for Budapest, reference was made to the accumulations of freight in the stations at Christmas time as a calamity. Again in Austria, on about the 25th of December, the Nord-Ferdinand, which is a state road, was also clogged with freight and suspended service for a time. The order for this reads that this condition of affairs has compelled the management to entirely suspend all slow-speed freight service for a few days, or until the present accumulations have been delivered.

Finally the same "calamity" has occurred on the new nationalized system in Italy in consequence of which a number of stations have been blocked with freight because of an insufficiency of rolling stock. For several weeks radical measures were taken against which the commercial interests of the peninsula naturally protested, nevertheless, the state, in order to avoid congestion, refused to accept certain classes of merchandise. A number of points were indicated for which no freight should be received, and in one case it lasted from the 22d of November to the 7th of December. Apparently, this method of relieving freight congestion has been more common in Italy than in any of the other countries mentioned, because it is quoted as having occurred, not only in November, but in December and in January, and due notices were issued at the time when the embargo was raised.

Kansas Railroad Laws.

The Board of Railroad Commissioners of Kansas, G. W. Kanavel, C. A. Riker and F. J. Ryan, have issued a pamphlet containing the railroad laws of that state, as amended to date, supplemented by the rules of practice for the conduct of proceedings before the commission. We note the principal changes made in the laws at the legislative session of the present year.

Chapter 268, published March 20, amends 11 sections of the former railroad laws. It prescribes the duties of the commissioners and clerks and fixes their salaries. It lays down elaborate and detailed provisions for the inspection and supervision of the railroads, express companies and sleeping car companies of the state. One section sets forth in particular a great number of items in connection with the property of the railroads of the state, concerning which the commission is required to gather information with a view to reporting what amount of money would be required to replace the physical properties. The commissioners may employ experts in this work, and the information gathered is to be printed "from time to time." Other sections of this law prescribe, with tiresome reiteration, the duties of the commission in its different fields.

Chapter 269 empowers the railroad commissioners to intervene in cases before the Interstate Commerce Commission, where the interests of Kansas shippers are involved.

Chapter 275 is a reciprocal demurrage law, requiring the railroads to furnish cars for shippers on demand; orders for 10 cars to be filled in three days; for 30 cars or more, 10 days; but these time limits do not excuse lack of diligence in furnishing cars. On failure to furnish cars ordered the railroad shall pay $5 per car per day to the person who applied for them, but the applicant must, if required, deposit with his requisition one-fourth of the freight charges on the prospective shipment, though not over $10 a car. If an applicant fails to load a car within 48 hours, he must pay the company $5 a day. There are provisions against bunching requisitions or bunching cars, and a shipper who does not use his cars must pay the $5 penalty and also pay damages to the company. But if an applicant elects to order cars without a deposit neither party shall be liable for the penalties. Freight must be transported at 50 miles a day, though this figure is not to be taken as a limit on the speed of live stock and perishable freight. Failure to transport shipments in good time involves a fine of $5 a day on carloads and five cents per 100 lbs. on less than carloads. With cars carrying 30 tons the consignee must be allowed 48 hours in which to unload, and for larger cars 72 hours. Where cars are bunched and delivered to consignee faster than he can unload, the carrier is to allow him such additional time as may be reasonably necessary. A shipper must be able, in ordering cars, to show that he had on hand the actual grain or other freight to put into them.

Chapter 270 requires the State Railroad Commission to investigate through freight rates and, if necessary, apply to the Interstate Commerce Commission for relief.

Chapter 272 regulates passenger fares. The ordinary single ticket rate is three cents a mile, but 2,000-mile tickets, good for the original purchaser, must be sold at $50 each, with a rebate of $9.50.

Chapter 278 fixes the maximum freight rates for certain grains. The rates in force January 1, 1907, are reduced 15 per cent., and the tariff rate must allow one stop-over for reconsignment or for milling, shelling, cleaning or storing, good for six months.

Chapter 271 requires the railroads to designate what cities or places shall be freight terminals, and requires the construction of proper freight houses and freight terminal facilities at such places. A railroad failing to comply shall forfeit $1,000 a day.

Chapter 282 requires railroads confiscating coal in transit to notify the consignee within three days, and within 30 days to pay him twice the invoiced price. If he has not received the invoice, twice the market value at point of origin. If the coal is billed to shipper's order, then payment is to be made to the person for whom the coal was intended. If a road delays payment for 30 days the consignee may recover, not only the double value, but an attorney's fee.

Chapter 276 requires live stock to be transported 15 miles an hour, exclusive of stops, unless unavoidable causes prevent. Failure makes a road liable for all damages, including depreciation of market price and shrinkage in the weight of animals.

Chapter 267 restates the general duties of the railroad commissioners.

Chapter 286 empowers the Mayor and council of a city of the first or second class to order an election to vote on granting aid to railroads; but not more than $30,000 in case of a first class city or $20,000 in a second class city.

Chapter 279 prohibits demurrage associations, or the employment of a common agent or bureau to collect demurrage rates.

Chapter 280 limits the working hours of trainmen, telegraph operators, etc., to 16 hours a day, with the usual conditions; but the crew of a train containing live stock or perishable freight in carload lots may run to the next division point. Any corporation or receiver knowingly violating this act shall be liable to $1,000 to $2,000 fine. The Commissioner of Labor is empowered to investigate complaints of violation, and to examine the railroad records. If he finds the complaint well founded he must lay it before the county attorney.

Chapter 281 fixes the liability of railroad companies to their employees for bodily injury. Every railroad is liable for all damages to any employee in consequence of any negligence of its agents or any mismanagement of its employees. Notice of the injury must be given in writing within eight months, but the notice need not state whether or not suit is intended to be brought.

Chapter 273 prohibits free transportation, with the usual exceptions. Among the persons excepted are a representative from each of the labor organizations of employees of the company, and employees who are on the retired list and who have been continuously in the service of the company for 15 years.

Chapter 277 requires railroads to furnish double-deck cars for the shipment of sheep, and if single-deck cars are used only one-half the regular rate for a carload lot may be charged.

Chapter 274 requires freight trains to carry passengers in the caboose on the same terms as on passenger trains, but persons under 15 years of age need not be carried unless accompanied by a competent person. Freights need not stop except at their regular stops, and the road may limit its liability, except as to wilful negligence. The caboose need not be stopped at the depot and the law does not apply to freight trains on main lines carrying live stock. Violation of this law by any officer or employee makes him liable to $100 fine or *30 days in jail*, or both.

Chapter 283 forbids railroads to build or repair cars or engines at division points where shops are located without providing sheds to shelter the workmen; penalty $25 to $100. This law goes into effect September 1.

Chapter 284 requires the chief officer of any state institution to sue a railroad which loses in transit any coal destined to such institution. Any state officer who neglects to notify the Attorney-General of the non-arrival of coal shall be deemed guilty of a misdemeanor and be fined not more than $500; and he shall be disqualified to longer hold his office.

Foreign Railroad Notes.

The Germans opened for traffic last January in their province of Togo on the Gulf of Guinea a new meter-gage railroad from the coast at Lorne north 76 miles through the palm-oil nut district into the highlands at Palime. They had previously a railroad from Lorne east directly along the coast to Anecho, about 25 miles.

Two new car works have been established in Douai, France, for the manufacture of cars of large capacity—40 to 50 kilometric tons. One of these will have capacity for 1,500 cars yearly.

The Japanese have already built a railroad on the southern part of the island of Saghalin, which part was assigned to them by the treaty of Portsmouth. There are coal mines on the island. Under their protectorate of southern Manchuria extensive shops

have been built at Meaden, intended, it is said, for building new cars and locomotives, as well for repairs.

The Henschel & Son locomotive works in Cassel turned out its 8,000th locomotive March 23. The 7,000th was finished Feb. 10, 1905. This firm has a contract for 110 locomotives for the Italian railroads.

Pennsylvania Railroad Improvements at Havre de Grace, Md.

The Pennsylvania Railroad has nearly completed the extensive improvements on the main line of the Philadelphia, Baltimore & Washington at Havre de Grace, Md., at the mouth of the Susquehanna river, and extending about 5½ miles, as far north as Principio and as far south as Oakington, which were begun in 1904. These include a new steel bridge, about a mile long, over the Susquehanna river, and changes in line on both sides of the river to eliminate grade crossings and straighten out curves. These improvements are part of the plans made to eventually reduce the running time between New York and Washington to four hours.

The new bridge is located about 150 ft. north of the old structure. The foundations contain 44,369 cu. yds. of masonry and 20,230,384 lbs. of iron and steel were used in the superstructure, which consists of 17 fixed deck spans and a through draw span 280 ft. long. The first fixed span on each end is 196 ft. 6 in. long; the remaining spans on the Havre de Grace end are each 200 ft. long, and on the Perryville end they are each 260 ft. long. The fixed spans have a clearance of 24 ft. 3 in. at mean tide, and the draw span has a clearance of 53 ft. The draw has a clear opening of 100 ft. on either side of the swing pier. The 20 piers are built of Alleghany Mountain sandstone with concrete backing and Port Deposit granite coping. They are at right angles to the bridge, with the exception of the two rest piers for the draw, which are swung 14 deg. to the west to bring them in line with the current of the river.

Pier No. 1, the east abutment, was built by open cofferdam construction on rock at an elevation of 4.4 ft. Excavation for piers 2, 3 and 4 was carried on by the open cofferdam construction, and in the case of pier 3 a depth of —32 ft. was reached. From the bottom of the excavations piles were driven to solid rock. In building pier 2, 294 piles were driven to a depth of —77 ft. Piers 3 and 4 each rest upon 390 piles driven to an average depth of —110 and —88 ft. respectively. The piles were all driven with a No. 2 steam hammer, and were followed below the top of the cofferdam by means of extension leads to the pile driver. They were sawed off and capped with concrete for a depth of 2 ft. below and 6 ft. above the heads. It was impracticable to put a timber grillage on top of the piles, as bracing of the cofferdam made it impossible to get timber of any length to the bottom of the excavations.

Piers 5 to 16, inclusive, were built on pneumatic caissons sunk to the following depths:

Pier.	Elevation of cutting edge.	Extreme depth. foundation.
No. 5.	— 74.6 ft.	— 76.8 ft.
" 6	63.3 "	65.5 "
" 7	85.5 "	— 87.6 "
" 8	77.0 "	81.2 "
" 9	42.5 "	46.0 "
East Rest Pier " 10	42.7 "	48.9 "
Center Pier " 11	38.5 "	45.5 "
West Rest Pier " 12	36.5 "	38.3 "
" 13	35.8 "	— 37.9 "
" 14	26.1 "	32.3 "
" 15	— 21.0 "	— 23.6 "
" 16	21.5 "	— 22.3 "

The caissons rest on rock, with the exception of pier 7, which rests on gravel, and pier 8, which rests on gravel and boulders. It was the intention to build piers 14, 15 and 16 by the open cofferdam method, but the idea was abandoned for 14 and 15 because there was so little sand and mud where the piers were located, while in the case of pier 16 it was not given up until a month was spent trying to put in a cofferdam and prevent its leaking.

Piers 17, 18, 19 and the west abutment were built on rock in open cofferdams at the following elevations:

	Pier.	Elevation.	Pier.	Elevation.
West Abutment	No. 17.	17.2 ft.	No. 19.	— 1.5 ft.
	No. 18	12.3 ft.	No. 20.	— 3.0 ft.

Work was started on the piers in the summer of 1904, but not much river work was done until the ice went out in 1905. The last masonry was laid on the fender pier December 16, 1905.

The fender at the draw is built of piles with a granite pier at the north end and a timber crib filled with stone at the south end. The granite pier rests on a caisson sunk to a depth of —44.8 ft., while the crib rests on the river bottom dredged to a depth of —30.5 ft.

Erection of the steel work was begun August 10, 1905, and finished May 22, 1906. The draw span was erected on falsework over the fender and swung into position May 19, 1906.

The curvature at each end of the bridge has been greatly reduced by changes in alinement. Two bad curves are eliminated south of Havre de Grace, there being a 2 deg. 5 min. curve to the left 2,626 ft. long, followed by a tangent 400 ft. long and then a 1 deg. curve to the right 4,537 ft. long. To offset this curvature, on the new line the following curves have been used: A 0 deg. 45 min. curve to the left 4,338 ft. long, then a tangent 3,847 ft. long, followed by a 0 deg. 40 min. curve to the right, 3,655 ft., which then returns to the old line. There is one other curve on the line, near Principio, a 0 deg. 30 min. curve to the right, 1,600 ft. long. On the old line near this point there is a 1 deg. curve to the right 1,600 ft. long. The difference in degrees of curvature between the old and the new lines is made up at the Principio end by going back on the 1 deg. 20 min. curve to the left, 600 ft., thus throwing the new tangent 8 deg. further north than the old tangent.



Old and New Bridges over the Susquehanna River at Havre de Grace, Md.; Philadelphia, Baltimore & Washington.

The junction of the main line with the Columbia & Port Deposit (a branch of the P., B. & W.), was thrown 1,200 ft. north at Perryville. This necessitated making extensive alterations for about 8,550 ft. and running into the old line north of Frenchtown.

All grade crossings on the main line are eliminated for this stretch of 5½ miles, and two out of three crossings on the C. & P. D. branch are now made with undergrade bridges.

Between Principio and Perryville the following bridges (for crossings) have been built:

3 Overhead bridges, for private roads.
1 Stone arch of 35 ft. span over Mill Creek.
1 Stone arch of 20 ft. span for roadway and pedestrians.
2 Undergrade bridges, one over a private road, and the other over the east leg of the old "Y" of the C. & P. D. branch.

Between Havre de Grace and Oakington the following bridges (for crossing) have been built:

2 Stone arches of 20 ft. span over alleys.
1 Stone arch of 19-ft. span over a small stream.
2 Overhead bridges, one over a private road and the other over the Philadelphia and Baltimore post road.

On the C. & P. D. branch the following bridges have been built:

2 Undergrade bridges, 1 at Perryville for post road, and 1 at Frenchtown over the public road.
A 12-ft. stone arch has been extended 27 ft. 3 in. on the east side, and 33 ft. 6 in. on the west side.
A 14-ft. stone arch has been extended 16 ft. 5 in. on the river side.

The change of line (excluding the river bridge) involved the use of 30,000 cu. yds. of masonry and necessitated 745,000 cu. yds. of excavation. The masonry is all of Alleghany Mountain sandstone with granite bridge seats.

GENERAL NEWS SECTION

NOTES.

The Governor of New York has signed a bill creating a grade crossing commission to deal with the grade crossing problems at Niagara Falls.

The trunk lines have agreed that from June 1, $2 demurrage will be charged on carloads of grain held at intermediate points for reconsignment, unless the delay is less than 48 hours.

The Georgia Railroad Commission, on May 10, issued an order putting the Seaboard Air Line Railway in class B, instead of class C, thus requiring a reduction of 10 per cent. in its freight rates.

The railroads south of the Potomac and Ohio rivers, and east of the Mississippi, will probably announce party tickets at 2½ cents a mile for 10 to 19 persons, and at 2 cents a mile for 20 or more.

The two houses of the legislature of Illinois agreed, May 10, on a 2-cent fare law, and the bill was sent to the Governor. From passengers paying cash fare on trains it will be legal still to collect 3 cents a mile.

The Oregon Short Line is to put up rest houses for its employees at Pocatello, Montpelier and Glenn's Ferry, Idaho. The largest of these houses, that at Pocatello, will be 56 ft. x 73 ft., and two stories high.

The railroads running east from Chicago have announced that from June 1 lumber will be charged at sixth class rates, which, to New York, will be an increase of 25 per cent.; to Philadelphia, 27.7 per cent., and to Buffalo, 20 per cent.

The new passenger steamer "City of Cleveland," under construction at the plant of the Detroit Shipbuilding Company for the Detroit & Cleveland Navigation Company, and intended to run between Detroit and Cleveland, was destroyed by fire on May 13; loss $700,000. The vessel was designed to carry 4,500 passengers.

The Supreme Court of the United States has sustained the decision of the Interstate Commerce Commission disapproving an advance in the freight rates on soap shipped by the Procter & Gamble Company, of Cincinnati. The proposed increase, about 17 per cent., was made by changing the classification from fourth class to third.

Judge Pritchard, in the United States Circuit Court, at Richmond, Va., May 9, in a suit brought by the Southern Railway, granted a temporary injunction, returnable June 27, restraining the Virginia State Corporation Commission from reducing passenger fares in that state. A similar order was granted to restrain the officials of the state of North Carolina from reducing either freight or passenger rates on the Southern Railway.

An officer of the Union Pacific says that he looks for a greater coal famine next year than ever before. "The Union Pacific Railroad, which has always taken care of the people along its lines, will no longer be able to do so, on account of the new law. The small dealers have in a way depended on the railroad supply of coal to help them out, and unless they store their own coal during the coming summer they will face a famine in the winter. The Union Pacific will store coal as usual this summer, but will have none to sell."

In the case of the city council of Atchison, Kan., against the Missouri Pacific, the Burlington and the Atchison, the granting of certain allowances or free service in the elevation, transfer, mixing, cleaning and other handling of grain at Kansas City, Leavenworth and Kansas City, which are withheld at Atchison, is declared by the Interstate Commerce Commission unlawful. The carriers should not furnish at Kansas City, Leavenworth or Argentine, elevator allowances or other free service in connection with the shipment of grain which are not furnished at Atchison.

The Interstate Commerce Commission has denied the plea of Southern cotton manufacturers for a reduction of the rates on cotton goods from that section to the Pacific Coast. The opinion, by Commissioner Lane, says: "The fact that such rates are higher than from the New England states does not of itself establish the unreasonableness of the higher rates. The New England mills are entitled to such advantage as they have from being closer to ports where cheap water competition has been established. The existence of a lower rate in the somewhat remote past does not necessarily prove anything of value in ascertaining the reasonableness of a rate existing to-day."

The Interstate Commerce Commission, in a case against the Chicago, St. Paul, Minneapolis & Omaha, and its connections eastward, has decided that a rate of 62 cents on rugs from St. Paul to Boston, by way of Duluth and the Mutual Transit Company's steamers, when there was in force at the same time from St. Paul a lake and rail rate, via Lake Michigan, of 45 cents, and an all rail rate [via Chicago] of 49 cents, was unreasonable; it should be only 45 cents. And yet it appears that the 62-cent rate was made up of a local rate to Duluth of 23 cents, and a lake-and-rail rate from there of 39 cents.

Eight railroads in the South have granted an increase of 6 per cent. in the wages of enginemen of freight trains, and 10 per cent. in those of enginemen on passenger and switching engines. The roads are the Atlanta & West Point, the Georgia, the Central of Georgia, the Southern, the Seaboard Line, the Georgia Southern & Florida, the Atlantic Coast Line and the Mobile & Ohio. The increase of pay recently granted on the New York, New Haven & Hartford is said to amount to 10 cents a day for brakemen, bringing the rate up to $2.20; 15 cents a day for baggagemen, making their pay $2.25; and 20 cents a day for yardmen, who will now receive $2.40 for eight hours.

In the United States District Court at Wilmington, N. C., May 11, the Laurinburg Oil Company and the Lumberton Ginning & Oil Company, were fined $10,000 and $5,000 respectively for having obtained a freight rate lower than that in legal effect by means of false certification of weights. At the suggestion of Attorneys Skinner and Walter, the cases as to the officers and directors of the mills were nolle prossed, with the exception of that of R. E. L. Correll, Superintendent and Manager of the Lumberton mill, for whom the corporation would not become responsible. The case as to Correll was continued to the October term. The cases have attracted attention as the first of their nature instituted by the commission against the shipper and not the transportation company.

Attorney-General Bonaparte has brought suits against 25 railroads to recover penalties for violation of the safety appliance law as follows: Alabama & Vicksburg; Atlantic Coast Line (25 violations); Atchison, Topeka & Santa Fe; Belt Railway of Chicago; Chicago & Eastern Illinois; Chicago, Burlington & Quincy; Chicago, Indianapolis & Louisville; Cleveland, Cincinnati, Chicago & St. Louis; Evansville & Terre Haute; Florida East Coast; Gulf & Ship Island; Illinois Central (46 violations); International & Great Northern (13 violations); Louisville & Nashville; Louisville, Henderson & St. Louis; Missouri, Kansas & Texas Ry. Co. of Texas; Mobile & Ohio (43 violations); Morgan's Louisiana & Texas; Nashville, Chattanooga & St. Louis; New Orleans & North Eastern Railroad Co. (11 violations); Peoria & Pekin Terminal; St. Louis & San Francisco; Seaboard Air Line; Texas & Pacific; Yazoo & Mississippi Valley (28 violations).

In the United States Court at Montgomery, May 8, preliminary injunctions were granted in the suits of ten roads in Alabama, restraining the state from putting into operation the rate laws just enacted. Continuance was taken in the application of the Louisville & Nashville because of its having made rates in violation of the law, which says that rates in effect January 1 last shall be the maximum charge. This feature was continued for 30 days by request of the state. The roads which secured the injunction are the Atlantic Coast Line, the Seaboard, the Central of Georgia, the Western of Alabama, the Alabama Great Southern, the Southern, the Mobile & Ohio, the Atlanta & Birmingham, the St. Louis & San Francisco and the Nashville, Chattanooga and St. Louis. The law in question would make the rates in force Jan. 1, 1907, the maximum rates; fixes rates on 110 articles, classifies the roads and provides for the abrogation of license of any road removing a case from the state to the federal court.

The Supreme Court of the United States, reversing the decision of the Court of Appeals of the state of Kentucky, has sustained the contention of the Adams Express Company that the state of Kentucky cannot interfere with the traffic in whisky between Ohio and Kentucky as carried on by the express company. It appears that to consumers in places in Knox and Laurel counties, where there is a state prohibition law, liquor is shipped c.o.d. from Cincinnati which is not ordered by the consignees, and the express company delivers the goods in such a way that the consignee does not know the name of the shipper. The Cincinnati liquor men procure the names of the users of liquor in the prohibition counties and keep on hand for them at the local express offices a constant supply of intoxicants, to be delivered to them whenever paid for, and the system is said to result in turning many of the express offices into liquor storehouses on a small scale. The express companies claimed that they were only common carriers, obliged under their contracts to make collections on c.o.d. packages. Justice Brewer, writing the decision, held that the traffic is interstate commerce, and hence not subject to state regulation. Justice Harlan dissented.

Electric Trains Under the Detroit River.

For the operation of the Detroit river tunnel, now being built for the Michigan Central, the electrified zone will be 4.6 miles long and will comprise with the yards some fifteen miles of track. Six 100-ton direct-current locomotives of the swivel-truck type, with geared motors, will comprise the initial equipment for hauling both freight and passenger trains. Each locomotive will be capable of hauling a 900-ton train up a 2 per cent. grade at a speed of 10 miles an hour. Four 280-h.p. motors will be mounted on each locomotive; two motors being placed on each of the two swivel trucks, with a multiple unit control system to enable the locomotives to be operated singly or in train. Automatic, high-speed air-brakes will form a part of the equipment. The electrical equipment for the locomotives as well as for the tunnel, in general, will be furnished by the General Electric Company.

Power for operating the system will be purchased from the Detroit Edison Company, and will be delivered to a sub-station at Detroit at a potential of 4,400 volts, and at a frequency of 60 cycles. At the sub-station two 1,000-k.w. synchronous motor generator sets will be installed for supplying direct-current to the third rail. Each of these sets will consist of a 1,000-k.w., 4,400-volt, three-phase, synchronous motor, direct-connected on a common base to a 1,000-k.w., 650-volt, compound wound, direct-current generator. A 15-k.w., 125-volt exciter for the synchronous motor will be mounted on a shaft extension of each of the motor-generator sets.

A complete electric lighting and electric pumping equipment forms a part of the project. The yards and approaches to the tunnel will be lighted by arc lamps. The tunnel will be lighted by incandescent lamps arranged on duplicate circuits. Alternating current from the main power supply at a frequency of 60 cycles will be used on the lighting circuits. To insure an uninterrupted lighting service the lighting circuits in the tunnels are so arranged that half the lamps in both tunnels will burn if, by chance, either of the lighting circuits in the tunnels should be broken. A single three-phase distributing circuit will run through each tunnel and from these circuits suitable connections will be made to step-down transformers. The secondaries of the step-down transformers will be interconnected with duplicate circuits for half the lamps in each of the tunnels.

Five sumps will be provided in the tunnel, each sump drained by induction motor centrifugal pumps arranged in duplicate. The motors on the pumps will operate directly at 4,400 volts and the controlling circuits with compensators will be centralized in the sub-station. For indicating the amount of water in each sump, a float system will be provided having both visible and audible indicating devices in the sub-station.

At the sub-station a regulating storage battery will be provided to carry the fluctuations of the load. If the main power supply from the Detroit Edison mains should be interrupted this storage battery will have sufficient capacity to operate the entire system for half an hour. In such an emergency, the lighting and pumping alternating-current equipment will be energized by 60-cycle, alternating-current from a 50-k.w. motor-generator set, the driving motor being supplied with current from the storage battery. Flexible switching arrangements will enable this interchange of power supply to be easily and quickly made.

A Grasping Corporation vs. the Down Trodden People.

If members of the Bala Golf Club cross the Pennsylvania Railroad tracks, which divide the club grounds into two sections, they will henceforth do so at their own risk. After a personal inspection of the links, Judge Staake has decided that the crossings were dangerous and sustained the recent action of Common Pleas Court No. 5 in granting an injunction to the railroad company restraining the golfers from using them. If balls are driven across the tracks by the players and they want to recover them they must run the risk of being run down by any of the 80 or more trains which pass through the grounds daily. Women players especially, the court said, were particularly liable to death or injury on the tracks, for the reason that, becoming absorbed in the game, they could easily be run down by trains they did not see approaching.—*Philadelphia Public Ledger.*

Description of Real Reciprocal Demurrage.

The railroads have just fixed the charges against each other for failure to return cars so high that greater promptness is assured. The same must be done with like charges against shippers. Nobody wants you to pay demurrage; just release the cars. That is the only object, not revenue. This is not understood by the advocates of what is miscalled "reciprocal demurrage" with respect to car supply. The shipper has a car in his possession which he will not load or unload promptly, so as to set it free for other service. A per diem charge is made against him—a penalty for not doing what he ought to and can do. So, they say, the railroad should be made to pay the like amount when it does not promptly furnish a car to the shipper when requested.

If the railroad had a car which it could furnish and would not, the cases would be alike and a charge might be called "reciprocal." But the very life of a railroad is in getting empty cars loaded. It would be suicide to withhold them from shippers. We do not fine people for not doing what they wish to do but cannot.

If the penalty is to be for not having constantly on hand cars enough to meet all requests then say so, but do not call it "reciprocal demurrage." Reciprocity would be this: If you make the railroad pay the shipper when it has no car for his load, then a reciprocal charge would be to make the shipper pay the railroad when he has no load for its car, as is often the case when crops fail or trade is dull; and surely nobody would propose that.—Judson Harmon, Receiver, C., H. & D.

Stewart Inter-Track Fence.

The accompanying illustration shows a design of inter-track and park fencing made by the Stewart Iron Works Co., Cincinnati, Ohio.



Stewart Inter-Track Fence.

It is made of special three-rib channel rail, the third rib being so placed as to give additional strength where most needed. The picket heads are made of malleable iron. The fence shown in the *Railroad Gazette* of May 3 as being an inter-track fence was, as was evident, a platform fence.

Long Island Bouquets.

On the Long Island Railroad this year only plants native to Long Island are to be used in the little parks surrounding the stations. At Patchogue a women's club, called Sorosis, is helping the station park along and the village lends its street roller and other implements. The railroad company furnishes land and labor, and brings rock from the East River tunnels for the drives and walks. About 600 trees and shrubs have been set out. The plot around the station contains about three acres, and its border of trees and bushes almost entirely hides the freight yard from view. At Nassau, on the road to Oyster Bay, 425 shrubs and 12 trees have been ordered. Bayport, Oakdale, Babylon, Merrick, Ronkonkoma, Oyster Bay and other stations already have parks.

Duff Ball-Bearing Screw Jack.

The Duff Manufacturing Co., Pittsburg, Pa., sole manufacturers of Barrett ratchet jacks, is putting on the market a new ball-bearing lifting jack which embodies new ideas and improvements, and which will be manufactured in connection with the Duff roller bearing screw jacks. The makers claim as principal features of this jack that the bearings cannot wear unevenly and that the balls are made larger than in other jacks, making operation easier and giving greater capacity. The gears cannot get out of mesh; this is most important, as any trouble of this kind would tend to derange the load and destroy the jack. Each of these new jacks has an additional bearing on the bevel pinion, insuring great ease of operation. The ball-bearing jacks are made interchangeable with the roller bearing jacks which this company has been building for several years so that it is possible to use roller bearings in place of ball bearings when desired. The jacks are designed to cover all purposes and provide any bearing that the purchaser may specify.



P. R. R. Cultivated Forests.

The Pennsylvania Railroad now has about 1,000 acres of land planted with trees, having just begun setting out the 550,000 which will complete this amount. At Mount Union, Pa., about 225,000 trees are being planted. At Altoona 250,000 or more red oak trees are being set out. At Hollidaysburg a "forest nursery" is being created, about 135 lbs. of seed being planted this year in nursery

beds, and many trees being set in nursery rooms for use next year. The total number on the 1,000 acres under cultivation is 2,250,000. The planting is done with great attention to scientific detail, under the supervision of the company's recently appointed forester, Mr. E. A. Sterling, formerly of the United States Bureau of Forestry.

The selection of species for each planting site is determined by the character of the ground and the suitability of the trees for ties and posts. Some of the seeds, such as catalpa and locust, will produce material useful for posts in 15 to 20 years, but others, such as Scotch pine and red oak, which will be grown for ties, will not be ready for cutting in less than 30 or 40 years. Chestnut is also being used. Its seedling will take nearly as long as red oak to mature, but the sprout growth, which will be depended on later in natural forests, will grow in about 20 years. These latter species are planted upon the theory that by the time they are full grown ties will be more generally and successfully treated with preservatives, for without that treatment such ties would be of secondary value. The Pennsylvania Railroad System now uses 5,000,000 new ties every year, and their average cost is 70 cents.

Railroad Business by Daylight.

"The public character of a railroad makes the control of it a public as well as a private trust in every hand that holds it, whether the hand be chosen by a court or otherwise. Let it be understood that there are no favors going, open or secret, but that it is fare and fare alike all around. And if the business committed to me by the courts shall suffer from this cause, either at the hands of public officials or those of rival lines, the reason will be plain to a wayfaring man and the lesson will be worth to the country all it costs. I was met by many outcries as I proceeded to enforce my policy by discarding all old arrangements which I thought conflicted with it and refusing to make new ones. But there was the law. When the people found I was really in earnest, and that all were treated fairly and alike, they loyally supported me. If I lost business by the course I took there was no evidence of it. Then it was my luck—perhaps I might claim a slight share of credit for it—that the general awakening shortly came to my aid."—Judson Harmon, Receiver, C., H. & D.

The Great Salt Lake Cut-Off.

The "Lucin cut-off" of the Southern Pacific, the 30-mile trestle bridge across Salt Lake, Utah, is to be called hereafter the "Great Salt Lake cut-off," to indicate to the uninformed just where the bridge is located. This causeway has now been in service four years and has stood up so well that to-day unless the traveler looks out of the window he would not know from the motion of the train that he was on a bridge. This is just as true of the 12 miles of open trestle as it is of the filled-in parts of the line. Tied, braced, floored and ballasted, the 40,000 piles that support the cut-off high above the water are as sound as when they were transplanted from forest to lake. The 16-ft. bridge is still as level as a floor.

The regular daily traffic over the cut-off is five eastbound and five westbound passenger trains, and seven eastbound and seven westbound freights, and there are many special freight and passenger trains, every one of which gains from one to seven hours by the cut-off route, which saves 43 miles and the heavy grades of the old line running around the lake. The $4,500,000 that the Southern Pacific spent on this cut-off is one of the most profitable investments ever made by a railroad.

Saw Ties; Do Not Hew Them.

Farmers and wood choppers along the Pennsylvania Railroad who have been furnishing the road ties, for the railroad's use, have been requested to have the ties sawed instead of hewn, as has been the custom. Husbanding of available tie material, which is rapidly disappearing, is the reason given by the railroad for this suggestion.

In the report of a forestry expert just made public, the farmer is shown where he can save money by having his tie timber sawed, even though he haul it some distance to a mill. It is shown that, while a timber 16 ft. long and 15 in. in diameter will make only two ties when hewn, with no saving of material, that same timber, if sawed, would produce four ties and at the same time produce 57.6 board feet by lumber, which would have been lost through hewing.

The Pennsylvania Railroad is using more than 5,000,000 wooden ties yearly, and the saving of timber, should tie producers heed this warning, is material. It is a common belief, and generally true, that wood with a sawed surface is more susceptible to decay than a hewed surface. The fuzzy surface is to some extent a prepared substance for spores; but a hewed tie usually has scoring marks which serve the same bad purpose. The portable sawmill is a perfected machine of such small cost that it is economically available for owners of timber lands.

Disastrous Derailment at Honda, Cal.

In the derailment of a special train, carrying an excursion, about 2 o'clock on the afternoon of May 11 at Honda, Cal., on the Coast division of the Southern Pacific, about 60 miles north of Santa Barbara, 16 or more passengers and four trainmen were killed and 33 passengers were injured. The cause of the derailment is given as a defective switch, but this statement lacks the endorsement of any competent authority. The train was running at high speed. Most of the killed and injured passengers were in the dining car, which was at or near the front end of the train; and many of the killed and injured were scalded. Nearly all of the killed were residents of Reading, Pa., from which place the larger part of the excursion started. The wreck took fire but the flames were soon extinguished.

Manufacturing and Business.

William T. Dunning has been elected a Director and Secretary of the Chester Steel Castings Co., Philadelphia.

The New York office of the Standard Railway Equipment Co., St. Louis, has been moved from 122 Liberty street to 90 West street.

Among orders recently received by the Bliss Electric Car Lighting Company, Milwaukee, is one from the Baltimore & Ohio for the equipment of the Royal Blue Limited trains.

The general offices of the Magnus Metal Company have been moved from Buffalo to New York, and the company no longer maintains an office in Buffalo. The new address is 111 Broadway.

G. P. Blackiston has resigned from the Crucible Steel Company of America, with which company he has been connected for the past eight years, to become President and General Manager of the Pittsburg Automatic Vise & Tool Company, Pittsburg, Pa.

The Allison, Campion, McClellan Company has been organized to engage in general engineering work as the successor of the John W. Allison Company. The offices of the company are 1625 Land Title building, Philadelphia, and 905-6 West street building, New York.

The Tennessee Coal & Iron Co. has placed an order with the Crocker-Wheeler Company, Ampere, N. J., for the complete electric motor equipment of its new steel rail mill at Birmingham, Ala. The equipment includes 15 form W rolling mill motors, and the order aggregates about 575 h.p.

The fire, which on the morning of May 9 broke out in the plant of the Falls Hollow Staybolt Co., at Cuyahoga Falls, Ohio, did considerable damage to part of the roof of the main building, but within two days the plant was running at its usual capacity and the filling of orders will not be delayed.

The exhibit of the Allis-Chalmers Company, Milwaukee, at the Jamestown Exposition, includes a portable air compressor built on the principles of the Christensen compressor. It is built for capacities of 11, 16, 20 and 50 cu. ft., and is furnished mounted on an ordinary four-wheel platform truck. It is adapted to use in small shops, where the need for compressed air does not warrant a large stationary compressor.

The General Railway Signal Company, Rochester, N. Y., has received the contract for all the signal and interlocking appliances to be installed in the tunnels of the Hudson Companies. The first section to be signaled consists of the double-track line about 2½ miles from the terminal station at Henderson street, in Hoboken, N. J., through the completed tunnels under the Hudson river to the foot of Morton street, New York, and through to the station at Christopher and Greenwich streets, a total of about 5¼ miles of track. The contract calls for the complete installation on this section of the signal apparatus, ready for operation, by September 1, when it is expected that trial trains will be run. The contract also includes the signal apparatus in the river tunnels and terminal station at Cortlandt street, and in the extension of the Morton street tunnels north under Sixth avenue to the terminal station at Thirty-fourth street. These parts of the system will not be completed for some time. The road is to be operated with direct current, using the third rail, and trains of two or more cars will be run. The alternating-current track-circuit apparatus of the General Railway Signal Company, which has been installed in the electric zone of the New York Central, will be employed, with some slight modifications. The automatic block signals are to be arranged with double overlap, and the Kinsman automatic stop. The latest form of Kinsman contact rail and shoe apparatus will be employed, the contact rail for the automatic stop being placed outside of the track rails and between them and the third rail. The arrangement and location of signals has been carefully worked out in connection with the calculated speed diagram throughout the tunnels, and the signals will be spaced to permit a minimum headway of 1½ minutes, although in some places there are sharp curves and some grades

as steep as 4½ per cent. This contract is the largest so far placed for signals on electrically operated roads.

Iron and Steel.

The New York Central lines will probably give orders soon for between 100,000 and 200,000 tons of rails.

The Harriman Lines have ordered 150,000 tons of open hearth rails from the Tennessee Coal & Iron Company for 1908 delivery. Of these 110,000 tons are for the Union Pacific and Southern Pacific systems and 40,000 tons for the Illinois Central.

The Pennsylvania has given orders for 142,600 tons of Bessemer rails for 1908 delivery, as follows: United States Steel Corporation, 71,500 tons; Pennsylvania Steel Company, 30,500 tons; Cambria Steel Company, 30,000 tons, and Lackawanna Steel Company, 10,600 tons.

The King Bridge Co. has an order from the New York Central for a rolling lift bridge to be erected at Hamburg, N. Y. It is estimated that this contract will require about 400 tons of bridge steel. The American Bridge Co. has taken orders for about 4,000 tons of bridge work from the Illinois Central, and the McClintic-Marshall Company 1,100 tons for another road.

The Illinois Steel Company, it is said, has orders for 75,000 tons of rails from the Chicago, Milwaukee & St. Paul; 45,000 tons for the Chicago, Burlington & Quincy; 25,000 tons for the Chicago, Rock Island & Pacific; 5,000 tons for the New York, Chicago & St. Louis, and 5,000 tons for the Chicago & Eastern Illinois, for 1908 delivery. About 100,000 tons additional are under negotiation.

OBITUARY NOTICES.

Albert Keep, formerly President of the Chicago & North-Western, died at his home in Chicago on April 12.

Frank H. Goodyear, President of the Buffalo & Susquehanna, died in Buffalo on April 11 after a long illness.

Nathan Guilford, who resigned as Vice-President of the New York Central Lines in charge of traffic last December, on account of ill health, died on May 11 at his home in Yonkers, N. Y., of bronchitis. Mr. Guilford was born in Cincinnati on February 7, 1841. He began railroad work in 1859 as a clerk in the freight department of the Little Miami Railroad, a subsidiary of the Pennsylvania. From 1869 to 1870 he was secretary to the President of the Little Miami, and then went to the Baltimore & Ohio as Assistant General Freight Agent. He was appointed General Freight Agent of this road in 1872, and five years later was made a member of the Western Executive Committee. In 1879 he was elected Vice-President of the Manhattan Elevated Railway in New York City, and in 1882 was made Assistant Commissioner of the Trunk Line Commission. He was Commissioner of the freight department of this Commission from 1885 to the fall of 1887, when he was appointed General Traffic Manager of the New York Central & Hudson River. His title was changed to Traffic Manager in 1898, and in 1905 he was elected Vice-President in charge of traffic of the New York Central Lines east of Buffalo.



Nathan Guilford.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Civil Engineers.

At the meeting of this society May 15 a paper by William H. Burr on "The Reinforced Concrete Bridge Across the Hudson River at Sandy Hill, N. Y.," was presented for discussion. This paper was printed in *Proceedings* for April, 1907.

New York Railroad Club.

At the meeting of this club in the new building of the Engineering Societies, 29 West Thirty-ninth street, May 17, C. L. Bardo, Assistant Superintendent New York division of the New York, New Haven & Hartford, will present a paper on "The Science of Freight Transportation."

Philadelphia Institute.

At a meeting of the Electrical section May 16 an address was made by C. O. Mailloux, of New York, on the Electrification of Steam Railways.

At the meeting of the Mechanical and Engineering section to be held May 23, an address will be made by James B. Bonner, of Philadelphia, on the Present Condition of the Work on the Panama Canal, with illustrations.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Chesapeake & Ohio.—H. T. Wickham, General Solicitor, has been appointed to the new office of General Counsel, with office at Richmond, Va. Henry Taylor, Jr., succeeds Mr. Wickham.

Chicago, Cincinnati & Louisville.—The general offices of this company have been moved from Cincinnati to Chicago.

Delaware & Hudson.—J. R. Maxwell and Frank E. Smith have been elected Directors, succeeding Frederick Cromwell and Alexander E. Orr, resigned.

Great Northern.—See New York, New Haven & Hartford.

Mexican Central.—H. R. Nickerson, Vice-President, has resigned.

New York, New Haven & Hartford.—Benjamin Campbell, Fourth Vice-President of the Great Northern, has been elected Vice-President in charge of traffic of the New York, New Haven & Hartford, effective June 1.

Pittsburg, Binghamton & Eastern.—H. A. Schwenecke, Chief Engineer, has been elected Vice-President and a member of the Executive Committee.

Pittsburg, Wheeling & Kentucky.—E. B. Taylor, Third Vice-President of the Pennsylvania Lines West, has been elected also President of the P., W. & K., succeeding W. P. Hubbard. The road is leased to the Pittsburg, Cincinnati, Chicago & St. Louis.

Southern Pacific.—A. K. Van Deventer, Assistant Treasurer, has been elected Treasurer, with office at New York, succeeding N. T. Smith, deceased.

Warren & Ouachita Valley.—The officers of this company are as follows: F. E. Weyerhaeuser, President, with office at St. Paul, Minn.; N. H. Clapp, Jr., Treasurer; C. J. Mansfield, Secretary; O. W. Wheless, Auditor; W. S. Hobbs, General Manager; all with offices at Warren, Ark.

Operating Officers.

Baltimore & Ohio.—H. R. Hamlin, chief clerk to the General Superintendent of the Pittsburg grand division, has been appointed Trainmaster of the Connellsville Terminal and of the Fairmont, Morgantown & Pittsburg, which territory is part of the Connellsville division. F. T. Moore remains Trainmaster of the rest of the division.

Chicago & Alton.—F. L. Richards, Trainmaster at Mexico, Mo., has been appointed Assistant Superintendent at Bloomington, Ill.

Chicago & Eastern Illinois.—J. Whitson has been appointed Trainmaster at Salem, Ill., succeeding G. B. Wright, resigned to go to the St. Louis & San Francisco.

Chicago, Rock Island & Pacific.—H. P. Greenough, Superintendent at Cedar Rapids, Iowa, has been appointed Superintendent at Dalhart, Tex., succeeding J. F. Sugrue, resigned.

The headquarters of the Oklahoma division have been moved from Chickasha, Ind. T., to El Reno, Okla.

Colorado Southern, New Orleans & Pacific.—W. W. Yeatman has been appointed Superintendent of the Orange division, with office at Orange, Tex.

Louisiana Railway & Navigation.—August Mann, Superintendent of the Donora plant of the United States Steel Corporation, has been appointed General Manager of the Louisiana Railway & Navigation.

Minneapolis, St. Paul & Sault Ste. Marie.—W. H. Schutt has been appointed Assistant to the General Manager.

Missouri, Kansas & Texas.—E. M. Gates has been appointed Trainmaster of the Cherokee, Osaga, Tulsa and Joplin divisions, with office at Parsons, Kan.

New York, New Haven & Hartford.—C. S. Lake, Superintendent of the Southern at Greensboro, N. C., has been appointed Superintendent of the Berkshire and Naugatuck divisions of the New York, New Haven & Hartford, succeeding J. P. Hopson, transferred.

Philadelphia & Reading.—B. Darwin has been appointed Trainmaster at Reading, Pa.

Southern.—F. P. Pelter, Superintendent at Nashville, Tenn., has been appointed Superintendent at Chattanooga, Tenn., succeeding C. C. Hodges, who takes Mr. Pelter's place at Nashville.

Texas & Pacific.—W. G. Mason has been appointed Superintendent of the Avoyelles division, succeeding H. Flanders, resigned to go to another company.

Traffic Officers.

Ann Arbor.—See Detroit, Toledo & Ironton.

Chicago Great Western.—J. H. Lyman, General Agent at Kansas City, Mo., has been appointed General Agent at San Francisco, succeeding F. O. Hatch, resigned. E. B. McGonahy, division freight and passenger agent at Chicago, succeeds Mr. Lyman.

Detroit, Toledo & Ironton.—C. P. Lamprey, General Traffic Manager of this road and of the Ann Arbor, has resigned, and his office has been abolished. H. C. Bell, Assistant General Freight Agent, has been appointed General Freight Agent.

Chesapeake & Ohio.—H. W. Fuller, General Passenger Agent, has been appointed to the new office of Passenger Traffic Manager, with office at Washington, D. C. John D. Potts, Assistant General Passenger Agent at Cincinnati, Ohio, succeeds Mr. Fuller, with office at Richmond, Va. W. S. Bronson has been appointed Assistant General Passenger Agent at Richmond, Va.

Northern Pacific.—J. C. Poore has been appointed Assistant General Passenger Agent, with office at St. Paul.

Peach River & Gulf.—E. H. Green, Jr., has been appointed Traffic Manager, with office at Timber, Tex., succeeding M. M. Riner, resigned to go into other business.

San Pedro, Los Angeles & Salt Lake.—Thomas C. Peck, Assistant General Passenger Agent, has been appointed General Passenger Agent.

Tehuantepec National.—E. H. Moore has been appointed General Freight and Passenger Agent, succeeding E. M. Cousin, resigned.

Engineering and Rolling Stock Officers.

Birmingham Southern.—R. C. White, Master Mechanic, has resigned to go into other business.

Erie.—G. B. Owen has been appointed Engineer of Maintenance of Way, with office at Jersey City, N. J., succeeding James Burke, transferred. A. Swartz has been appointed Division Engineer at Huntington, Ind., succeeding A. Crable, transferred.

Mexican Railway.—J. B. Cozart has been appointed Master Mechanic at Atizaco, succeeding E. I. Shipp, resigned.

New York Central & Hudson River.—The territory in charge of C. E. Lindsay, Engineer of Maintenance of Way of the electric division, extends from Fifty-seventh street, New York City, to Mount Vernon and Kingsbridge. H. S. Balliet, Engineer of Maintenance of Way of the Grand Central Station, is in charge of the rest of the Electric division, and has been appointed also Signal Engineer of the Electric division.

Vandalia.—F. H. Watts, Engineer of Maintenance of Way at Logansport, Ind., has been appointed Engineer of Maintenance of Way at Indianapolis, succeeding A. R. Holliday, resigned.

LOCOMOTIVE BUILDING.

The Illinois Steel Company, Chicago, is in the market for one locomotive.

The Great Northern has reserved space with the Baldwin Locomotive Works for 100 locomotives.

The Colorado Midland has ordered six consolidation locomotives from the Baldwin Locomotive Works.

The Lake Superior & Ishpeming has placed an order for locomotives with the Baldwin Locomotive Works.

The Boston & Albany has ordered 10 consolidation, nine Pacific, eight double end and nine switching locomotives.

The Toledo, St. Louis & Western has ordered six switching locomotives from the American Locomotive Company.

The Brooks & Ross Lumber Company, Chicago, has ordered one locomotive from the American Locomotive Company.

The Intercolonial, it is reported, has ordered 10 consolidation locomotives from the Canadian Locomotive Company.

The Carthagena-Magdalena Railroad, Colombia, has ordered two Shay locomotives from the Lima Locomotive & Machine Co.

The New Orleans Terminal denies being about to buy two switching locomotives, as reported in the *Railroad Gazette* of May 3.

The St. Louis, Springfield & Oklahoma Western, a projected 250-mile line, expects to ask bids on rolling stock within the next 60 days. C. S. Stocker, Stigler, Ind. T., is President.

The Chilian Government Railways Administration has ordered 30 freight and passenger locomotives from the Baldwin Locomotive Works. The contract was made through Wessel, Duval & Co., Broad Exchange building, New York.

The Long Island, as reported in the *Railroad Gazette* of May 10, has ordered five 10-wheel locomotives from the American Locomotive Company for July delivery. The specifications are as follows:

General Dimensions.

Type of locomotive	Ten-wheel
Weight on drivers	128,000 lbs.
Total weight	167,000 "
Diameter of cylinders	21 in.
Stroke of pistons	26 "
Diameter of drivers	60½ "
Boiler, type	Straight; wide firebox
" working steam pressure	200 lbs.
Heating surface, total	2,024.64 sq. ft.
Tubes, number	272
" material	Charcoal iron
" outside diameter	2 in.
" length	13 ft. 4⅜ "
Firebox, length	119⅛ "
" width	83¼ "
" material	Penn. R. R. specifications
Grate area	689 sq. ft.
Tank capacity for water	6,000 gals.
Coal capacity	12 tons

Special Equipment.

Air-brakes	Westinghouse
Axles	Penn. R. R. specifications
Bell ringer	Gollmar
Boiler lagging	Sectional magnesia
Brake-beams	Davis solid truss
Couplers	Tower
Headlights	Glazier 20th century
Injector	Nathan simplex
Journal bearings	Ajax
Piston rod packings	U. S. metallic
Valve rod packings	U. S. metallic
Safety valve	Crosby
Sanding devices	Leach and gravity
Sight-feed lubricators	Nathan
Springs	Pittsburg Spring & Steel Co.
Steam gages	Crosby
Steam heat equipment	Leslie Regulator
Tires, driving wheel	Midvale
" truck wheel	Steel tired
" tender wheel	Schoen

The Japanese Imperial Government Railway, as reported in the *Railroad Gazette* of May 10, has ordered 24 simple, 3-ft. 6-in. gage, eight-wheel (4-4-0) locomotives with six-wheel tenders, from the American Locomotive Company for March and April, 1908, delivery. The specifications are:

General Dimensions.

Type of locomotive	Eight-wheel (4-4-0) with 6-wheel tender
Diameter of cylinders	16 in.
Stroke of piston	24 "
Diameters of drivers	4 ft. 6 in.
Boiler, type	Telescopic
" working steam pressure	160 lbs.
" heating surface	943 sq. ft.
Tubes, number	163
" material	Solid drawn brass
" outside diameter	1¾ in.
" length	10 ft. 7½ "
Firebox, length	6 ft. 6 "
Firebox, material	Copper
Grate area	Not less than 14¼ sq. ft.
Tank capacity for water	2,000 gals.
Coal capacity	3 tons

CAR BUILDING.

The New York & Queens County (*Electric*) is in the market for 40 electric cars.

John Morrell & Company, Ottumwa, Iowa, recently ordered 30 refrigerator cars from the American Car & Foundry Co.

The Victoria, Fisher & Western has ordered 30 standard gage logging cars from the Marshall Car Wheel & Foundry Company.

The Canadian Northern, it is reported, has ordered 50 steel cars of 100,000 lbs. capacity from the Dominion Car & Foundry Company.

The Arms Palace Horse Car Company, Chicago, is asking bids on 12 commercial express horse cars for service on passenger trains only.

The British Columbia Mills Lumber & Trading Company, Vancouver, B. C., it is reported, is building six flat cars at its Vancouver shops.

The Rhode Island Company, Providence, has ordered 55 cars. Of this number 35 are to be delivered this summer and the rest in the fall.

The St. Louis, Springfield & Oklahoma Western expects to ask bids on rolling stock within the next 60 days. C. S. Stocker, Stigler, Ind. T., is President.

The Harriman Lines, as reported in the *Railroad Gazette* of April 5, have again revised plans on 30 steel express cars and will shortly ask for new bids.

The Colorado Midland, as reported in the *Railroad Gazette* of March 8, has ordered 100 steel underframe coal cars from the Pressed Steel Car Company.

The Grand Trunk Pacific, it is reported, has ordered 1,000 flat cars of 60,000 lbs. capacity, 20 cabooses, 12 ballast distributing cars and nine flat cars of 80,000 lbs. capacity from the Canada Car Company.

The Cauca Railroad, which is being built in Colombia by the Colombian Pacific Railroad, has ordered ten 40,000-lb. box and flat cars and ten drop bottom dump cars from the American Car & Foundry Co.

The Temiskaming & Northern Ontario, it is reported, has ordered two work cars from Rhodes, Curry & Company, and three work cars and two second-hand coaches from the Crossen Car Mfg. Company.

The Illinois Central, as reported in the *Railroad Gazette* of April 26, has ordered 500 steel dump cars of 100,000 lbs. capacity from the American Car & Foundry Co. The cars will be 36 ft. 6 in. long, 9 ft. 7 in. wide and 4 ft. 6 in. high, inside measurements.

J. G. White & Co., New York, are about to order for the Philippine Railway 15 third class 41-ft. passenger cars, forty 20-ton box cars, forty 10-ton box cars and four cabooses. The company is also figuring on buying a number of steam or gasolene electric motor cars, which, if decided on, will probably be combination baggage and first and third class passenger cars.

The Duluth & Iron Range has ordered 10 refrigerator cars of 60,000 lbs. capacity from the American Car & Foundry Co. These cars will be 36 ft. long, 8 ft. 10 in. wide and 7 ft. 7 in. high, outside measurements. The special equipment includes:

Bolsters	Common sense
Brake-beams	National Hollow
Brake-shoes	Streeter steel back, Christie type
Brakes	Westinghouse
Draft rigging	Bryan tandem spring type
Journal boxes	McCord

The Atchison, Topeka & Santa Fe, as reported in the *Railroad Gazette* of May 10, has ordered 50 bunk cars from the Chicago, New York & Boston Refrigerator Company for June delivery. These cars will measure 49 ft. 6 in. long, 9 ft. 2⅝ in. wide and 8 ft. high, inside measurements. The special equipment includes:

Brake-beams	Kewanee
Brake-shoes	American Brake-Shoe & Foundry Co.
Brakes	Westinghouse
Brasses	Hewitt
Couplers	Janney
Draft rigging	Miner
Dust guards	Soule
Roofs	Hutchins

Swift & Company, Chicago, have ordered 50 steel tank cars of 60,000 lbs. capacity from the Bettendorf Axle Company, for August delivery. These cars will be 31 ft. long and 9 ft. wide, over all. The special equipment includes:

Axles	Griffin Wheel Co.
Bolsters	Bettendorf
Brake-beams	Chicago Railway Equipment Co.
Brakes	Fitzgerald
Brasses	Harrigan
Couplers	Major
Draft rigging	Miner
Dust guards	Harrison
Trucks	Bettendorf
Wheels	Griffin Wheel Company

The Atlantic Coast Line, as reported in the *Railroad Gazette* of May 10, has ordered 50 low side gondola cars of 80,000 lbs. capacity from the Hicks Locomotive & Car Works. These cars will weigh 31,000 lbs. and will measure 35 ft. 3½ in. long, 8 ft. 6 in. wide and 2 ft. 3 in. high, inside measurements, and 40 ft. long, 9 ft. 10 in. wide and 6 ft. 6½ in. high, over all. Bodies and underframes will be of wood. The special equipment includes:

Bolsters	Cast-steel body and truck
Brake-beams	Pennsylvania deck
Brake-shoes	Christie
Brakes	Westinghouse
Couplers	Tower
Draft rigging	Farlow twin spring
Dust guards	Harrison
Journal boxes	Symington
Paint	Atlantic Coast Line standard
Springs	Atlantic Coast Line standard
Trucks	Atlantic Coast Line standard

The Wilkesbarre & Hazleton, as reported in the *Railroad Gazette* of May 10, has ordered four drop bottom gondola cars of 60,000 lbs. capacity, one flat car of 50,000 lbs. capacity, and three box cars of 50,000 lbs. capacity from the Hicks Locomotive & Car Works. The rebuilding of the gondolas will be at Huntington, Pa., and of the box and flat cars at Chicago, Ill. The gondolas will weigh 24,000 to 25,000 lbs., and will measure 25 ft. 7 in. long, 8 ft. 6 in. wide and 3 ft. 10¾ in. high, inside measurements, and 28 ft. long, 8 ft. 11½ in. wide and 4 ft. 10½ in. high, over all. The flat car will measure 36 ft. long, 8 ft. 9 in. wide and 2 ft. 10½ in. high from top of rail to center of drawbar, over all. The box cars will measure 32 ft. 9 in. long, 8 ft. 1 in. wide and 7 ft. 4 in. high, inside measurements, and 34 ft. 10 in. long, and 9 ft. 3 in. wide, over all. Bodies and underframes of all cars will be of wood. The special equipment includes:

Brake-shoes for gondolas	Christie
Brakes for gondolas and flat cars	Westinghouse
Draft rigging for gondolas	Graham
Springs, for box cars	Diamond arch bar

RAILROAD STRUCTURES.

GREENVILLE, S. C.—The Southern has given a contract for putting up a shop at Greenville. Work is also about to begin on a new freight house.

HOUSTON, TEX.—The Missouri, Kansas & Texas, according to local reports, is planning to spend $150,000 enlarging its terminal facilities here.

JERSEY CITY, N. J.—The Hudson County Board of Freeholders are asking bids for a viaduct from Hoboken to Jersey City. The previous bids were rejected owing to changes in the plans. There is a fund of $1,000,000 to carry out this project.

MONTREAL, QUE.—The Quebec, Montreal & Southern has been authorized by the Dominion Railway Commission to build a steel bridge over the Nicolet river.

MORGAN CITY, LA.—The pier work on the $5,000,000 steel drawbridge of the Southern Pacific across Berwick Bay, at this place, has been finished, and it is expected to have the steel superstructure finished and the bridge open for traffic in four months.

NEW YORK, N. Y.—The lowest bid recently opened for constructing the steel and masonry approach for the Blackwell's Island bridge was that of the Snare & Triest Company, who offered to do the work for $1,576,760. The other bidders were: Williams Engineering & Contracting Company, $1,590,000; John Peirce Company, $1,749,000; J. H. Gray Company, $1,762,000, and Frank Bradley, $1,830,425. The contract will be let as soon as the Bridge Commissioner goes over the tabulations and security offered. The lowest bidder will probably get the contract, and must begin work within five days.

PLANTAGENET, ONT.—The Canadian Northern Ontario has been authorized by the Dominion Railway Commission to build a steel bridge over the South Nation river at North Plantagenet.

PRINCETON, B. C.—The Dominion Railway Commission has authorized the Vancouver, Victoria & Eastern to construct a steel bridge over the Similkaween river at this place.

WINNIPEG, MAN.—Plans are about finished, and bids are to be asked May 17 by the Canadian Northern for new shops and freight yards at Winnipeg. The buildings are to be of steel, concrete and brick, and will include a 39-stall roundhouse; a foundry 100 ft. x 200 ft., and blacksmith shop 100 ft. x 250 ft., in one building; store and office building 85 ft. x 300 ft.; machine and erecting shop 160 ft. x 600 ft., with a capacity for 25 locomotives. The repair shops, all in one building 200 ft. x 535 ft., include coach 180 ft. x 200 ft., paint 80 ft. x 200 ft., boiler and wheel 190 ft. x 200 ft., and tank 85 ft. x 200 ft. In addition there is to be a freight repair shop 100 ft. x 400 ft.; planing mill 85 ft. x 300 ft.; also power house, dry kiln, lumber storage sheds and oil house, each in a separate building. There is to be a water tank with 60,000 gals. capacity, and sorting tracks with a capacity for 520 cars.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BURR'S FERRY, BROWNDELL & CHESTER.—Work, it is said, is under way on an extension of this road from its terminus 10 miles east of Browndell, Tex., to Chester, La., 70 miles. Contract let for building the entire line. It is expected that the road will be finished and in operation by next year.

CAIRO & THEBES.—Bids are wanted May 22 by this company for building five miles of roadbed, bridging and concrete work between Thebes bridge and the Chicago & Eastern Illinois crossing. J. L. Armstrong, Chief Engineer, Cairo, Ill. (Mar. 15, p. 380.)

CANANEA, YAQUI RIVER & PACIFIC.—See Southern Pacific.

CHESAPEAKE & OHIO.—The Raleigh & Southwestern, it is said, has filed a mortgage to secure funds for building a line from a connection with the Piney branch of the Chesapeake & Ohio at Raleigh, W. Va., up the Piney river and over the divide, thence down the tributaries of the Guyandotte river in Raleigh or Wyoming counties; also for an extension from Raleigh up Beaver creek into the Glade creek valley. Johnson & Briggs, Richmond, Va., have contracts for some of the work. The line is now under construction from the mouth of Soak creek, Raleigh County, up that stream into the valley of Winding Gulf creek. It is reported to be a project of the Chesapeake & Ohio.

CHICAGO CITY RAILWAY.—The Board of Supervising Engineers estimate the cost of rehabilitating the line of this company during the next three years at $16,000,000, and on the Chicago Union Traction Company about $24,000,000 on the north and west sides. Of this, between $4,000,000 and $5,000,000, it is expected, will be spent for improvements within the next year.

CHICAGO UNION TRACTION.—See Chicago City Railway.

DENISON, BONHAM & NEW ORLEANS.—This company, which has projected a line from Ravenna, Tex., on the Missouri, Kansas & Texas southeast to Gilmer on the St. Louis South-western and the Texas Southern, about 125 miles, it is said is asking for bids May 18 for grading 20 miles from Ravenna east to Bois D'Arc creek, in Fannin County. E. D. Steger, Barnum, Tex., is President of the company. Bids to be sent to J. T. Munson, President of the Southern Railway Construction Company, Denison, Tex.

EUREKA HILL.—Contract has been let to N. Straw for grading this proposed line from the mines at Tintic, Utah, and the new smelter to be built by Jesse Knight and associates, west to Robinson, eight miles. It will cost about $10,000 a mile to build the line.

GEORGIA & FLORIDA.—Bids are wanted May 21 by A. E. Hess, Chief Engineer of the Augusta Construction Company, 519 Dyer Building, Augusta, Ga., for grading, piling, trestle bridging, drainage, etc., on connecting links of this road between Augusta, Ga., and Madison, Fla. The bids may be for sections or for the entire work, which aggregates about 150 miles in the counties of Richmond, Burke, Emanuel, Bulloch, Toomes, Montgomery, Jeff Davis, Coffee, Berrien and Lowndes, in the state of Georgia.

GRAND TRUNK PACIFIC.—Owing to unexpected delays due to the late opening of spring, the non-delivery of ties contracted for, and failure in forwarding construction supplies promptly, the expectation that the National Transcontinental would be open for traffic to Edmonton this fall is not likely to be realized. The final completion of the road will probably be delayed by at least one year. The beginning of spring work on the western divisions will be at least six weeks later than last year. Contracts were let for ties last year to lay 1,200 miles of track, but only a small portion of the contracts have been filled. Some 200 miles of roadbed is ready for track laying, and rails are ready for practically the entire distance between Winnipeg and Edmonton, but no ties are available. The labor problem is not such a source of difficulty as was expected. The Grand Trunk Pacific has brought in over 1,500 laborers this spring, principally from Scotland. The number of men employed on the western section is 8,000.

GOTEBO & SOUTHWESTERN.—Incorporated in Oklahoma with $300,000 capital and office at Gotebo. The company proposes to build a line from Gotebo, in Kiowa County south to Frederick in Comanche County, 45 miles. The incorporators include: P. Richert, R. B. Wells, H. E. Colby and J. L. Kliewer, of Gotebo; and J. W. Onstott, of Cooperton.

GREENVILLE, ELIZABETH & WOLFS MILL.—See Southern.

ILLINOIS CENTRAL.—The Yazoo & Mississippi Valley has extended its Memphis division from Roundaway, Miss., to Lombardy, 8.2 miles.

KANAWHA & WEST VIRGINIA.—This company is now operating its road between Charleston, W. Va., and Blakesley, 39 miles.

MISSISSIPPI CENTRAL.—This company, which has completed 10 miles of its proposed extension from Hattiesburg, Miss., southeast towards Pascagoula, has 15 miles additional under construction. Contract for the first eight miles let to Bowles & Hemingway.

Work is also under way on the western extension from Brookhaven, Miss., west to Natchez, 66 miles. Contracts for this work let to the Worthington Construction Company, of Brookhaven, and the O. A. Gilson Construction Company, of Natchez. (March 15, p. 387.)

MISSOURI PACIFIC.—The Springfield Southwestern on April 20 was opened for business from Springfield, Mo., to Crane, 33.9 miles.

MORGANTOWN & KINGWOOD.—This company, which operates a line from Morgantown, W. Va., southeast to Kingwood, 30 miles, is being extended south to Rowlesburg, 20 miles. It is expected to have this extension in operation by the first of next month.

NEW ORLEANS GREAT NORTHERN.—Contracts are reported let by this company to finish its proposed line from New Orleans, La., north to Jackson, Miss., also for branches in Louisiana and Mississippi. It is expected to have the grading finished from Jackson south to Monticello by July 1, and the entire line finished south to New Orleans by September 1. Work will soon be started on the branch line east to Columbia, Miss. The new branch from Rio, La., west to Franklinton, 21 miles, has been opened for business. Last year the company built 44 miles in Louisiana and 14 miles in Mississippi.

NEW YORK SUBWAYS.—Bids were opened May 14 for the second section of the subway loop to connect the Williamsburg and Brooklyn bridges, between Canal and Broome streets in the Borough of Manhattan. The Cranford Company bid $2,150,000 for the tunnel and $60,000 for the pipe galleries, and the Degnon Contracting Company $2,800,000 and $75,000. The contract for the first section, between Pearl and Canal streets, was let to the Degnon Contracting Company for $2,952,000 and $83,000 for the pipe galleries. There are three more sections on the Manhattan side to be contracted for.

OREGON RAILROAD & NAVIGATION COMPANY.—Plans have been filed in Lewiston, Idaho, by this company, showing its right of way from the mouth of Lapwai Creek, twelve miles above Lewiston, east to the west edge of the Bitter Root Forest Reserve, approximately 75 miles, along the south bank of the Clearwater river. The proposed line, if built, would give the Union Pacific-Chicago, Milwaukee & St. Paul combination a more direct line between the Mississippi river, Portland and the Pacific Ocean.

PENNSYLVANIA.—Contracts were recently let for work on the Pennsylvania, New York & Long Island, under which name the eastern end of the tunnel and terminal improvements in the city of New York is being built. The contracts are for the section of the tunnel between East avenue shaft and Thomas avenue, Long Island City. The work is divided between Naughton & Co. and Arthur Mc Mullen, of New York.

PENSACOLA, ALABAMA & TENNESSEE.—Announcement is reported made by this company, now operating a line from Pensacola, Fla., to Muskogee, 26 miles, that it will build an extension west to Mobile, Ala., about 50 miles.

PHILADELPHIA & WESTCHESTER TRACTION.—Local reports state that this company may eventually extend its lines into New Jersey and make an electric line to Atlantic City. It is said a private right of way has been surveyed and arrangements made for procuring capital The Philadelphia & Garretsford, a subsidiary line of the P. & W. T., recently let a contract for the building of a double-track extension a mile long, over private right of way, from Aldan to Barker avenue, Collingdale. This line begins at 69th and Market streets at the terminal of the Philadelphia Rapid Transit elevated line, and extends through Upper Darby, Garretsford and Clifton Heights to its present terminus at Aldan.

PLUM VALLEY.—An officer writes that this company has projected a line from Plum City, Wis., southeast paralleling Plum creek via Maybe Station, Porcupine and Little Plum, thence southwest to Pepin on the Chicago, Burlington & Quincy. It is undecided when bids will be asked for the work. P. M. Ingold, President, Plum City. (April 12, p. 531.)

RALEIGH & SOUTHWESTERN.—See Chesapeake & Ohio.

ST. LOUIS, SPRINGFIELD & OKLAHOMA.—An officer writes that contracts are to be let next week for part of the work, and the balance within 60 days, for its proposed line from Sallisaw, Ind. T., southwest via Stigler Junction, McAllister, Legal, Scullin and Sulphur, thence west via Davis and Duncan in Ind. T., to Lawton, Oklahoma, 250 miles. (Apr. 5, p. 500.)

SAVANNAH & SOUTHWESTERN.—Incorporated in Georgia with $7,000,000 capital to build a line from Savannah, Ga., to a point on the Gulf of Mexico and Florida. The incorporators include: D. G. Purse, L. McNeil, E. M. Frank, John J. McDonough and J. H. H. Antelman, of Savannah; H. R. Brown, C. W. Dean and W. A. Walker. The office of the company is to be at Savannah.

SOUTHERN.—This company, it is said, is about to begin laying track on an extension from Bushnell, N. C., for 17 miles west toward the Tennessee-North Carolina state line. Track has been laid from Maryville, Tenn., south one mile and work is to be resumed shortly on about 40 miles to a connection with the line running from Bushnell. Work on the piers for the bridges and the culverts in the gorge of the Little Tennessee river is under way. R. B. Oliver has a sub-contract for track laying.

The Greenville, Elizabeth & Wolfs Mill has been extended from Napanee, Miss., to Wolfs Mill, five miles.

SOUTHERN PACIFIC.—The Yaqui River division of the Cananea, Yaqui River & Pacific has been extended south to Fundicion, 45 miles from Corral. Of this 15 miles was built last year.

SPOKANE & INLAND.—The Palouse line has been opened for business from Spring Valley, Wash., south to Oakesdale, 13 miles.

SPRINGFIELD SOUTHWESTERN.—See Missouri Pacific.

SUSQUEHANNA (ELECTRIC).—This new company is said to have bought the Lancaster Railway & Light Company and proposes to build an electric line from Christiana, Pa., east to Coatesville, 12 miles.

TEMISKAMING & NORTHERN ONTARIO.—An officer writes in reference to the proposed branch from Cobalt, Ont., to Sudbury, that preliminary and location surveys have been authorized, but that nothing additional has been provided for in connection with this work. (Apr. 26, p. 600.)

WESTERN ALLEGHENY.—See Bessemer & Lake Erie.

RAILROAD CORPORATION NEWS.

ATLANTIC CITY & SUBURBAN TRACTION.—John L. Clawson has been appointed Receiver of this company, which owns and operates 18 miles of road between Atlantic City, N. J., and Pleasantville.

There is outstanding $750,000 stock and $750,000 5 per cent. refunding mortgage bonds of 1933 on which interest, it is understood, was defaulted February 1.

Boston & Maine.—See New York, New Haven & Hartford.

Chicago, Indiana & Eastern.—See Pennsylvania Company.

Delaware & Hudson.—The managers have authorized the issue of $10,000,000 equipment trust bonds.

Mexican Central.—See United Railways of Mexico.

National of Mexico.—See United Railways of Mexico.

New York, New Haven & Hartford.—It is believed that this company has acquired control of the Boston & Maine. See page 666. See Providence Securities Company.

Pennsylvania Company.—This company, having secured all the stocks and bonds of the Chicago, Indiana & Eastern, has made it a part of the Logansport division of the Pittsburg, Cincinnati, Chicago & St. Louis, thereby providing for the Pennsylvania system a second entrance into Muncie, Ind. The Chicago, Indiana & Eastern runs from Converse, on the P., C., C. & St. L., to Muncie, 43 miles, and had been in the hands of a receiver since September, 1904.

Pittsburg, Cincinnati, Chicago & St. Louis.—See Pennsylvania Company.

Providence Securities Company.—This company has sold to Clark, Dodge & Co. and Kissel, Kinnicutt & Co., New York, $3,500,000 50-year, 4 per cent. debenture bonds, dated May 1, 1907, guaranteed principal and interest by the New York, New Haven & Hartford. They are part of an outstanding issue of $19,911,000. The Providence Securities Company controls 272 miles of street railway in and near Providence, R. I., and Pawtucket; all its capital stock is owned by the N. Y., N. H. & H.

Seaboard Air Line.—This company has sold to Henry & West, Philadelphia, $1,300,000 series I, 5 per cent. equipment trust notes of May 1, 1907, maturing in 20 equal semi-annual installments beginning November 1, 1907. They are issued under the "Philadelphia plan," making them free from taxation and are secured on 1,000 box cars, 500 gondolas, 50 ballast cars and 10 coaches. The Provident Life & Trust Co. is trustee.

Southern Pacific.—About $36,000,000 additional preferred stock is to be issued to holders of the $197,849,258 common and $40,000,000 preferred stock to the extent of 15 per cent. their holdings on May 31, 1907. Subscriptions are to be made on or before June 15. The directors, it is announced, decided to issue the new stock after considering the following statement:

Estimated Statement of Earnings for Fiscal Year Ending June 30, 1907.

Probable earnings of company for the year ending June 30, 1907, approximately	$44,697,000
Fixed charges, including reserve for depreciation of rolling stock	18,929,000
Surplus over fixed and other charges	$25,768,000
Deduct dividends of 7 per cent. on preferred stock	2,769,000
Dividend of 5 per cent. on common stock	9,892,000
Surplus after payment of dividends about	$13,100,000

Expenditures Uncapitalized.

At the present time the floating debt of the Southern Pacific Co. is $32,300,000, of which $14,250,000 is due Union Pacific Railroad Co. This floating debt was incurred in the following manner:

Two years ago the short-term, two-fifths-year, 4½ per cent. bonds, amounting to $30,000,000, were paid off, and we have sold against them only $7,253,000, leaving of unsold bonds	$22,747,000
The Southern Pacific Railroad Co. has retired outstanding old bonds, amounting to $12,638,000, against which they have sold refunding bonds amounting to $6,167,000, leaving unsold bonds in treasury	6,471,000
The Central Pacific Railway Co. has paid three installments of notes due the United States Government, releasing refunding bonds of that company which are in the treasury to amount of	8,822,000
There is also in the treasury against which nothing has been sold G. H. & S. A. second mortgage bonds	374,000
Total capital expenditure against which nothing has been issued	$38,414,000

This more than accounts for the floating debt of $32,300,000.

Also the following free assets against which there has not been any issue of capital obligations:

Bonds and stocks, principally of oil companies in California	$10,947,183
Expended for the construction and acquisition of new lines, including about 994 miles of completed railroad (which are unmortgaged) and on about 1,635 miles of railroad on which construction is in part progressing	39,860,254
For electric railways, principally around Los Angeles and Salt Lake City	16,234,336
Rolling stock and steamships ($7,255,000, it is said, for latter)	21,854,965
Terminal real estate	13,357,464
Grand total	$140,668,202

The Directors have decided to make dividend distributions on the common stock payable quarterly hereafter instead of semi-annually, and therefore have declared a quarterly dividend of 1¼ per cent. on the common stock payable July 1.

Union Pacific.—A meeting of the shareholders is to be called next month to authorize $100,000,000 additional common stock and $75,000,000 convertible 4 per cent., 20 year bonds. There is already outstanding $196,178,700 common stock, and of the new issue $42,857,143 will be reserved for conversion into the new bonds. The convertible bonds are to be offered to stockholders of record on May 29 at 90 and accrued interest to the extent of 25 per cent. of their holdings. They are convertible up to July 1, 1917, into common stock at $175 per share, and are redeemable at the option of the company on July 1, 1912, or on any semi-annual interest day thereafter, at 102½. At the meeting of the Board of Directors on May 9, the Chairman submitted the following statement:

Estimated Earnings for Year Ending June 30, 1907.

Estimated earnings over operating expenses for year ending June 30, 1907	$32,465,000
Deducting interest on funded debt	8,645,000
Sinking fund requirements	12,000
Interest on loans	877,000
Other expenses	27,000
Will leave a surplus of approximately	$22,900,000
Add interest and dividends other than from investment securities	$854,280
Income from investment securities	12,323,000
Rental of steamships	244,000
Total income of company, say	$36,324,000
Dividend on the preferred stock	4,000,000
Dividend on the common stock	20,000,000
Over and above all requirements of every kind, there will remain something over	$12,000,000

The Union Pacific as the holder of about 45 per cent. of the Southern Pacific Company's stock, will have to take about $15,000,000 of the new preferred stock, which the directors of the Southern Pacific Co. to-day decided to offer to its stockholders, and that amount will be added to its present requirements, bringing them up to, say, $65,000,000.

The floating debt of the Union Pacific was incurred for the following expenditures, which have not been capitalized:

Construction and acquisition of new lines	$29,172,000
Payments on account of the San Pedro, Los Angeles & Salt Lake	18,050,000
Steamships "Manchuria" and "Mongolia"	5,126,000
Rolling stock	9,302,000
Lands and miscellaneous real estate	2,033,000
Total	$63,683,000

Securities Owned.

	Face Value.	Cost.	Charged on Books at
Bonds	$80,097,000		$71,654,000
Investment stocks and rights	127,759,000	$131,182,000	98,273,000
Other stock	70,623,000		39,311,000

The entire free assets, excluding the $29,172,000 advanced for new construction and the unmortgaged railroads are, therefore, in round figures, $243,000,000.

The company also has 1,628 miles of completed road unmortgaged, against which it is expecting to issue and hold in its treasury $70,000,000 to $80,000,000 of first mortgage bonds.

The directors have decided to pay dividends on the common stock quarterly hereafter instead of semi-annually, and therefore have declared a quarterly dividend of 2½ per cent. on the common stock payable July 1.

United Railways of Mexico.—This company, according to press despatches from Mexico City, is about to be organized as the holding company for the National Railroad of Mexico, the Interoceanic of Mexico, the Mexican International and the Mexican Central. (Dec. 21, 1906, p. 176.)

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS. Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS. We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

CONTENTS

EDITORIAL:
- Importance of the June Conventions..... 697
- Mallet Compounds in Brazil..... 697
- Government Accident Bulletin..... 697
- Purchase of the Quebec & Lake St. John. 697
- Virginia Commission Report on Lawyer Collision..... 698
- The Harmet Process..... 699
- What Constitutes Negligence?..... 699
- New Publications..... 699

ILLUSTRATED:
- Norfolk & Western Improvement Work... 701
- Prussian State Railway Signals..... 709
- Standard Locomotives of the Midland Ry. 710
- Track Deformations and Their Prevention 713
- Compression of Steel Ingots by Wire Drawing..... 716
- Proposed New Union Station at Toronto 718

CONTRIBUTIONS:
- Mallet Compounds in Brazil..... 709
- Superelevation..... 709

MISCELLANEOUS:
- Express Rates Ordered Reduced..... 709
- Report of the Illinois Railroad and Warehouse Commission..... 701
- Government Accident Bulletin No. 22.... 707
- April Railroad Law..... 712
- Hand-Brakes and Their Use on Steep Grades..... 715
- Air Brake Control on Heavy Grades..... 719
- Cost of Safety Devices on Harriman Line 720

Foreign Railroad Notes:
- Fuel Shortage in Russia..... 708
- Heavy Rails on the Paris, L. & M..... 712

GENERAL NEWS SECTION:
- Notes..... 721
- Obituary..... 724
- Meetings and Announcements..... 724
- Elections and Appointments..... 724
- Locomotive Building..... 725
- Car Building..... 726
- Railroad Structures..... 726
- Railroad Construction..... 726
- Railroad Corporation News..... 728

VOL. XLII., No. 21. FRIDAY, MAY 24, 1907.

The presidents of the Master Mechanics' and Master Car Builders' associations have sent out to members and to the general managers of member roads a joint circular letter urging full representation at the coming conventions at Atlantic City. The acute condition of car shortage which has developed since the last convention makes the work which these associations have accomplished in the standardization of rolling equipment and the creation and enforcement of the rules governing the condition of, and repairs to, freight cars for the interchange of traffic, assume special and peculiar importance. When every car is needed as badly as at present the prompt movement of equipment under the rules of interchange, and the prompt administration of repairs thereto as provided for in the M. C. B. code, are of more than usual moment. The demands on the motive power departments are also more pressing than ever before. The good to the railroads which always results from the coming together of the men in charge of these departments should be proportionately greater under conditions such as those of 1907. Every road should be represented at the conventions.

We print in another column a letter from M. da Silva Freire, Locomotive Superintendent of the Central of Brazil. He visited the Railway Congress and was so impressed with the possibilities of the Mallet compound that he has just ordered several for his own hilly road. They are small ones, but they are expected to give him the needful power, better adjusted to the weight limitations of his bridges, than, say, a consolidation locomotive of the same weight would be. The Mallet compounds seem to be winning golden opinions for themselves in heavy service on the two roads in this country upon which they have already been used. The pioneer, on the Baltimore & Ohio, has probably attracted more attention than any other engine that has been brought out in recent years, and its economies have been most carefully watched by outsiders, especially those who are apt to be confronted with problems similar to those that led to its construction. This good performance has been supplemented by the work of the engines that were built for the Great Northern, where they have been used in pusher service on the 2.2 per cent. grades over the Cascade range. The coal saving in this case is very remarkable, amounting to 43.8 per cent. and is so much that it probably cannot be entirely attributed to the compound feature when comparing the performance with that of the consolidation locomotive on the same work, but is undoubtedly due, in part, to the more economical working of a large power plant in comparison with a smaller one. The advantages of the design do not stop, however, with mere saving in coal consumption, important as that may be, for the desirability of operating unbroken trains over such ruling grades without too great a multiplication of power units is in itself very important, and the use of the design will probably be continuously extended for especially heavy work. It also has the advantage of affording an available means of extending the wheel base and thus securing a tractive effort where the bridge and track construction are of such a character as to render the concentrated weights of the consolidation engine prohibitive; so that its appearance on such lines that have heavy grades is quite probable, for it appears to be the most efficient design of pushing locomotive that has thus far been brought out.

The Interstate Commerce Commission once more has to report an appalling death list in connection with its accident record. Bulletin No. 22, reprinted in this issue of the *Railroad Gazette*, shows 180 passengers and 294 employees killed in train accidents, this record including the disasters at Atlantic City, Woodville, Lawyer, Enderlin and Terra Cotta. A comparison given in the report shows that this quarter is one of the three most disastrous quarters since the government records were begun, the other two being those ending in December, 1903, and September, 1904. On the occurrence of the collision in the District of Columbia, December 30, the commission began a public investigation of that collision and the one at Lawyer, but the report of this investigation does not appear in the present bulletin, and nothing is said as to when it will appear. Concerning the Woodville collision a report has been published by the State Railroad Commission of Indiana and a notice of this report was given in the *Railroad Gazette* of April 5. The facts of the Lawyer collision have also been authoritatively made public, the Interstate Commerce Commission having been anticipated by the State Corporation Commission of Virginia, which has issued a report of its findings in that case. In Virginia, as in Indiana, the public investigation was satisfactory and intelligent, though the Virginia commissioners, like their brethren in Indiana, supplement their sound conclusions in the case under investigation by some general observations which do them little credit. This Virginia decision is discussed under another head.

The tendency for small railroads to be absorbed by larger systems is particularly noticeable in Canada where, aside from the Intercolonial, the government line, the railroads of the country are coming rapidly into control of three groups, the Canadian Pa-

cific, the Grand Trunk and the Canadian Northern. The most recent instance is the purchase by the Canadian Northern interests of the control of the stock of the Quebec & Lake St. John Railway, a local road in the province of Quebec, hitherto owned and controlled in Quebec and London. This road runs from the city of Quebec across the Laurentian mountains to Roberval on Lake St. John, 188 miles, with a branch from Lake St. John eastward to Chicoutimi, the head of navigation of the river Saguenay, and a branch westward from a point 80 miles northeast of Quebec to La Tuque, a great waterpower at the head of navigation of the St. Maurice river. The road, therefore, commands the trade of much of the northern part of the province of Quebec and the lumber traffic of its two greatest rivers. The Quebec & Lake St. John has, including the new La Tuque branch, 286 miles of substantially built line well equipped with rolling stock, including parlor and sleeping cars which are necessary in order to handle the fishing, hunting and tourist travel. The trip is a most popular one to go from Quebec to Lake St. John by rail thence down the Saguenay and back by the St. Lawrence by steamer, or vice versa, and in summer there is a large passenger travel over the road. Last year 325,000 passengers and 345,000 tons of freight were carried. The forest solitudes in and beyond the Laurentian mountains are being rapidly settled, and already pulp, paper and saw mills and other industries give employment to 10,000 men. The settling of these regions, which is going on at the rate of about 3,000 new settlers a year, is under the control of a colonization department of the company. Already the fertile territory about Lake St. John has an agricultural population of 50,000. The road is also important in its relation to the city of Quebec, which has lost much of its old trade in shipbuilding, timber and shipping. Yet the city is more prosperous than ever, as the outlet for the back country opened by the Quebec & Lake St. John. These are the characteristerics of the road as a local property. It is, however, particularly valuable to the Canadian Northern as a Quebec connection. The Canadian Northern Quebec Railway (the former Great Northern Railway of Canada) runs from Montreal to Riviere a Pierre, on the Quebec & Lake St. John, 57 miles northeast of Quebec. Over the Lake St. John road the Canadian Northern now has its own line all the way from Montreal to Quebec. This is 195 miles long, as compared with 172 miles by the Canadian Pacific, 174 miles by the Grand Trunk and 165 miles by the Intercolonial between those cities. More than this the Quebec and Lake St. John brings to the Canadian Northern interests ownership of a large terminal property covering 400,000 ft. of ground in the heart of the city of Quebec, with deep-water steamship docks having a frontage a quarter of a mile long. It will now be possible for the Canadian Northern, besides using this large terminal property, to have direct connection with the great terminal grain elevator which was built some time ago for the Great Northern of Canada, but with which that road has had no direct connection. The plans of the Mackenzie & Mann interests are believed to include the development of Quebec as an important grain terminal port as soon as the Canadian Northern line is complete from Winnipeg, the central receiving point for the grain of the Canadian northwest, east to Montreal. As the size of ocean steamers increases, the difficulties of navigation of the St. Lawrence above Quebec grow more serious, and the reasons for making Quebec an increasingly important export port grow strongly. Besides its importance to the Canadian Northern as a through connection and important terminal line, it gives that road a most important advantage in the railroad development of the northern part of the province of Quebec which is sure to come before very many years. The Quebec & Lake St. John is already on the ground and is therefore best able to build lines into this rich wilderness. The charter of the road covers the vast country lying between Lake St. John and James Bay, a region as large as France, abounding in spruce forests, water powers and agricultural lands, and with great possibilities of development of mineral deposits.

VIRGINIA COMMISSION REPORT ON LAWYER COLLISION.

The Virginia Corporation Commission has made a report on the collision which occurred at Lawyer, Va., Nov. 29 (*Railroad Gazette*, Dec. 7 and 14), the conclusions of which we will briefly summarize.

The block signal rules were plainly disregarded by the operator at Rangoon. He disobeyed the order requiring him to hold the second train until he had asked for and received "block clear" from the operator at Lawyer. The conductor of the train which was stopped erred in judgment in not cutting out the car with the defective coupling, after having been advised to do so by the car inspector at Lynchburg, and especially as he was delayed by it 45 minutes some distance beyond Lynchburg.

The evidence as to the promptness of the flagman is doubtful, but the commission believes that at best he probably could not have prevented the collision. The second train was running faster than the first and, therefore, as the commission takes care to point out, the flagging rule could not be of value unless a time interval were also maintained at each block station. The commission deferred further comment on the block system pending the publication of the report of the Interstate Commerce Commission on that subject, which had not then been published.

The operator at Lawyer is also criticised, the management of his signal station being declared highly unsatisfactory.

It is found that signalmen exchanged working hours without asking leave to do so and were not required to submit their daily block sheets to any one for inspection. Operators and signalmen have been employed without sufficient experience, and after the slightest and most insufficient examination as to their qualifications.

The train despatcher should have known of the condition of the leading train and should have given instructions to the conductor concerning the car with the defective coupling.

From this point the report goes on to discuss the general management of the operating department of the Southern Railway. The commission finds that the operating staff has been greatly overtaxed. The Danville division consists of 637 miles, too much to be handled by a single officer, however able. Directly flowing from this condition

"we find that the discipline which must obtain on a well regulated railway was conspicuously lacking in several of the operating departments under investigation. It was shown that the operators and signalmen charged with the important duty of directing the movements of trains, were under no immediate supervision; the manner in which they performed their duties was not made the subject of any special inquiry by any officer or superior charged with that immediate responsibility. The method of selection of operators seems to have been loose and unsystematic; the degree of knowledge and experience, not to say skill, of these operators seems not to have engaged the serious attention to which this important question was entitled; nor did the subject of general fitness of these operators, from the standpoint of character and habits, both before and after employment, receive such official attention as the public interest required. The block sheets kept by these operators were not examined from time to time by any supervising agent or officer, an omission which destroyed in a large measure the element of safety which these sheets were intended to provide. It was further shown that these operators were in the habit of exchanging work with each other, resulting in continuous service on the part of one operator for eighteen hours or more, a period beyond the safety limit, which should have been promptly detected and remedied in the ordinary course of business."

The report then takes up the matter of excessive speed and the practice of keeping train crews on duty 40 to 45 hours, and offers a number of sensible criticisms; but all the statements of fact in this part of the report are so general and so vague that it is impossible to judge as to whether the position taken by the commission is or is not well supported by the evidence. It is well said that officers, as well as employees, should be punished when found directly responsible for fatal accidents, but the difficult problem of defining "direct responsibility" where a dozen men are involved is left as much in the air as ever.

But things admitted by officers of the Southern Railway and other things which are commonly known compel the acceptance of most of the commissioners' conclusions as sound; at the same time it is unfortunate that an official report should leave the public to supply for itself such a large part of the information on which any opinion must be based. Besides this, the report is weak in some of its details. The suggestion that a time interval should be maintained so as to make flagging effective only serves to confuse the public mind. No railroad can find much fault with this, for the standard railroad rules, requiring both the space interval and flag protection are calculated to confuse both the public and the commissioners. If the commissioners would denounce such confusing rules they could then pursue a logical course; but in recognizing them they join the railroads in an impossible task. With long time-intervals, flagging *might* be made useful; but in that case a part of the benefit of the block system is wasted. To get its full benefit short time intervals must be provided for; but short time intervals and the flagging system cannot be made to "consist" with each other.

The requirement that a despatcher shall tell a conductor how to deal with a defective car is also based on a very shaky principle. It is worthy to go with the New York commissioners' dictum that the despatcher shall control the lever movements at a dozen interlocking towers. It is well enough for conductors, if they so desire, to ask advice of a despatcher—if he is anything more than

a telegraph operator—but what can a state officer be thinking of to recognize as competent for his duties a passenger conductor who, with a car before his eyes, knows less about its safety than a despatcher who is 10 or 100 miles away? In matters of convenience and expediency, especially as related to the needs of other trains, the despatcher may, indeed, have something to say about the management of a train; but so far as the safety of the cars is concerned the conductor's authority must be absolute—until some one arrives on the spot who knows more than he does.

But, as already intimated, these weak spots in the report are overshadowed by the strong ones. The condemnation of excessive working hours on freight trains and of the excessive size of division superintendents' territories, deserves particular notice. The evil of long hours is already well known, but this and other state railroad commissions ought to make it more thoroughly and more widely known. It is an elusive evil, difficult to reach and expose, for reasons familiar to all. Errors and neglects due to physical or mental weariness are perhaps in a majority of cases not proved; the claim that weariness was not the trouble can be put forward with boldness and confidence. And yet everybody knows that, with men's minds and consciences as they are, rigid time-limit rules are necessary to safe train-working.

Superintendents with too many miles to look after are common all over the country. The Southern Railway has made hopeful improvement in this feature but there is room for much more of this—as there is on most roads. The Southern has done a wise thing in reducing the size of freight solicitors' districts—provided it has taken care not to reduce the size of the *men* who do this work—but it is proper to observe that a traveling freight agent cannot take the place of a traveling superintendent. The customers of a railroad—as well as the employees—always want to deal with a high officer, and it is good business sense, on an extensive railroad system, to fill the division office with a man strong enough—and clothed with enough authority—to be recognized as "high."

THE HARMET PROCESS.

It is too much to expect immediate results from the present far-reaching protest against the methods of the steel rail makers in their efforts to produce maximum tonnage at maximum profit. But it is inevitable that some radical improvements in these methods must be made in the near future. If better methods of rolling will not bring about the desired results and open hearth melting will, then the Bessemer furnaces in the rail mills must be abandoned or turned into another channel of production. If 30 per cent. cropping of the ingot is necessary instead of the 10 or 15 per cent. now cut off, the loss must be pocketed or made up in increased prices. These changes will not be made in a day or a year, and meanwhile the bad rails now in track will continue to break and more bad rails will continue to be laid down. The railroads cannot stop buying rails altogether to enforce their demands; they can only appeal to the cupidity of the rail makers by offering better prices for better rails. The oppression of the trust is food for other thought and somewhat beside the point now. What is wanted is a better rail, almost regardless of cost.

In another column in this issue is a description of a French method of improving the quality of ingots, which seems to offer a solution for overcoming two of the most dangerous defects in steel: piping and segregation. The information on which the article is based was obtained from the Ordnance Department of the United States Army and is, we think, impartial and reliable. Ordnance officers are constantly in search of metallurgical processes which will produce metal of high resistance and uniform quality, and no more conservative or careful body of men can be found. A bursting gun endangers the lives of a gun crew, six to ten men; but a broken rail endangers the lives of a whole trainload of passengers. Surely the need for the best material at almost any cost is as great in railroad work as it is in the army and navy!

There are, of course, difficulties in applying this process to commercial production on the enormous scale demanded in rail mills which do not enter into the production of ingots on a comparatively small scale for ordnance and other special uses. It requires ten minutes to compress each ingot, and the cost is considerable, although we have no definite information on this point. In a rail mill the production is almost continuous, and it would require not less than five presses to supply a single mill. On the other hand there is, or should be, a saving of nearly 25 per cent. in the crop ends. The French government requires 28 per cent. crop in uncompressed ingots and only 5 per cent. on compressed ingots. The letters printed last week were almost unanimous in demanding from 25 to 30 per cent. crop. This saving is even greater than it seems, for it costs much more to remelt crop ends than it costs to handle a corresponding amount of metal from the blast furnace to the ingot mold in the continuous process where the molten iron never cools from one operation to the other. There is also the great advantage of preliminary working of the ingot before passing to the rolls. The small shrinkage cracks which are incipient causes of broken rails are never completely welded in the rolling process. In the Harmet wire drawing process they are not allowed to develop in the ingot.

We are convinced that this process, as yet unknown in the United States, is well worth careful investigation. It is only one of the improvements which might be applied to advantage in rail making. High phosphorus Bessemer steel is another cause which must be carefully investigated and perhaps abandoned for steel made by the open hearth process. A redesigned section for heavy rails is almost equally imperative if any real progress is to be made. In the meantime, determined demands for rails rolled to the best available specifications will do much to remedy the worst phases of a situation which is little short of criminal.

Just as the Government Accident Bulletin comes out, with the official details of the Woodville (Ind.) collision (November, 1906), we have the news that Engineman Galnour, who neglected to assure himself that the freight train had notice that a second passenger train was to follow, has been tried and acquitted of the charge of manslaughter; and this on the ground, apparently, that his neglect to whistle, or his neglect to stop when he received no whistle-signal from the freight, was an error such as any prudent and careful engineman might commit, and therefore not the kind of negligence that constitutes manslaughter. This is a miscarriage of justice, but it is not easy at this distance to see just where the trouble is. As we understand the law of Indiana, as interpreted by the Supreme Court of the state, such plain neglect of duty, with no mitigating circumstances shown, constitutes manslaughter. The minimum punishment is two years in state's prison. Possibly the severity of the required punishment led the jury to acquit, but an acquittal certainly seems to violate the letter of the law, and also its spirit, if we can trust the legislature, which fixed the two-year minimum, to rightly interpret its spirit. The reason why we are unable to decide as to the responsibility for this miscarriage of justice is that the charge to the jury, section 13, given in the footnote,* is confusing. It seems to conflict with the statute. If the jurymen could get no simpler instruction than that, they were, perhaps, justified in acquitting the engineman for lack of information as to the meaning of the law. We cannot take the space to analyze this charge, but the reader probably will not ask us to. Its surprising character is perhaps most strikingly shown in the clause, which seems to declare that if an engineman has many and complicated duties the fact may excuse manslaughter! There is one way of looking at this verdict in which it may perhaps be called rational. The jury decided, in effect, that Galnour was exercising ordinary care. As errors of this kind have been occurring with distressing regularity for the past forty years, it will possibly be well if we all accept the view taken by this judge and these jurymen, that only by extraordinary care—that is, an unattainable degree of care—can such rules be satisfactorily carried out. Accepting this we must abolish the rules and adopt the block system.

NEW PUBLICATIONS.

The Engineering Index Annual for 1906; compiled from the Engineering Index, published monthly in the *Engineering Magazine*. New York and London. The *Engineering Magazine*. 412 pages, 6½ in. x 9¼ in. Price $2, cloth.

This is an index of articles of interest to the railroad man and the engineer which have appeared in the technical papers of this country and Europe during the year 1906. Up to 1906 there have been

*Every omission—that is, failure to discharge a duty—is not necessarily a negligent omission or failure, though you may find that the defendant omitted or failed to discharge some duty put upon him as alleged; and if you further find that such failure or omission was not on account of carelessness, recklessness, or inattention to business, or neglect, then I charge you, while the state may have proved that he was guilty of such omission or failure, yet such proof, without proof of negligence, would be insufficient upon which to base a verdict of guilty.

In considering the question as to whether or not the defendant was guilty of neglect of duty, as charged in some one of the paragraphs or counts of the affidavit against him, you may consider as to what all his duties were with reference to running the train he is charged in the affidavit with running. And in passing upon the question as to whether or not the defendant was guilty of such negligence you may consider what duties he had to discharge in running the train in question on the night and morning alleged; whether they were few and simple, or many and important; and if he omitted or failed to discharge one of his duties, whereby the death of John Doe occurred as alleged in the affidavit, whether such omission or failure was one that other reasonably prudent and careful engineers, placed in a like situation, in the exercise of ordinary care commensurate with the conditions and surroundings, might have omitted or failed to have performed under the same or similar circumstances; if so, then I charge you, if you find that there was an omission or failure to perform, but which was not due to the failure of the defendant to exercise ordinary care in running his engine past train No. 98, as alleged in the affidavit, you should return a verdict for the defendant.

four volumes issued in a similar series of which the first, edited and published by the Association of Engineering Societies, under the direction of Professor J. B. Johnson, covered the years 1884 to 1891 inclusive; the second, from 1892 to 1895 inclusive; the third, from 1896 to 1900 inclusive, and the fourth, from 1901 to 1905 inclusive. Beginning with 1906, instead of publishing such a volume every five years, the publication of annual indexes, of which this is the first, has been begun. This index is a summary of similar records of current technical literature which appear month by month in the *Engineering Magazine*. Instead of being classified alphabetically as has been done in the past, subjects are classified in the present volume under the following divisions: Civil, Electrical, Mechanical, Marine and Naval, and Railway Engineering, Street and Electric Railways and Industrial Economy. These large groups are subdivided according to special divisions of each field. There are 250 technical and engineering journals indexed, about one-fourth of which are in one of five foreign languages. A brief abstract of each article is given showing its scope and purpose, as well as the approximate number of words it contains. The field covered is a broad one, centering about the engineering professions, but including many articles of general interest to engineers. The index is invaluable to anyone who wishes a compact and convenient record of the more important engineering articles of the year. It would, in fact, be most difficult to get such information without it. As an annual publication it should be of very much greater value than before, for it thus represents current practice instead of including much obsolete material.

The Steam Engine and Other Heat Motion. By W. H. P. Creighton, U. S. N. (retired), Professor of Mechanical Engineering, Tulane University. John Wiley & Sons.

When an observant student, a teacher of engineering of more than 20 years experience, undertakes the task of preparing a text book, the resulting volume cannot fail to attract attention. The Steam Engine, by Lieut. Creighton, recently published by Messrs. John Wiley & Sons, is such a volume. When compared with well-known texts dealing with this subject it appears as a distinct type, not that it is necessarily better than others, for that must always remain a matter of personal opinion, but because it has a character which is all its own. First of all, the tendency of American writers has often expressed itself in the appearance of volumes dealing with the steam engine as a machine, and of other volumes dealing with theories underlying its action, while the present work of 500 pages appears as an exponent of the whole field. It is both elementary and advanced. While it describes types of engines, explains the manner of their action and gives practical suggestions concerning their operation, it also deals with thermodynamic principles which the average student approaches with some hesitation. For example, while there are descriptions of valves and valve diagrams, there are also presentations of such thermodynamic subjects as Hirn's analysis and the entropy-temperature diagrams. The range of topics thus introduced required that their treatment be brief, but enough is given to make the book of great value to self-instructed students, and to professors who, in the handling of classes, prefer to reach beyond their text. The first chapter deals with such elementary matters as definitions of work, energy, temperature, horse-power and efficiency; the second, with the steam engine indicator; the third, with work under expansion; and the fourth, with valve diagrams and slide-valve design. These four chapters, making up approximately 100 pages and followed by four other chapters occupying another 100 pages, presenting such principles and applications of thermodynamics as effects of heat, the measurement of the effect of heat on water and steam, heat interchange, and entropy, after which are eight other chapters occupying approximately 200 pages, relating specifically to steam equipment, such as condensers and air-pumps, small auxiliaries, multiple-expansion engines, systems of control, steam engine tests, superheated steam and the steam turbine. These are probably the best portions of the book. The three concluding chapters are upon the gas-engine, gas-producers, boiling in a vacuum, and refrigeration. The chapter upon boiling in a vacuum is evidently drawn from the author's experience in sugar mills work and gives definition to a phase of thermodynamics of great importance in certain portions of our country.

CONTRIBUTIONS

Mallet Compounds in Brazil.

Rio de Janeiro, May 1, 1907.

To the Editor of the Railroad Gazette:

I herewith enclose the table of dimensions of our new Mallet engines, which weigh 208,000 lbs. [See General News Section.] As your Mr. Morris may remember, I got a good idea of this kind of locomotive by riding up the Alleghanies on one, by permission of Mr. Muhlfeld, of the Baltimore & Ohio. We are going to try this type on our mountain districts, where there is a series of 1.8 per cent. grades and 10-degree curves. I suppose that except for a few of these locomotives now in service in the United States, the Central of Brazil is the only road in all America that has ordered any.

J. J. da Silva Freire,
Loco. Superintendent, Central of Brazil.

Superelevation.

Detroit, Mich., May 19, 1907.

To the Editor of the Railroad Gazette:

The writer trusts that the younger engineers will not be misled as feared by your correspondent in your issue of May 17. He has not forgotten that car wheels have flanges, and that seven out of the eight of them in an eight-wheeled truck are not in contact with the rail head at any specific moment, and are therefore not in service at that moment. The point at issue, so far as the writer is concerned, is whether the lateral friction of car wheels on track rails does or does not neutralize the centripetal force generated by elevating the outer rail three or six or eight inches. The writer uses the term centripetal force with some trepidation since your correspondent has expunged it from the language of the scientific world; but most of your readers will understand it in the ordinary way.

If the outer wheel were a cog wheel and the outer rail a toothed rack so as to ensure longitudinal adhesion such a departure from usual practice would not affect the forces we are now considering; and if such rack and gear were perfectly lubricated so as to give perfect freedom of lateral motion (always limited by the flanges) we should then have the ideal case where superelevation, every inch of it, would exert its full effect to counteract centrifugal force just as is now the commonly accepted practice. If now we clean off the lubricating substance and restore normal conditions re-establishing lateral friction we thereby introduce a change; and that change covers the contention of the writer, viz., that the horizontal effect of superelevation is smothered by the lateral friction and does not relieve the centrifugal force.

John A. Fulton.

Express Rates Ordered Reduced.

The Interstate Commerce Commission has rendered its first opinion in a case involving the reasonableness of an express rate. The Society of American Florists claimed that the rate charged by the United States Express Company on cut flowers from New Jersey points to New York City was excessive. This rate till July, 1906, was 50 cents per 100 lbs., and at that time was raised to $1. The Commission orders it reduced to 60 cents. The express company claimed that the delivery service given cut flowers in New York was much more expensive than that given other articles, and that it could not increase its rate a sufficient amount to meet the expense of this special service without largely increasing the total rate, because of its contracts, under which it is required to pay 45 per cent. of its gross receipts to the railroad companies.

From the opinion of Commissioner Lane it appears that the service rendered by the railroad company is no greater or different under the new rate of $1 than it was under the old rate of 50 cents. The percentage of gross revenue paid by the express company to the Central of New Jersey is 43 per cent., and to the Lehigh Valley 40 per cent. No reason is shown why the railroad charges and agents' commission should be doubled, excepting that the express company has to pay double the amount under its contracts to its agents and to the railroad company—a necessity or condition which the Commission does not recognize as controlling as to rates. An express company cannot justify a rate which, in comparison with other rates, is excessive and unreasonable, by showing that it gives a service that is exceptionally expensive, where the burden of the rate charged therefor, falling upon the shipper, increases an already sufficient return to the railroad. To pay the agent a commission instead of a salary, and to pay the railroad a percentage instead of a fixed amount; or a mileage, or a tonnage, may be, practically, a very satisfactory arrangement between the express company and the railroad and the agent; but such an arrangement cannot be held to support the reasonableness of any rate which the express company may choose to charge. What if the express company had contracted with its agent to pay him 50 per cent. of all gross receipts, or with the railroad to pay it 90 per cent. of such receipts?

Generally speaking, the flowers are delivered at the stations to the express agent and are not collected by express wagons; the producers furnish men to assist the agents of the express company to load the flowers onto the cars; the express agents at points of origin have little, if any, service to perform with respect to most of such shipments, except to make out waybills therefor and to assist in the loading of the boxes onto the cars; the express companies give special care to boxes containing flowers while in transit; the defendant has a special delivery service from the Hoboken station to the delivery points in New York; this service consists of wagons which

carry the flowers from Hoboken to the business places of the consignees; it takes such wagons approximately one hour and a half or two hours to transport the flowers from the train to the commission merchant in New York; such commission merchant consignees are grouped in New York City within three or four blocks of each other; the wagons, teams, and men used in such service in no way differ from those used generally in the express business, and these facilities are used throughout the remainder of the day in such general business; the justification advanced by the defendant for the increase in the rate complained of is that the rate previously existing was not remunerative, owing to the expense of the delivery service in New York City; and the United States Express Company employs agents at the points of origin who are, generally speaking, paid for their services in gathering, billing, loading, unloading, and delivering express matter with a percentage of the gross receipts at such offices, which percentages range downward from 20 per cent. It appears that after the rate was raised in 1902 to 50 cents a wagon express began business in the Chatham district, and has continued therein ever since, carrying flowers produced by that district to New York City at a rate of 60 cents; that such wagon express calls at the greenhouses for the flowers and delivers them from one hour to an hour and a quarter earlier in New York City than the rail express, and delivers the empties at the greenhouses on its return trip; that it is a rule of the defendant that its agents shall call for packages to be carried by it within certain prescribed limits from the agents' offices and shall deliver packages within such limits; that such service has not been given to the shippers of flowers complaining, but that no complaint of this failure to obey the rules of the company was made to any of the general officers thereof; that the general merchandise rate for the Chatham district is one-half that on cut flowers; that the rate on meat and vegetables in corrugated paper boxes is 40 cents per 100 lbs.; dry goods, notions, ice cream, etc., 50 cents; beer, ale, mineral waters, etc., 35 cents; berries, fruits etc., 40 cents; millinery, feathers, hats, and cameras (boxed), Saratoga chips, cigar boxes, doll carriages and straw goods, 50 cents.

Report of the Illinois Railroad and Warehouse Commission.

The Railroad and Warehouse Commission of Illinois, in its report just made to the Governor, advises against participation in the widespread movement among the states to reduce passenger fares by legislative action, at least until careful investigation can be made of the conditions which might be considered to justify such action. The report says:

"There seems to be a popular demand for a reduction in passenger fares, and nearly all the states surrounding us are yielding to this demand. What action should be taken by this Commission with reference to the reduction of passenger rates should be determined by a thorough investigation of existing conditions in this state, entirely uninfluenced by the action taken or proposed in adjoining states. Hasty and ill-advised action cannot but operate to the detriment not only of the railroads of the state, but of the people as well. There seems to be a disposition on the part of some to insist upon the presentation of this question to the legislature at its coming session. In the absence of action by that body it will, of course, become the duty of this Commission to make such investigation and enter such order as the facts elicited shall warrant.

"The railroads in the state of Illinois carried 54,757,396 passengers earning revenue during the year covered by this report [ending June 30, 1906,] which was 1,210,086 more than the preceding year. The average amount received from each passenger was $0.54, being 5 cents less per passenger than during the preceding year. The amount of passenger revenue per mile of road was $2,992 as against $3,176 per mile the preceding year, or a decrease in passenger revenue per mile of road of $184. The average distance haul of each passenger was 27.7 miles, a decrease of five miles from the preceding year, and the average amount per passenger per mile was 1.95 cents.

"The total revenue from the movement of passengers in the state of Illinois during the year ending June 30, 1906, was $29,619,969, which was a decrease from the amount received for the same service in 1905 of $2,241,492. This decrease in the passenger earnings is probably accounted for by the fact of the large increase of electric interurban tracks, which in many cases parallel the existing steam railroads. Many more miles of electric line are in process of construction under like conditions, which will absorb a large amount of short distance travel and must of necessity affect the passenger earnings of the steam roads."

Referring to the reduction in freight rates made by the Commission during the year covered by the report, the latter says: "After a long and exhaustive hearing, the Commission ordered a flat reduction of 20 per cent. on the classes numbered one to five inclusive, that is, merchandise classes, on January 1, 1906, and a graduated scale of reduction on classes six to ten inclusive, and commodity rates, commencing with 10 per cent. on the short mileage, effective July 1, 1906. The reduction of 20 per cent. on the first five classes has been in effect for six months at the date of this report, and the predictions of the railroads that it would be ruinous to their business has not materialized. The number of tons of freight hauled earning revenue for the year ending with the date of this report in the state of Illinois was 146,127,775, which was an increase of 22,543,686 tons over the previous year. The average amount received for each ton of freight was $0.73, against $0.75 the preceding year, or a reduction of only two cents, and the freight earnings per mile of road were $7,880 as against $7,086 the preceding year, or an increase of $794 per mile."

The steam railroad mileage in the state on June 30, 1906, was 11,894 miles, an increase of 257 miles; 2,229 miles of second, third and fourth main track, an increase of 146 miles; 6,005 miles of yard tracks and sidings, an increase of 74 miles, and 416.46 miles of industrial tracks, an increase of 0.92 miles. This last is significant, especially when considered in connection with the letter of Russell Harding to the Interstate Commerce Commission published in the *Railroad Gazette* of January 18, in which he asserted that one of the chief causes of the present car shortage and traffic congestion is the lack of sufficient industrial tracks. The total steam road mileage of the state was 20,544 miles, an increase of 478 miles.

Electric roads had a main line and branch mileage of 936 miles, the increase for the year being 173 miles. The total mileage of electric railways, which includes interurban and elevated roads but not street railways, was 1,187 miles, an increase for the year of 205 miles. The street railways are specifically exempted by law from the jurisdiction of the commission and make no report of any kind to any department of the state government. Concerning this the report says: "It would seem to be just and necessary that a public utility enjoying special privileges by courtesy of the state and municipalities, should be required to submit some kind of a statement of its business to some department of the state government for the information of the people who invest in its securities."

The number of accidents on steam roads from movement of trains was 958 killed and 3,636 injured, an increase over the previous year of 66 killed and 546 injured. From causes other than the above there were 18 killed and 1,563 injured, making the total from all causes 976 killed and 5,189 injured.

The interurban and elevated roads killed 48 and injured 468, an increase of 19 and 23 respectively. These roads carried 183,650,979 passengers, an increase of 21,801,904, and 1,277,566 tons of freight, an increase of 641,823 tons.

Norfolk & Western Improvement Work.

BY GEORGE L. FOWLER,
Associate Editor of the *Railroad Gazette*.

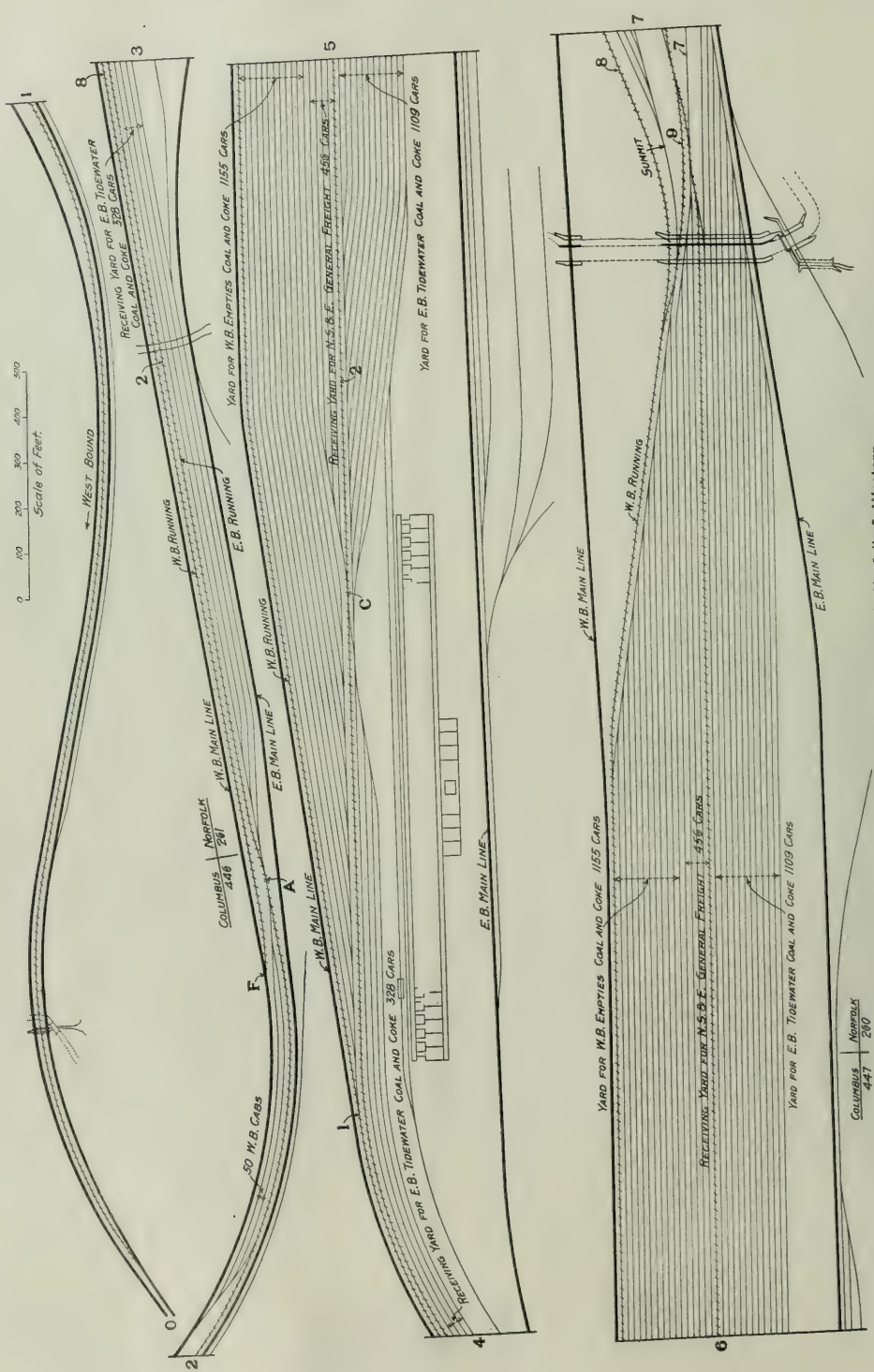
III.

YARDS.

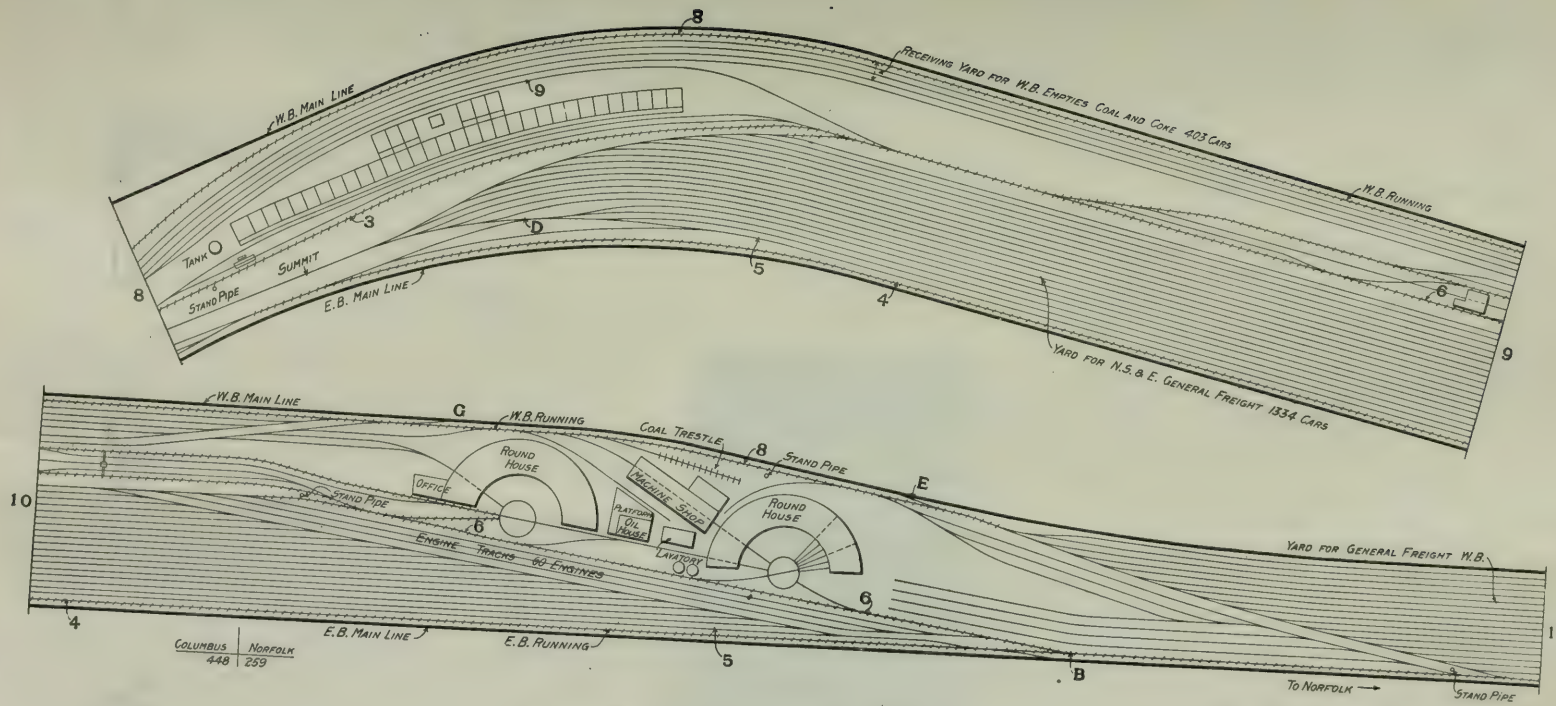
ROANOKE YARD.

Roanoke, Va., is situated at the crossing of the ways. It is the junction point of the main line, extending from tidewater to the mines, and of the north and south divisions running from Hagerstown, Md., to Winston-Salem, N. C. It is not an originating point for any large amount of traffic like Bluefield or Williamson, but it is an important distributing center and the demands are such that a large yard is required. Tidewater coal made up at Bluefield passes through the yard without breaking up, and the new yard has been so designed that this can be done without delay or interference, though the great mass of the general traffic entering from the four points of the compass, and sent out in as many directions, must be reclassified and arranged for distribution. This is, of course, cut down to the lowest possible notch, and there is no general reclassification of either east or westbound coal cars. The empties are sent on to Bluefield for distribution among the several operations, as will be described later, just as the tidewater coal is sent through to the east. Yet with this relief the reclassification of what remains is a large undertaking, for at the present time about 2,500 cars are passed through the yard daily, intended for the four lines running out of Roanoke. To do the work 10 locomotives are kept in service night and day. The yard is not yet entirely completed, but will be finished during the summer months.

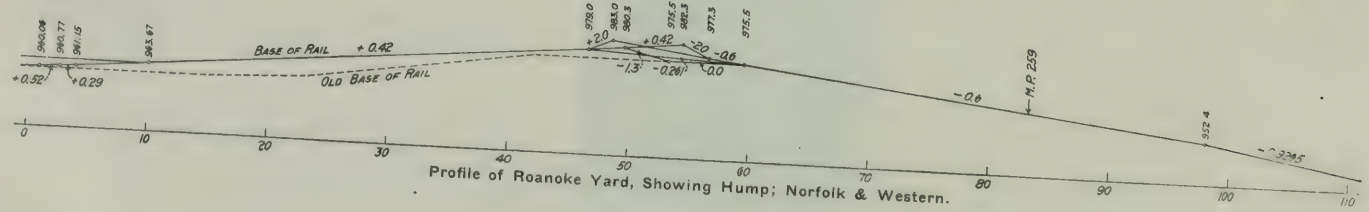
As in the case of the Bluefield and Williamson yards, that at Roanoke has been constructed at great expense and with large quantities of material to be moved. In one place the channel of the Roanoke river had to be changed in order to obtain the necessary width for the tracks and this, with the other excavations needed, run the amount up to 1,385,000 cu. yds., and the cost to $1,240,000. This cost, however, includes a new roundhouse. It is true that the topography of the Roanoke location is not as rugged as it is either at Bluefield or Williamson, still the country is rolling and it has been necessary to level hills of considerable height in order to lay the tracks and, in many places, this leveling has been so accompanied by adjacent filling that when the work has been



Plan of Western End of Roanoke Yard; Norfolk & Western.



Plan of Eastern End of Roanoke Yard; Norfolk & Western.



Profile of Roanoke Yard, Showing Hump; Norfolk & Western.

done, there is apparently little to show in corroboration of the figures given for material moved. This yard is, however, nearly all steam shovel work in a hard, shaly sort of clay and sandstone that digs with comparative ease and stands well with little inclination to wash down or slide and fill the ditches.

The yard has a total length of 20,000 ft., is located at the western part of the city, and is the best exemplification of any on the line of the underlying principle of placing the yard between the two main lines of rails. Here it is completely done. The tracks separate at the entrance of the yard and pass along its northern and southern borders, even including the roundhouse and buildings in the swing as at Williamson.

Bearing in mind that the bulk of traffic at Roanoke is eastbound and needs no sorting or classification, we can turn to the physical features of the yard.

As in the case of the westbound traffic at Bluefield, the eastbound freights enter a middle siding that has been cleared for their reception at the west end of the yard and, as this traffic is the most important, the major portion of the yard is devoted to it. These trains then pass over this middle track which, as in the case of all other running tracks, is indicated by a hatched line, until the caboose reaches the point A, where it is cut off and dropped back into one of the tracks reserved for the westbound cabs.

If the train is made up of tidewater coal, it may be run in to one of the three tracks indicated as a receiving yard for that traffic with a capacity of 328 cars, or it may continue on over the running track marked (1) to the yard for eastbound tidewater coal and coke. When the train is left in the first yard the engine is cut off and passes over the running track marked (2) between the yards for general eastbound freight and that for coal and coke to the running track (3) and thence on to the standing tracks or roundhouse.



West End of Roanoke Yard.

If the train is to be sent direct into the tidewater coal and coke yard, it swings away from the receiving yard, and running along the north side of the same, reaches the ladder track at the west end of the main yard. Then, after cutting loose, the engine runs out the east ladder track upon running track (4) and on to the point B whence it backs in to the roundhouse or storage tracks.

Eastbound general freight on reaching the point A swings off directly upon the running track (2) and follows it to the lead of the ladder track of the eastbound freight receiving yard at C, and then swings into that yard. The engine runs out over the eastern ladder upon running track (3) and thence to the roundhouse.

Outgoing tidewater coal and coke, needing no reclassifying, are pulled out of the yard upon running track (4) which they follow to the point B, where they are run out on the main eastbound track.

The general freight, after its reception in the receiving yard, is classified and distributed over the several tracks of the yard for north, south and eastbound general freight, which has a capacity of 1,334 cars, and is thence pulled out over its eastern ladder track to the point B, where it reaches the main eastbound line.

Engines for eastbound general freight can reach the ladder track of the yard from the engine storage tracks at either end. For tidewater coal the engine runs out on track (6) to B and then backs up over track (5), skirting the general eastbound classification yard to D, when it crosses into the ladder track of the coal and coke yard, and thence out as already stated. In both cases, for general freight and for coal, the caboose is picked up at the extreme eastern end of the yard, which is not shown in the engraving. The classification of the general freight is accomplished by means of a hump located at the point marked "summit." The cars are pushed out upon track (7) and thence over the hump from which they drop down into the classification yard by gravity. The eastbound traffic is thus cared for without crossing or in any way conflicting with any engine or train movement in the opposite direction.

The westbound general freight traffic, which is here a light movement, is cared for by a combination of receiving and classification yard having a capacity of 1,107 cars. The trains leave the main line at the entrance to the yard and, moving over the ladder track to one of the 16 tracks forming the yard, are left to be sorted, while the engine is sent out on to the ladder at the west end. The caboose in the meantime has been dropped at the east entrance to the yard and is picked up by the outgoing eastbound train. The engine then passes out over the engine running tracks (8) on the north side of the roundhouse to the west of the standing tracks and roundhouse; backing into the same.

When a westbound train has been made up in the classification yard, the engine takes it and, hauling it to the running track (8), crosses directly to the westbound track at E, or it may continue along the running track (8) between the roundhouse and the westbound track to F, just beyond which point the caboose is coupled on.

In the case of the westbound empties, they drop the caboose as before and then follow the main track beyond the westbound general yard and the roundhouse to the point G, where they turn in and cross the running track to the ladder of the yard for westbound coal and coke empties, which has a capacity of 403 cars. The engine then runs out on the west end ladder and backs over running track (9) to the storage tracks and roundhouse.

From the receiving yard the empties are pushed over a hump located at H and dropped down into the classification yard for empties that has a capacity of 1,155 cars. The engine for westbound empties leaves the roundhouse by running track (6), which it follows to its junction with track (3); thence by way of track (9) it crosses to the westbound running track (8), which it follows along the north side of the yard to the ladder track at I. Backing in on this track it couples to its train and hauls it out over the running tracks (8) to F, where it reaches the main line and takes its caboose at the same point as the general merchandise trains.

The yard is entirely free and independent from that devoted to passenger service as well as that of the shops, and it is made of such size that it will be capable of handling, not only the present traffic but some future increase. In it the east and westbound movements are kept entirely apart. There is no crossing of the traffic, either in the yard or on the main line, and there can be absolutely no interference with the passenger trains. In these particulars this, as well as the yards at Williamson and Bluefield, is deserving of most careful study.

EAST PORTSMOUTH YARD.

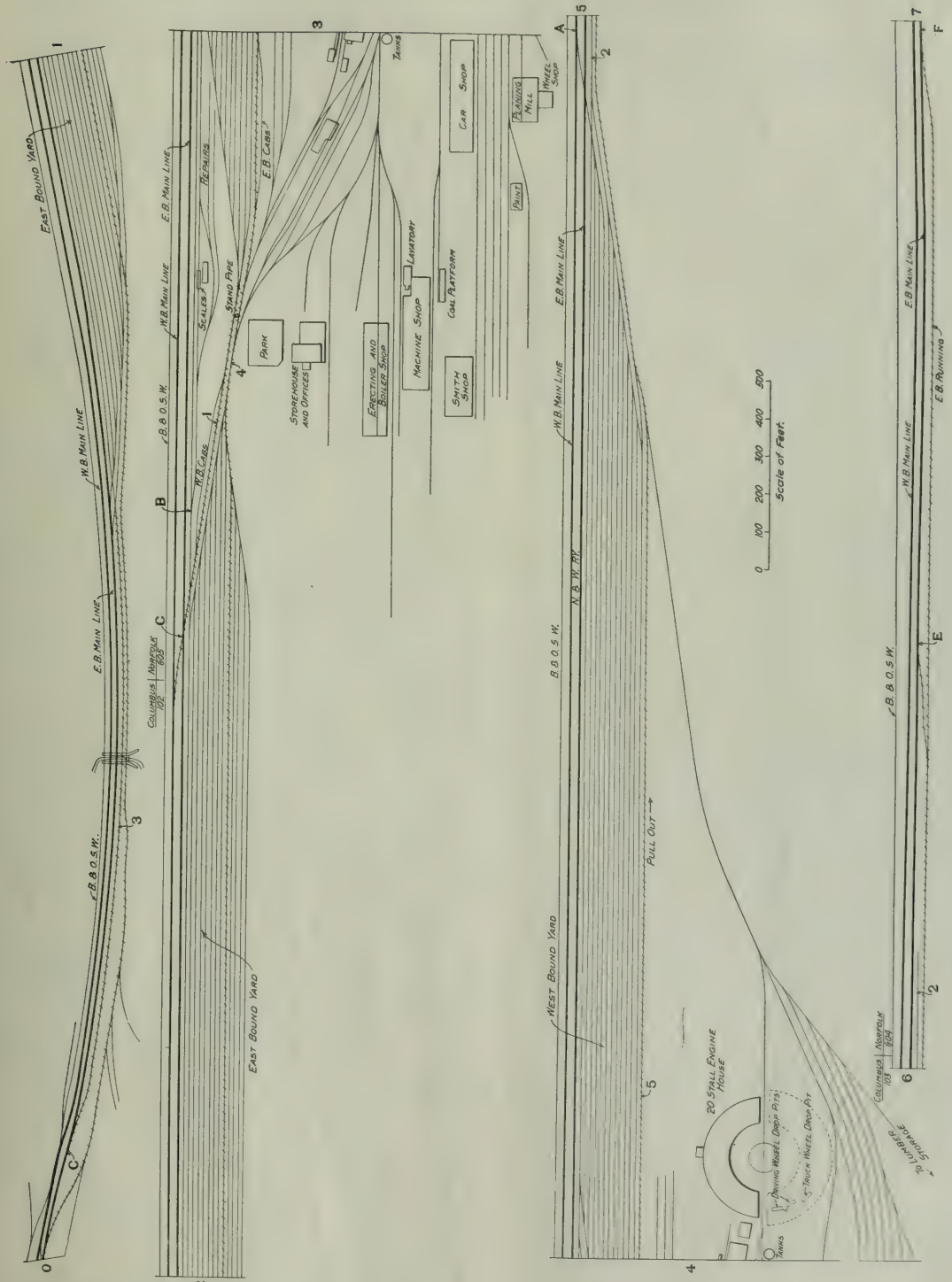
The yard at East Portsmouth, Ohio, on the Ohio river, 138 miles west of Williamson, serves as a receiving and distributing yard at the junction of the three main lines running to Columbus, Cincinnati and Norfolk. At this point the bulk of the loaded traffic is westbound and there is comparatively little that originates between that point and Naugatuck, where the Big Sandy line leaves the original line. Owing to the peculiarities of location it was impossible to place this yard between the main lines. These here run parallel to that of the Baltimore & Ohio Southwestern, and the yard is limited in length by the location of Portsmouth.

The yard is not yet entirely completed, but when it is it will have a length of about 13,000 ft. Although the ground is level near the river considerable filling has been required which amounts to about 500,000 cu. yds., and has cost about $407,000.

As the work to be done at this point is far less involved than at either of the other three, that have thus far been considered, the arrangement of the yard is correspondingly simplified. As in the case of the westbound general freight yard at Roanoke, one yard is made to serve the double purpose of receiving and classification for each direction of movement. On approaching the yard from the east, the trains hold to the main westbound track until reaching the head of the westbound yard at A, where, by means of a crossover they turn directly into the ladder track, crossing the eastbound main line in doing so. The engine then leaves the train in the yard and goes to the roundhouse from the west end by way of the running track (1), while the caboose is switched down upon the cab track.

The classification is effected by pulling the train back upon the tail track (2) and kicking the cars over the ladder and in upon the assigned tracks of the yard. When a train has been made up, the engine reaches it from the roundhouse by a reverse movement and pulls out over running track (1) picking up the caboose at B and crossing the main eastbound track again at C.

The eastbound movement is effected in the same way, except that there is no crossing of the eastbound main line. The trains enter the yard at C and follow the running track (3) that has been cleared for their reception to the ladder of the eastbound yard. The engine passes on to the roundhouse from the east ladder by way of the track (4) and the caboose is brought around the yard and



Plan of East Portsmouth Yard; Norfolk & Western.

put upon the cab track ready for delivery at B. The eastbound engine reaches its trains by a reverse movement and pulls out over the running track (5), picking up the caboose as it passes its siding. It then continues on along the south side of the yard and reaches the main line at E or F, both of which points are beyond the extreme limits of the sorting and poling tracks of the westbound traffic. Provision is made for weighing cars between the two yards, so that they may be run out over the scales and poled back as required. With this arrangement there is no interference between the east and westbound movements as far as the freight work is concerned. The only interference being in the hauling of the westbound freight trains across the eastbound main tracks as they enter and leave the yard, a matter that, owing to the light character of the passenger traffic at this place is of no importance, especially as this crossing is done between the points where the eastbound freight enter and leave the yard.

SOUTH NORFOLK YARD.

The new yard at South Norfolk is intended for the sole purpose of a receiving yard for eastbound traffic in order to relieve a possible congestion at Lambert's Point and the city yards. It is at Lambert's Point that the road has its tidewater terminal from which the coal is delivered to vessels. This terminal was fully described in the *Railroad Gazette* of July 24, 1903. In loading or waiting for vessels it frequently occurs that there will be an accumulation which if run into the terminal would so congest it as to hinder the work. For that reason this yard has been built on the outskirts of Norfolk and the borders of the Dismal Swamp. As already stated, it is intended for eastbound traffic only and has no provision for doing any westbound work. It has a length of about 12,800 ft., and, when completed, will be provided with a hump between the receiving and classification yards.

It is built upon low but firm ground and is raised above the natural surface. Although this natural surface is level, the extent of the yard involved a correspondingly large amount of material to be placed, amounting in all to 120,000 cu. yds., and its cost up to date is $132,000, but the yard is not yet complete.

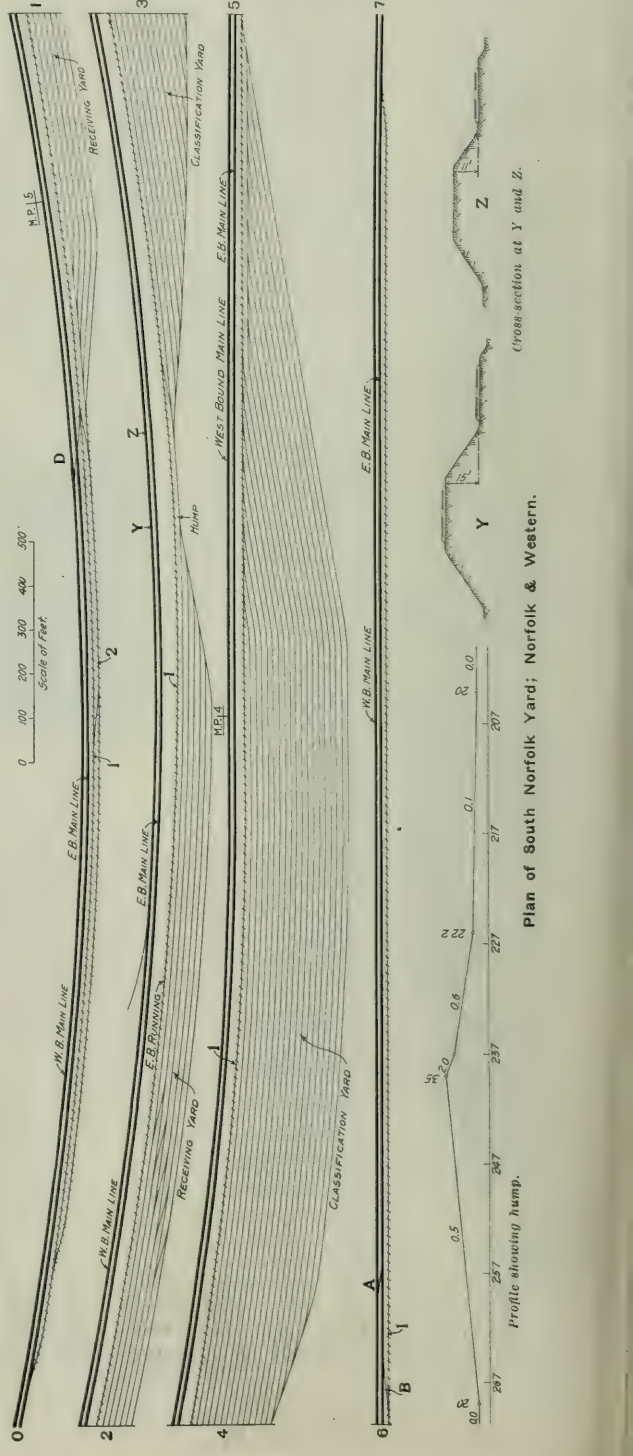
Inasmuch as the yard has to deal with traffic in one direction only, it was unnecessary to place it between the tracks of the main line in order to avoid an interference. It is, therefore, placed outside these lines and to the south of them on the side of the eastbound track which it is intended to serve. Trains approaching it from the west leave the main line at the west entrance and swing off upon running track 1. If the train is to be broken or is intended for the receiving yard it is run in on track 2, which is a westbound continuation of the ladder of the receiving yard. It can then be run direct in upon its proper track. If, however, no work is to be done upon it, it may continue along the main track to the terminal yards.

In the receiving yard there are cross-overs between adjacent tracks, so that one train can be shifted ahead of another whenever it is so desired. The work at the hump is, of course, to be conducted in the ordinary manner. It will be noticed that at the east end of the classification yard there are two ladders serving eight and 10 tracks respectively, and each delivering to running track 1. This is to enable two engines to work at that end of the yard at the same time without interfering with each other.

When a train is ready to be sent to Norfolk an engine is sent out over the westbound track and it can cross to the eastbound at A and back into its train. When pulling out, it may go directly upon the eastbound track at B or continue on down the running track 1, where it may wait for orders and go out on the main line at C. There is also a cross-over from the east to the west line near the western end of the yard at D. In these yard movements the cabooses are pulled out of the receiving yard and sent in to Norfolk over the running track 1 with the engine.

As the movement is all in one direction the detail of all of the yard work is equally simple, both that relating to the movement of the cars and the clerical work attending it as will be shown in a later article.

These yards are shown in this detail because it is the intention to set forth in a later article the methods of operation followed in them in caring for and recording the cars as they pass through and also to show the value of the principle laid down at the outset of so constructing them that there is a free movement of traffic in both directions without the interference of one with the other. Where the whole yard is between the main line tracks, as at Roanoke and Williamson, this is comparatively easy of accomplishment, though study will be required in order to pass one by the other within these limits and still leave free access to roundhouses and storage yards. There the yard must be on one side of the main line, as at Bluefield and East Portsmouth, the problem becomes more difficult, but not impossible of solution with single crossings of one main line track and none in the case of the opposing currents of the freight traffic. Studied independently each of these yards is well worthy of attention, but taken together and with their fundamental principle kept in mind they form a most interesting exemplification of what can be accomplished along lines that have been definitely fixed and still have the flexibility demanded by a widely varying topography. This varies from the flat, open, unobstructed country at Norfolk to the level bottom land that is abruptly bounded by hills at East Portsmouth, to the heavy rolling territory of Roanoke, through the hilly, rough topography of Bluefield, to the narrow, tortuous valley of the Tug river at Williamson. Variations in detail were called for at every point and so there will be needed variations in the detail of operation in order that the traffic may be forwarded without delay. It is this variation of



Plan of South Norfolk Yard; Norfolk & Western.

detail that lends interest to the whole when considered as a unit that has been adapted to the conditions that it has been called upon to meet.

(To be continued.)

Government Accident Bulletin No. 22.*

The Interstate Commerce Commission has issued Accident Bulletin No. 22, containing its report of railroad accidents in the United States during the three months ending December 31, 1906. The number of persons killed in train accidents was 474 and of injured 4,940. Accidents of other kinds bring the total number of casualties up to 20,944 (1,430 killed and 19,514 injured). These reports deal only with (*a*) passengers and (*b*) employees on duty.

TABLE No. 1.—*Casualties to Persons.*

	Passengers.		Employees		Tot'l persons reported	
	Kil'd.	Inj'd.	Kil'd.	Inj'd.	Kil'd.	Inj'd.
Collisions	119	1,630	189	1,330	308	2,960
Derailments	61	892	85	625	146	1,517
Misc. train accidents, inc. boiler explo...	..	26	20	437	20	463
Total train accidents	180	2,548	294	2,392	474	4,940
Coupling or uncoupling	..	...	84	1,083	84	1,083
While doing other work about trains...	..	...	79	4,464	79	4,464
In contact with overhead bridges, etc....	2	18	35	407	37	425
Falling from or getting on cars or engs.	34	540	229	3,280	263	3,820
Other causes	18	563	475	4,219	493	4,782
Total (other than train accidents)..	54	1,121	902	13,453	956	14,574
Total all classes	234	3,669	1,196	15,845	1,430	19,514

The totals of collisions and derailments and of deaths and injuries caused by them continue very large. The general cause of the increase over former periods, so far as it is possible to speak definitely on the subject, has been repeatedly stated in these bulletins, and need not be given here. The specific causes of the more prominent accidents are given in connection with Table 2*a* as usual. The number of passengers killed in train accidents in this quarter, 180, is the largest on record except that for the quarter ending September 30, 1904 (Bulletin No. 13), when it was 228. Bulletin No. 10 contained the next highest record. The totals under this head, in this and the 12 bulletins last preceding, are as follows:

Passengers Killed in Train Accidents.

Bulletin No.	Quarter ending	Killed.	Bulletin No.	Quarter ending	Killed.
22.	December, 1906..	180	14.	December, 1904..	53
21.	September, 1906.	52	13.	September, 1904.	228
20.	June, 1906.	27	12.	June, 1904.	23
19.	March, 1906	62	11.	March, 1904	40
18.	December, 1905..	50	10.	December, 1903..	*a*147
17.	September, 1905.	43			
16.	June, 1905	41	*a* Three times the average of the nine preceding quarters.		
15.	March, 1905. ...	28			

The five principal accidents in Bulletin No. 13, with the number of persons killed in each, were: A bridge disaster in Colorado, 88; a butting collision in Tennessee, 63; a derailment at a misplaced switch in Illinois, 24; a collision in Illinois, 18, and a collision in New Jersey, 16.

Bulletin No. 10 includes a derailment in Pennsylvania, due to an accidental obstruction, 65 killed; a collision in Louisiana, 32; a collision in Michigan, 18, and one in Indiana, 16. Besides these disasters to passenger trains, there were in that quarter two collisions of work trains, killing 17 and 16 employees, respectively.

The other principal items in the present bulletin, compared with the last preceding quarter and with the quarter one year ago, appear as follows:

	Bulletins		
	No. 22.	No. 21.	No. 18.
1. Passengers killed in train accidents	180	52	50
2. Passengers killed, all causes	234	110	101
3. Employees killed in train accidents	294	215	320
4. Employees killed in coupling	84	81	85
5. Total passengers and employees killed, all causes	1,430	1,182	1,109

Of the 180 fatalities in this quarter, as shown above, 143 are attributable to three accidents—collisions No. 23 and No. 28 (Table 2*a* following) and derailment No. 10.

TABLE No. 2.—*Collisions and Derailments.*

	No.	Loss.	Persons Killed.	Persons Injured.
Collisions, rear	583	$627,125	113	907
" butting	297	500,011	128	1,089
" trains separating	174	50,210	4	85
" miscellaneous	1,167	539,533	63	879
Total collisions	2,226	$1,716,879	308	2,960
Derailments due to:				
Defects of roadway, etc.	341	$250,231	8	648
Defects of equipment	771	569,550	20	167
Negligence of trainmen, signalmen, etc.	147	119,809	69	192
Unforeseen obstruction of track, etc...	68	72,626	13	66
Malicious obstruction of track, etc....	14	17,113	1	32
Miscellaneous causes	398	353,020	35	412
Total derailments	1,739	$1,382,349	146	1,517
Total collisions and derailments	3,965	$3,099,228	454	4,477

*Six of the accidents in Table 2-A may be identified by reference to the *Railroad Gazette* accident reports for the months named:
Collision No. 22, December, Enderlin, N. D.
" " 23, December, Terra Cotta, D. C.
" " 25, October, Lansingburg, N. Y.
" " 28, November, Woodville, Ind.
" " 30, November, Lawyer, Va.
Derailment No. 10, October, Atlantic City, N. J.

Following is the usual list of Class A train accidents—all in which the damage is reported at $10,000 or over; notable cases in which passengers are killed, and those doing damage less than $10,000 and down to $2,000, wherever the circumstances or the cause may be of particular interest:

TABLE 2*a*.—*Causes of Forty Prominent Train Accidents (Class A).*

[NOTE.—R., stands for rear collision; B., butting collision; M., miscellaneous collisions; D., derailment; P., passenger train; F., freight and miscellaneous trains.]

No.	Class.	Kind of train.	Killed.	Injured.	Damage to engines, cars & roadway.	Reference to record.	Cause.
			Collisions.				
1	R.	P. & F.	1	10	$2,300	55	Freight train, stopped by automatic block signal, run into at rear by passenger train, which had overrun automatic disk block signal, the face of which was partly covered by snow. Engineman appears to have taken chances.
2	B.	F. & F.	1	5	2,560	85	Operator wrote "95" for "75" in telegraphic order.
3	R.	F. & F.	0	0	3,000	87	Block signalman B. authorized A to clear signal when block was occupied; engineman approached station in fog with speed not under proper control.
4	B.	F. & F.	0	0	3,192	10	Signalman gave false clear block signal to westbound train; operator failed to deliver order to eastbound train; one of these men in service 18 days, the other 8 months.
5	B.	F. & P.	1	11	4,000	45	Two empty engines, coupled together, encroached on time of regular passenger train; second engineman depended on the first; the first misread time by watch.
6	R.	F. & P.	2	26	4,475	79	Freight train approached station in fog with speed not under proper control.
7	B.	P. & F.	2	33	6,900	9	Operator omitted word "second" from order; operator in service 6 weeks.
8	R.	P. & F.	0	3	7,000	6	Signalman (1 a.m.) gave false clear block signal; flagman failed to go back, though instructed by locomotive whistle signal to do so. Signalman, 34 years of age, in service 8 days.
9	B.	F. & F.	5	1	7,600	19	Men in charge of eastbound train overlooked meeting point.
10	B.	P. & F.	3	24	8,500	13	Freight approached meeting place with speed not under proper control; conductor and engineman appear to have passed a switch without knowing it.
11	M.	P. & F.	2	24	9,056	82	Switch wrong; believed to have been maliciously misplaced.
12	B.	F. & F.	1	1	9,400	56	Operator omitted "2d No. 155" from order, though he repeated it to despatcher correctly; operator in service 39 days.
13	M.	F. & F.	0	0	10,300	72	Freight train without engine left standing on grade with no hand-brakes set; ran back down grade.
14	B.	F. & F.	4	3	10,998	16	Operator failed to deliver meeting order; operator decamped.
15	B.	P. & F.	3	7	12,330	14	Eastbound freight encroached on time of westbound passenger; engineman killed; conductor evidently reckless.
16	B.	P. & P.	1	49	12,500	1	Engineman's watch wrong; see note in text below.
17	R.	F. & F.	0	2	12,553	48	Failure to flag, and excessive speed.
18	B.	F. & F.	0	3	13,000	80	Operator fell asleep and failed to deliver meeting order; on duty 24 hours; his superior ignorant of this.
19	B.	F. & F.	4	3	13,200	76	Conductor and engineman of extra train made mistake of 1 hour in reading timetable. Engineman, 18 months in service, was killed; conductor 6 months in service.
20	B.	P. & F.	1	13	14,000	91	Despatcher sent order reading "No. 50." Order delivered read "No. 52." Impossible to decide whether error is chargeable to despatcher or to the receiving operator.
21	B.	F. & F.	3	3	14,543	17	Operator, holding three orders for train, delivered only two.
22	B.	P. & F.	9	66	15,000	74	Passenger train (1 a.m.) collided with switching freight train at entrance of yard. See note in text below.
23	R.	P. & F.	43	63	16,000	83	See note in text below.
24	B.	F. & F.	2	5	16,763	57	Northbound extra train overlooked order to clear track for southbound extra train; no explanation of forgetfulness.
25	R.	P. & P.	5	20	20,400	2	Extra passenger train ran into regular passenger train standing at station. See note in text below.
26	R.	P. & F.	1	9	21,900	73	Passenger train ran past automatic block signal and flagman; engineman killed. He made no effort to stop, and it is believed he had in some way been incapacitated before the collision.
27	B.	P. & F.	0	6	25,520	89	Misplaced switch at entrance of passing track. Wreck destroyed by fire, which appears to have started in a car of oil.
28	B.	P. & F.	43	155	37,000	40	See note in text below.
29	R.	F. & F.	0	11	38,000	114*a*	Rear collision of freights due to false clear block signal and nonobservance of yard speed limit. Passenger train on adjacent main track wrecked because not time to warn it. Wreck burned by fire from caboose stove.
30	B.	P. & F.	7	8	55,615	58	False clear block signal. See note in text below.
Total			144	564	$427,605		
			Derailments.				
1	D.	F.	0	0	$4,994	28	Careless running on descending grade; conductor and engineman on duty 23 hours.
2	D	P.	2	14	5,700	64	Angle-bar broken by shortening of rails

No.	Class.	Kind of train.	Killed.	Injured.	Damage to eq.	Reference to record.	Cause.
							due to cold weather; speed 55 miles an hour.
3	D.	P.	0	22	7,500	66	Unexplained; speed 55 miles an hour.
4	D.	P.	0	49	7,700	35	Broken rail; speed 60 miles an hour. Rail had excess of phosphorus and manganese.
5	D.	P.	0	45	9,148	34	Unexplained; speed 60 miles an hour.
6	D.	F.	0	0	10,000	29	Drawbar pulled out.
7	D.	F.	0	0	10,200	109	Unexplained; 14 cars fell through trestle; wreck took fire, probably from heated journal.
8	D	P.	0	10	15,726	32	Low joint; sudden application of brakes; speed 25 miles an hour. Section foreman dismissed.
9	D.	F.	1	6	16,000	71	Runaway on steep grade; mismanagement of air brakes.
10	D	P.	57	36	20,000	36	Rail out of place at entrance of drawbridge. See note in text below.
Total			60	182	$106,968		
Grand total			204	746	$534,573		

Collision No. 23, causing the death of 43 passengers and the injury of 63, occurred at Terra Cotta, D. C., on the Baltimore & Ohio Railroad, on the night of December 30, 1906, between 6.30 and 7 o'clock. The night was dark and a dense fog prevailed. The leading train, No. 66, had just stopped at the station when it was run into at the rear by a following extra train, consisting of an engine and eight empty passenger cars, and its rear car was completely wrecked. The circumstances of this collision are under investigation, and the Commission intends to issue a special bulletin containing a summary of the facts and its conclusions therefrom.

Collision No. 28, resulting in the death of 42 passengers and one trainman, and the injury of 150 passengers and five trainmen, was between a westbound passenger train and an eastbound freight. It occurred about 3 o'clock in the morning during a blinding snowstorm. The engines were wrecked and took fire, and five passenger cars, one baggage car and three freight cars were burned up. The bodies of the passengers who were killed, except two, were consumed in the fire. The passenger train was No. 47, second section. The first section of the passenger train carried green flags to indicate to freight trains running in the opposite direction that they must keep out of the way of the second section, but the freight in this case did not get, or did not heed, the signals, and started out from a side track, where it had been waiting, immediately after the passage of the first section. The signal lights fixed on the passenger engine close to the signal flags were not burning, and therefore the men in charge of the freight had no visual notice that there would be a second section of the passenger train.

To provide against the failure of lights in such cases the engineman of the passenger train is required to sound a whistle signal at the point where he meets a freight train. In this case the engineman says that he sounded the whistle, indicating that he was carrying green signals, and the men in charge of the freight admit that they heard a whistle signal, but thought it sounded like a crossing signal. The signal which should have been given consists of one long blast and two short blasts, while that for a highway crossing consists of two long and two short blasts. Whatever may have been the character of this signal, the engineman of the freight, if he understood it to be a notice of a second section, should have acknowledged it by sounding the whistle of his engine. He did not sound this signal. This being so, it was the duty of the engineman of the passenger train, under the rule, to stop and give the proper notice to the freight train by word of mouth. This was not done, and the passenger engineman can give no excuse for his failure to do so. This engineman is reported as having a clear record for the five years preceding the accident. As to the extinguishment of his signal lights, he says that they were burning when he left a station about 30 miles east of the point of collision. The snow was falling rapidly at the time and the wind was blowing a gale, and he appears to have allowed the lamps to go out without paying attention to the fact. This engineman had been in the service of the road 16 years, and had been on duty two hours and 30 minutes, after a sufficient time for rest.

Derailment No. 10 was due to an unexplained fault in a drawbridge. The train, southbound, was made up of three cars, propelled by electricity, the leading car being the motor car. It was running at ordinary speed, probably 30 to 40 miles an hour. At the entrance of the drawbridge the leading car jumped the track and, after running a short distance on the ties, the leading truck of the car rode over the guard timber at the outer edge of the bridge floor, and the car, with the two following it, fell into the stream below. Of the passengers in the cars 56, with the motorman—57 persons in all—were drowned, and 36 passengers were injured. The drawbridge is of the "turntable" style, turning on a vertical axis. It had been opened for the passage of a vessel a short time before. Preparatory to opening, the rails of the track at the end of the draw, which extend over a few inches onto the fixed span adjoining, had been lifted so as to clear the fixed rails during the movement of the bridge. When the bridge was returned to its normal position for the movement of trains the supports under these lifted rails were withdrawn, and the rails should have dropped into place by gravity. For some reason, not explained, one or both of the rails of the southbound track did not thus drop, though the bridge itself was locked in position; and this caused the derailment. The attendant in charge had failed to notice the fault, although he stepped to a point within a few feet of the end of the draw to take up a red flag which, according to the regulations, he had displayed on the fixed span as an auxiliary stop signal while the draw was open. Not seeing the misplaced rail, he took up the flag and notified the signalman in the cabin south of the draw that the fixed semaphore signals might be cleared for trains. These fixed signals were interlocked with the bridge, but not with the track rails, and therefore there was nothing to prevent the giving of the clear signal to this train, notwithstanding the imperfection in the track.

The attendant at the bridge who thus wrongfully authorized a clear signal was 65 years old, a man of experience in positions of this kind, and with a good previous record.

Collision No. 16 was between passenger train No. 601, westbound, and passenger train No. 10, eastbound, between the switches at the station where they were ordered to meet. The eastbound train had the right to the track and the westbound encroached on its time in consequence of the engineman's watch being slow. It is the conclusion of the superintendent that the engineman had allowed his watch to run down. The westbound train should have entered the side track east of the point of collision, and for this the conductor, as well as the engineman, is held responsible.

Collision No. 22 occurred in the middle of the night and was due to the neglect of a flagman to give a warning signal a sufficient distance from his train. The passenger train was approaching a station at full speed and ran into a freight train switching on the main track. The flagman of the freight had been instructed to go out two miles, but he only went about 1,500 ft., and then stopped on a curve where the engineman of the approaching passenger train could see him for only a very short distance before reaching him.

Collision No. 25 was due to a combination of high speed and an insufficient time interval between trains carrying passengers. A regular westbound passenger train standing at a station was run into by a following extra passenger train carrying troops and horses, and consisting of 18 live-stock cars, nine sleeping cars and a caboose. This train had left the last preceding station about four minutes behind the regular train, and was run at high speed (about 60 miles an hour or faster over a line where the grade was descending at 40 ft. per mile)—so high that on approaching the station the engineman was unable to obey the stop signal given by the flagman of the train standing at the station, who had gone back about 1,400 ft. and who was in a position where the engineman of the troop train could see the flag in time to have a space of about 2,000 ft. in which to stop. He was unable to do this, and his engine struck the standing train while running at about 20 miles an hour. This engineman was held responsible for the collision, and the conductor of the train also for permitting the excessive speed. Both of these men, as well as those in charge of the regular train, were also held blameworthy for not complying with the rules regarding despatcher's orders, the regular train having passed the extra train without authority when the men of both trains held orders under which the extra train should have kept ahead. Of the 28 cars in the extra train 24 were air-braked.

Collision No. 30 occurred about 6.15 a.m. on a line worked by the telegraph block system. Southbound passenger train No. 33 of the Southern Railway left Rangoon, Va., at 6.06 a.m., and after running about 1½ miles was stopped by the automatic application of the air-brakes, caused by the parting of the train, the parting being due to the failure of the drawbar of an express car in which the coupler was defective. About three or four minutes after the train had come to a stop it was run into at the rear by a following passenger train, No. 37, and the rear car of the standing train was crushed, seven persons in it being killed. Eight persons on the train were injured. Train No. 37 had passed Rangoon at 6.14 a.m., the signalman at that point giving it a clear block signal. This signalman, 22 years of age, and in the service of the company two and one-half years, asserts that the signalman at Lawyers, the south end of the block section, had reported the passage of No. 33. The signalman at Lawyers denies this, and his records, on which no entry was made for No. 33, bear out his statement. The flagman of train No. 33 had gone back between 300 and 400 yards to warn the following train, but the line of the road at this point is descending about 60 ft. to the mile, the train was running at high speed, and the flag signal was unavailing. This collision, like No. 23, may be made the subject of a special report.

Representatives of the business and manufactures of Moscow cry aloud to the authorities for improvements in transportation which will secure the supply of fuel, lack of which threatens to cripple this the greatest manufacturing city of Russia. They say the average consumption of the city per year for five years has been, all in tons: Wood, 3,816,800; coal, 1,261,800; petroleum, 3,978,-

000. The cost of coal is about $6.30 per ton. An equivalent quantity of petroleum costs 9 per cent. more, and of wood 14 per cent. more. But the wood is giving out and is especially of minor importance in manufactures. Petroleum is subject to great fluctuations in prices and now costs more than twice as much as a few years ago; and the only permanent dependence must be on coal from the Donez mines, which are about 570 miles distant by the present rail route. New lines, double tracks, and big American cars are called for.

Prussian State Railway Signals.

BY W. H. POCKELS.

On the Prussian State Railways, for the control of the traffic, signals can be divided into six parts:

1. Disc signals.
2. Signals on signal posts.
3. Vorsignale.*
4. Signals on water towers.
5. Point signals.

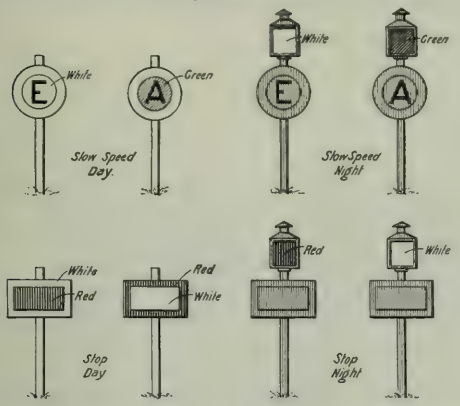


Fig. 1—Disc Signals.

Slow Speed.

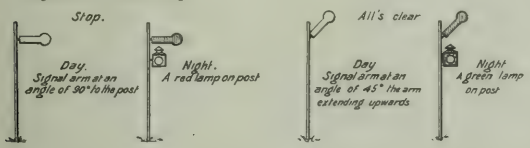
Day.—At the beginning and end of a stretch of rail where the train must travel at slow speed, two discs are placed. The advancing train perceives a round disc colored green with a white edge and the letter A (Anfang = beginning); at the other end a white disc with the letter E (Ende = end).

Night.—On the discs are placed lamps—A green and E white.

Stop such as by a repaired line or dangerous spot.

Day.—A rectangular disc is placed painted red having a white border.

Night.—A red lamp.



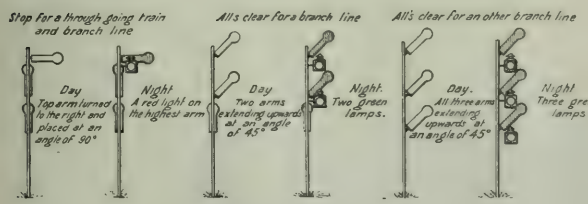


Fig. 2—Semaphore Signals.

Stop.

All's clear.

Stop for a through-going train and branch line.

All's clear for a branch line.

All's clear for another branch line.

Bracket signals are used at junctions, the left-hand signal used for the line on the left extending upwards to perhaps 10 or more arms.

*Warning signals in advance of the main signal.

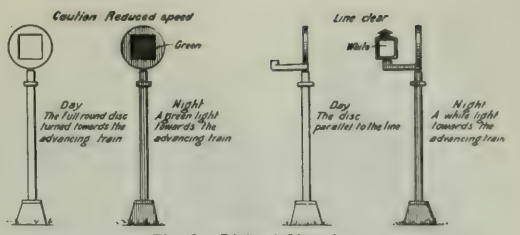


Fig. 3—Distant Signals.

Where the signal post is hidden from the sight of the driver by means of a curve in a cutting, or by a tunnel or bridge, vorsignale (warning signals) are used, consisting of a movable disc, to which is applied a lantern for night purposes.

4. WATER TOWERS.

1. The discharge pipes of the crane, like the ordinary English ones, move on a pivot. When in use they turn till at right angles to the line, when not in use they are turned parallel to the line.

2. At night they are registered when parallel to the line by a white light.

3. When at right angles to the line a red light is shown to the advancing object.

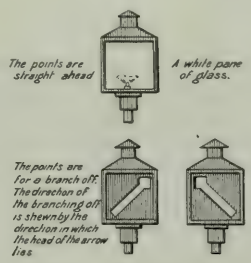


Fig. 4—Point Signals.

The use of the point signals is to show from a distance the curves of the railroad to the driver.

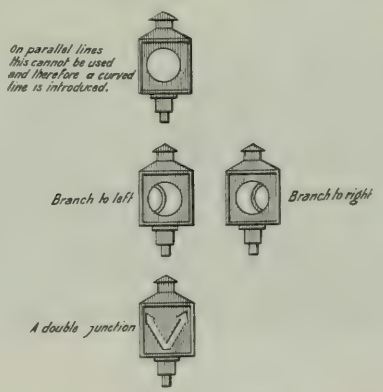


Fig. 5—Point Signals.

In addition to these signals, I also include a brief description of:

1. Signals with electric bells and horns.
2. Hand-signals by the officials.
3. Head and tail lights.
4. Signals of the train staff.
5. Shunting signals.

I have extracted a few of the rules for the instruction of the railroad employees:

1. The electric bells are rung in groups of five seconds between each.

2. Signals 1 and 2 are the means of warning the railroad servants of the start of a train from one station to another.

3. If a locomotive has not reached the electric bell after it has been sounded 15 minutes, the start signal must be sounded again.

4. The danger signal serves to warn the neighboring station or bahnwärter of an important obstruction on the line, such as, line not clear, accident, etc.

5. The horn-signals I. and III. serve as a warning signal on

branch lines where the traffic is not so important, and also for the gangers working on the line.

6. The signal IV. is given by the bahnwärter:

(1) When he hears his neighbor give it.

(2) When he notices a train movement of which no previous notice has been given, such as special light engine.

(3) When he notices anything out of the ordinary on a passing train which might cause disaster.

1. SIGNALS WITH ELECTRIC BELLS AND HORNS.

Audible Signals.

1. The train goes in the direction from A— B (starting signal)	One special ring of the bells.
2. The train goes in the direction from B— A (starting signal)	Two special rings of the bells.
3. The train is not to proceed (stop signal)	Three special rings of the bells.
4. Something special on the line (danger signal)	Six special rings of the bells.

Horn Signals.

I.	Signal · ‿ ‿ ——	once.
II.	" · · ‿ ‿ ——	twice.
III.	" —— —— —— ——	four times.
IV.	" ‿ ‿ ‿ ‿	twice.

2. HAND SIGNALS.

The hand-signals of the bahnwärter are as follows:

Slow Speed.

Day.—Any article held at arm's length at right angles to the line (usually the flags in their case).

Night.—A lamp held at arm's length with a green light.

Stop.

Day.—Any article held at arm's length and swung round so as to describe a circle (a red flag is generally used).

Night.—A lamp held at arm's length and swung round so as to describe a circle, the lamp showing a red light.

3. HEAD AND TAIL LIGHTS.

(*a*) When a train travels over a single line, or on the line especially set apart for the train.

(1) In daytime.—No special signal.

(2) At night.—Two white lamps in front on the frames.

(*b*) When the train travels exceptionally, not on the line set apart for the purpose, or in the case of a non-scheduled train on a branch line.

(1) In daytime.—The locomotive carries before the funnel a red circular disc with a white border.

(2) At night.—Two red lamps in front on the frames.

If the locomotive is not attached to the front of the train, or travels tender forwards, the lamps must be placed in the very front of the train.

(*a*) On the last vehicle of the train:

(1) By day—A red and white circular disc is placed on the left buffer, and two quadrilateral discs, of red and white color, the diagonals, alternately colored red and white, are placed at the top of the wagon or carriage.

(2) At night.—Lamps take the place of discs.

A special train is recognized:

On the last vehicle of the train, by day, a red and white circular disc is placed on the left buffer, and a green circular disc is placed on the back in the topmost corner, the other corner being occupied by a red and white quadrilateral disc.

At night the discs are replaced by lamps.

(*b*) A train coming in the opposite direction carries at the stack by day a green circular disc, by night a green lamp.

4. SIGNALS OF THE TRAIN STAFF.

(*a*) With the steam whistle:

(1) Warning—a long tone ——.

(2) Put on the brake—(*a*) A little—A short tone ‿.
(*b*) Hard—Three short tones ‿ ‿ ‿.

(3) Take the brake off—Two long tones —— ——.

(*b*) With the mouth-whistle:

(1) Take your seats, please—a long tone ————.

(2) Start—Two long tones – · ——.

5. SHUNTING.

With the mouth-whistle or horn:

(1) Proceed—A long tone ——.

(2) Reverse gear.—Two long tones – ——.

(3) Stop.—Three short tones ‿ ‿ ‿.

Shunting by hand signals:

(1) Proceed.—Moving the arm from a horizontal position upwards, then downwards. At night the same process, but holding a lamp.

(2) Reverse gear.—Horizontally moving the arm from right to left. At night the same process, but with a lamp.

(3) Stop—Moving the arm in a circular direction, keeping it perfectly stiff. At night the same process, but holding a lamp.

Standard Locomotives of the Midland Railway.

The accompanying engravings illustrate four of the standard freight and passenger locomotives that are in use upon the Midland Railway of England. These engines may be taken as representative of the characteristics of English design in that they are marked by extreme simplicity in all their lines and are equally divided between inside and outside cylinders, though in the case of the four-coupled compound express passenger locomotive the outside cylinders are the low-pressure ones of a three-cylinder type. In this engine, shown in the reproduction of the photograph of No. 2,632, there is but one high-pressure cylinder, and that is between the frames, thus reversing the arrangement of the well-known Webb compound in which there were two high and one low-pressure cylinder, the latter being between the frames; and following the arrangement that was used in France in the eighties, but which has since been discarded for the four-cylinder machine. These machines have cylinders of 19 in. and 21 in. diameter, so that the ratios of volume between the two sets is as 1 to 2.44, showing the tendency of modern practice to put this ratio higher than it was a few years ago. The cylinders have an inclination to the rear, in order that they may be raised to clear the truck wheels. As for weights, this engine is crowding pretty close up to what we are pleased to consider American standards. A weight of 43,380 lbs. on the front pair of driving wheels puts a load on each wheel that is well up in the scale.

The inside-connected express passenger locomotive, of which a photograph of No. 845 is reproduced, is of a somewhat lower capacity than the three-cylinder compound, but is also used in high-speed service. In neither of these engines is there any equalization of the weight between the two pairs of drivers, a condition that is considered so absolutely essential on engines in the United States. It also appears, too, from tables that are issued that the ratio of adhesion to weight on drivers is put somewhat lower on the Midland than is usually considered in calculations in the United States, though it is about the same as that actually allowed for working conditions. A difference is also made in the matter of adhesion as to whether sand is used upon the rail or not. Without sand the adhesion is calculated on the basis of 450 lbs. resistance per ton of weight, or about 20 per cent., and with sand it is placed at 607 lbs., or about 27 per cent. When sand is used it is blown on the rail by a steam jet.

The determination of the tractive power of these locomotives is done by means of the indicator, but the work is also calculated by the formula:

$$T = \frac{p\ d^2\ L}{2240\ D},$$

in which, T = tractive power in tons,
d = diameter of cylinders in inches,
L = length of stroke in inches,
p = maximum boiler pressure minus 40 lbs.

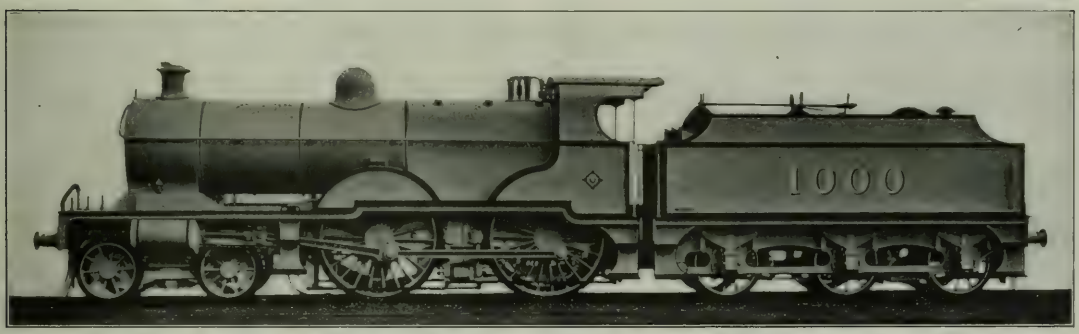
It will be seen that though this formula is identical in form with that used in this country it differs materially from it in expression and in assumed constants. The expression differs in giving the result in tons instead of pounds, which is immaterial, but in the assumed pressure there is some difference as well. The general practice in the United States is to assume the maximum mean effective pressure to be 85 per cent. of the boiler pressure, no matter what this may be. The Midland formula, on the other hand, makes a specific reduction of pressure from that of the boiler, so that the assumed mean effective pressure advances more rapidly, in proportion, than that of the boiler, becoming 80 per cent. of the same at 200 lbs. and dropping to 73½ per cent. at 150 lbs.

All the compounds on the Midland are of the three-cylinder type, and one that is somewhat heavier though possessed of the same general characteristics as No. 2,632 is shown in the reproduction of the photograph of No. 1,000. This engine weighs 3,024 lbs. more than the other, of which 2,128 lbs. are upon the driving wheels. This increase of adhesion, brought about by the increase of weight, is met by a raising of the steam pressure from 195 lbs. to 220 lbs. The tanks are of the same capacity, though that used on No. 1,000 is the heavier of the two. In the tractive power calculated for these two engines the effect of the fixed reduction for the mean effective pressure becomes apparent, for though the cylinders remain the same the difference in the steam pressure causes a rise of 26 per cent. in the tabulated tractive power, although the actual increase of boiler pressure is less than 13 per cent. This tractive power, it will be remembered, is deduced from indicator cards. In general appearance there is but little difference between the two engines, though there is in the arrangement of the details, as will be seen by a comparison of the engravings.

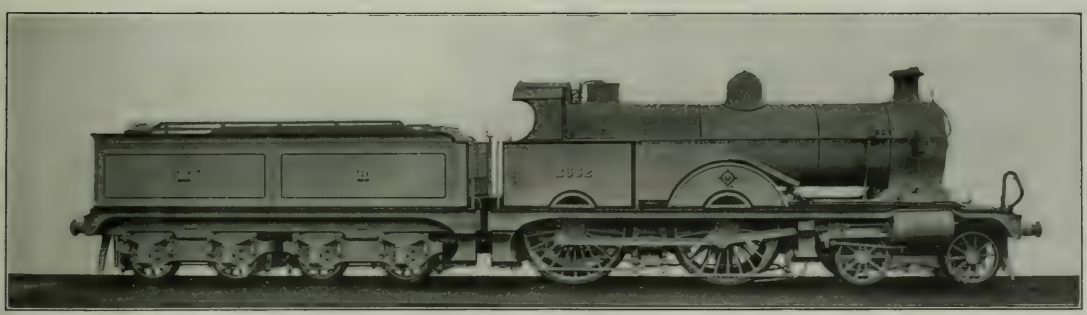
The fourth engine shown (No. 2,736) is a six-coupled goods engine, and, in one way serves as an example of the persistence of a type. In the United States a road engine without a truck is almost unheard of, and it is only in recent years that a pony truck has been considered altogether safe for high speeds, and yet it would be difficult to produce an authenticated instance of a derailment of an engine due solely to the absence of a truck. It will be noticed that, in this English engine, the wheels are placed well to the front and rear, with a long wheel base of 16 ft. 6 in. This arrangement is possible with inside cylinders and would be quite out of the question were they to be upon the outside. With the long wheel base and the reduction of the overhang that is characteristic of American locomotives, the tendency of the machine to teeter or gallop is reduced to a minimum and the liability to



Inside Connected 6-Coupled Goods Locomotive; Midland Railway.



Three Cylinder Compound Express Locomotive; Midland Railway.



Three Cylinder Compound Express Passenger Locomotive; Midland Railway.



Inside Connected Express Passenger Locomotive; Midland Railway.

derailment cut down accordingly. So that it would seem that the danger arising from the absence of a truck is not due so much to that absence as it is to the location of the other wheels.

This engine, like the other simple engine illustrated (No. 845) has inside cylinders, and is possessed of the same general characteristics. A comparison of the weights upon drivers of all of these engines shows a variation between those of the same engine due to the lack of equalization. Take, for example, the 4-4-0 passenger engine No. 845. The weight on the front drivers empty is 38,528 lbs. and that on the rear is 34,664 lbs. These are increased to 41,356 lbs. and 37,968 lbs. respectively when the boilers are filled with water, showing an increase of 2,828 lbs. for the front and 3,304 lbs. for the rear wheels, the greater increase on the latter being due to their location beneath the firebox. This variation in the load and the lack of distribution of blows that are received in running over inequalities of the track must put an excessive stress at times upon the springs of the wheels that are required to momentarily sustain it.

The amount of this variation in the static load on the drivers of the four engines under consideration is shown in the following table:

Engine No.		Weight on drivers—Front.	Intermediate.	Rear.
845	Empty	38,528 lbs.	.....	34,664 lbs.
845	Working order	41,356 "	.....	37,968 "
2632	Empty	40,740 "	.....	38,080 "
2632	Working order	43,680 "	.....	41,776 "
1000	Empty	40,432 "	.....	40,768 "
1000	Working order	43,792 "	.....	43,792 "
2736	Empty	27,132 "	34,244 lbs.	26,964 "
2736	Working order	30,856 "	37,856 "	29,428 "

This variation is here especially noticeable in the case of the six-coupled goods locomotive where there is a difference of 8,428 lbs. in the weights on the main and rear drivers, a difference many times greater than that existing between the two trucks of the Baltimore & Ohio Mallet compound.

A resume of the principal dimensions of these Midland engines is given in the following table:

	Engines—No. 845.	No. 2632.	No. 1000.	No. 2736.
H. p. cylinder, diameter	19½ in.	19 in.	19 in.	18 in.
L. p. cylinder, diameter	.....	21 in.	21 in.	.....
Ratio, h.p. to l.p. cylinders	.....	2.56	2.56	.....
Piston stroke	26 in.	26 in.	26 in.	26 in.
Steam pressure	180 lbs.	195 lbs.	220 lbs.	175 lbs.
Heating surface, tubes	1,383 sq. ft.	1,448 sq. ft.	1,305.5 sq. ft.	1,302.9 sq. ft.
" " firebox	145 "	150 "	152.8 "	125.0 "
" " total	1,528 "	1,598 "	1,458.3 "	1,427.9 "
Grate area	25 "	26 "	28.4 "	21.1 "
Weight, empty	108,416 lbs.	120,400 lbs.	124,096 lbs.	88,340 lbs.
" loaded	118,496 "	131,040 "	133,952 "	98,140 "
" on drivers, empty	73,192 "	78,820 "	81,200 "	88,340 "
" on drivers, loaded	79,324 "	85,456 "	87,584 "	98,140 "
" eng. & tendr, light	157,248 "	188,048 "	176,288 "	134,260 "
" eng. & tndr, loaded	211,252 "	248,640 "	230,048 "	181,500 "
Tank capacity, water	3,500 gals.	4,500 gals.	3,500 gals.	3,500 gals.
Tank capacity, coal	4 tons.	5 tons.	7 tons.	4 tons.
Wheel base, rigid	9 ft. 6 in.	9 ft. 6 in.	9 ft. 6 in.	16 ft. 0 in.
" " total	23 " 5½ "	24 " 3 "	24 " 3 "	16 " 0 "
" " eng. & tendr.	46 " 0¼ "	51 " 8⅜ "	48 " 3¼ "	38 " 3¼ "
Total length, eng. & tendr.	54 " 11 "	60 " 10 "	57 " 2 "	50 " 3½ "
Tractive power:				
Per indicator	17,069 lbs.	19,040 lbs.	24,035 lbs.	18,032 lbs.
Midland formula	17,087 "	18,780 "	23,542 "	18,049 "
U. S. formula	18,674 "	20,983 "	24,491 "	19,888 "
Wheels, diameter, truck	39½ in.	42½ in.	42½ in.	.....
" " driving	81 "	84 "	84 "	63 in.
" " tender	51 "	42 "	51 "	51 "
Weight on drivers / Tractive effort*	4.25	4.25	3.59	4.94
Total weight / Tractive effort	6.35	6.52	5.49	4.94
Tractive eff. x diam. drvrs / Heating surface	989.85	1,055.68	1,405.53	877.48
Heating surface / Grate area	61.20	61.45	51.35	67.67
Firebox heating surface / Total heating surface	0.095	0.094	0.105	0.087
Weight on drivers / Heating surface	51.91	53.48	60.06	68.73
Total weight / Heating surface	77.48	82.00	91.86	.....

*The figures used for tractive effort in all succeeding ratings are by the U. S. formula, and weights are loaded weights.

April Railroad Law.

The following abstracts cover cases in railroad law decided by the Federal courts in April:

When interstate rates are established.—Rates are established when a schedule thereof is filed by the carrier with the Interstate Commerce Commission and copies are furnished by the railroad company to its freight offices, although the rates are not "posted." The provision requiring "posting" does not make this a condition precedent to the establishment of the rate. Its object is to afford special facilities to the public for ascertaining the rates in force. Texas & Pacific vs. Cisco Oil Mill, 27 Sup. Ct. 358.

Interstate shipments.—The bare intention of the owner of an interstate shipment of a car from the original terminal point to another point in the same state over the line of a connecting carrier does not make this later transportation interstate, and as such beyond the control of the railroad commission of the state in which this transportation occurs. Gulf, Colorado & Santa Fe vs. Texas, 27 Sup. Ct. 361.

Invitation to alight.—The simple announcement of the next station by a porter on a train, though made on the near approach to the station, is not an invitation to a passenger to leave his seat and attempt to alight before the train actually stops. Where this is done and an injury results the passenger is barred of a recovery against the railroad company by reason of his contributory negligence. Illinois Central vs. Warren, 149 Fed. Rep. 658.

Inequality in taxation.—State taxes will not be enjoined by the Federal courts on the ground of discrimination because of undervaluation of the other taxable property of the state unless the inequality is shown to be the result of a scheme or agreement among the taxing officers. Chicago, Burlington & Quincy Railway Co. vs. Babcock, 27 Sup. Ct. Rep. 326.

Consideration for limitation of liability.—A clause in a bill of lading exempting a carrier of goods from liability for loss by fire is valid though no concession in the rate was granted the shipper and no option was given him to receive any other form of bill of lading. Arthur vs. Texas & Pacific, 27 Sup. Ct. Rep. 338.

Shipper's right to relief from excessive rates in state courts.—A shipper cannot immediately invoke the aid of a state court to obtain relief from an unreasonable freight rate on an interstate rate where the rate complained of has been filed with the Interstate Commerce Commission and promulgated as provided by law. Until changed as provided by the act it is the duty of the carrier to enforce the rate against the shipper. The only wrongs that can be righted by any independent action or suit are those that cannot be corrected by the commission in the method and under the procedure laid down in the statute. Texas & Pacific vs. Abilene Cotton Oil Co., 27 Sup. Ct. Rep. 350.

Foreclosure of mortgage.—A strict compliance with the provision of a railroad mortgage requiring a request to the trustee by the holders of a majority in amount of the bonds secured and tender of indemnity against liability for costs as a condition to the suit for foreclosure is not required where it appears that a compliance is impossible and the trustee is antagonistic to the foreclosure by reason of interest in a second mortgage. Cochran vs. Pittsburg, Shawmut & Northern, 150 Fed. Rep. 682.

Consolidation or merger.—The Circuit Court of South Carolina in a case involving the status of the Atlantic Coast Line Railroad Company points out that there is a marked distinction between a consolidation and a merger of the two railroad companies. It is this: in a consolidation both companies go out of existence as separate corporations and a new corporation is created which takes their place and property. In the case of a merger, however, one company loses its identity by absorption in the other which remains in existence and succeeds to its property and issues its own stock to the stockholders of the merged company. Lee vs. Atlantic Coast Line Railroad Company, 150 Fed. Rep. 775.

Right to enjoin scalping.—The Circuit Court for the Northern district of Illinois holds that a railroad company has a present property interest in the right to issue special non-transferable tickets and have them maintained as non-transferable, whether such tickets are already issued or are to be issued from time to time in the future as its business or the needs of the public may require. Having this interest it may protect it by the use of the writ of injunction against scalpers, since the company is without an adequate legal remedy. Pennsylvania Railroad Co. vs. Bay, 150 Fed. Rep. 770.

Automatic couplers.—A shovel car is a car within the meaning of the Federal statute requiring cars used in moving interstate traffic to be equipped with automatic couplers. Schlemmer vs. Buffalo, Rochester & Pittsburg, 27 Sup. Ct. Rep. 407.

Indictment for giving rebates.—The offense of granting a rebate is sufficiently covered by an averment in the indictment that the defendant railroad company received the legal rate and granted and paid to the shipper a certain rebate or concession whereby it transported the property shipped at less than the legal rate. It is unnecessary to allege a prior agreement for the rebate. United States vs. Chicago, St. Paul, Minneapolis & Omaha, Sup. Ct. Rep. 84. Rep. 84.

Right of alien to sue for death.—In a case involving the right of an alien to recover for the death of a relative in a railroad accident the Circuit Court of Pennsylvania holds that the statute giving the right of action—and it is a purely statutory right—does not confer the right on a non-resident alien. Zeiger vs. Pennsylvania Railroad Co., 151 Fed. Rep. 348.

The Paris, Lyons & Mediterranean Railroad is to renew the track on its lines of heaviest traffic with rails weighing 94 lbs. a yard, and with cross-ties nearer together than heretofore.

Track Deformations and Their Prevention.*†

BY G. CUENOT,
Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway.

XI.

METHODS FOR REMEDYING TRACK DEFORMATION.

After having studied the principal deformations to which the track is submitted, it is proper to summarize the causes which have produced them and to search for methods to remedy them.

We have seen that the deformations consist of the creeping of the track, the reduction in gage of the track, or its spreading, the compression of the supports, the extraction of the screw spikes, which contributes to the vertical deformation of the rails, and finally of the shock, which is produced right at the joint, and which renders the latter the worst point in the track. We have set aside in this enumeration, which is not necessarily complete, the sliding of the track, which is exercised in a peculiar manner, and has no relation with the deformations in question. The latter, as also those we have pointed out, are due to two principal causes: the flexure of the tie and the longitudinal movement of the track, this last movement being itself a function of the flexure. Recapitulating, it is, therefore, the reduction of the effect of these two causes to which all specialists should bend their efforts. But, before examining in detail the proper means for diminishing the importance of this effect, it is necessary to give an account of the manner in which the tie rests on the ballast, because its position in the ballast ought to fix the tamped bed which should be made, and the length to give to it.

DEFORMATION OF THE ROADBED.

It follows from numerous statements which we have worked out that the tie, however well tamped it may be, and of whatever length, gives, at the end of a certain time after the passage of trains, the same form of flexure to the ballast which it experiences (see Figs. 30, 31 and 32). This flexure we have made known above; it is either, if the tie is long (more than 7.54 ft.), a concave curve with light swelling in the center, or else, if the tie is short (less than 6.88 ft.), a convex curve. This deformation of the ballast is not, as has been thought, an elastic deformation, but entirely permanent, which remains when the cause which produced it has ceased.

The ballast, in spite of all contrary appearances, is not elastic; it subsides successively and little by little under the passage of vehicles. This subsidence is variable according to the nature of the ballast and the state of the subsoil, and amounts to 1.18 or 1.57 in. when it is a question of gravel and a subgrade capable of deformation (embankment and cut argillaceous), and some millimeters only, when the ballast is composed of broken stone, and when the subgrade resists more completely. Thus it would seem that the track ought to descend, and by appreciable quantities; it is not so, happily, and at the end of a certain time a sort of equilibrium is produced; the tie becomes suspended above the ballast when it is not submitted to any load; it reposes on its extremities, whatever may be the care used in the tamping, and inflects in the void existing between the upper part of the ballast and its lower face, a void which arises from the subsidence of the support under the load. This observation, which I have made many times, and which is of great importance, as we shall see further along, has likewise been registered by Mr. Coüard (paper of July, 1897, on the vertical deformation of rails). One reads, in fact, on page 36 of this interesting article, the following conclusion of the causes of the vertical deformation of rails. "It is necessary to conclude that the ties fixed to the rail rest on certain points suspended above the ballast, and that right at the rail there are formed under the ties, even the best tamped, depressions in the ballast, on the edges of which the tie is supported; under the passage of a wheel even lightly loaded, the ties make contact with the ballast and inflect to the bottom of the depressions; from this moment only the increase of the bending is proportional to the load."

POSITION OF THE TIE IN THE TRACK.

The tie thus takes an appreciable flexure, which produces the dislocation of the joint and the deformation of the rail, and this flexure is due, in the ordinary case, to its excessive length, and to the unequal distribution of the pressure on the ballast, which is a consequence of it. The elasticity, which it is believed should be attributed to the ballast, and which is so construed from the fact that the tie returns nearly to the place which it occupied before the passage of the load, depends upon the bent tie itself and on the reaction of the roadbed. It is possible that the tie does not always rest on its extremities, but that it is supported on its central part, which is the case with center bound ties; that is to say with those which oscillate about their center, and which render the track unstable; this is produced when the tie meets a resistance at its center superior to that at its extremities, which is due either to the inequalities in the roadbed, or to the shocks arising from the vertical deformation of the rails, which unwedge the tie and remove the extremities from support.

The way ballast behaves under pressure leads to consequences which should be fully understood, and which explain the poor stability of certain tracks. Long ties have often been preferred because they could be shifted endwise and re-employed after adzing; that is a very bad practice, which it is necessary to abandon definitely. The ties rest, as has been seen, on their extremities; the longest by reason of their flexure on the one hand, and by the unequal distribution of the load on the ballast on the other are situated at a higher level than that of the shorter ties, when, after the passage of vehicles, they have returned to their initial position. For the compression of ballast is as much greater as the point considered is brought nearer to the point of application of the load, in the particular case of the rail. This explains why ties of unequal length succeeding each other in the track are of different heights, and produce a track in the form of a mountain, with high points and low points. The track becomes jolty; the rails present inequalities prejudicial to their good stability, and that effect is the more sensible the greater the speed.

But the same principle does not hold with ties of different cross sections. Under the load they descend unequally in the track, but these inequalities should be restricted in comparison with the first, because the longitudinal deformation of the tie is greater than its sinking. From a long tie resting suspended on its extremities, it follows that, in the experiments which we have made, the wood ties ought to be found, after the passage of a certain number of trains, at a higher level than that of the composite ties. This circumstance, which is perfectly explained, has nothing mischievous in it, since the whole track is displaced parallel to itself. But inequalities may occur at the passage from the composite ties to the ordinary ties.

EFFECT OF CLIMATIC VARIATIONS ON THE TIE.

The fact that the ties rest on the end, as has been proved, is also confirmed by the manner in which they behave on a very wet subsoil, or, on the contrary, on a very dry support. When the roadbed is argillaceous, it is known that it rapidly becomes muddy; the water is arrested on its surface and rises, especially in the central part, with the mud which it induces. The ballast becomes dirty, and the tie pumps because it rests on a muddy bed, which has, little by little, replaced the ballast buried in the roadbed. One of the methods for arresting this movement and this pumping consists in the establishment of walls at the extremities of the ties; the central part of the track is thus consolidated, the water remains in its interior, but the tie no longer pumps, because it is carried on a firmer soil, and because it no longer has the tendency to be supported on the less solid part, in consequence of its greater flexure. This method amounts to diminishing its length by increasing the points of support.

In the same way, when the variations of temperature are produced, the loaded tie modifies of itself its bed. When the ballast and the roadbed are very wet it spreads and assumes a longer bed; on the contrary, when the support becomes dry, the tie rises, so to speak, above its original axis. It takes a smaller bed, inferior to that which its length would permit.

This arises from the manner in which the load is distributed over a given surface, and the fact pointed out is the particular explanation of a more general law. The zone of influence of a load is of much greater extent, as the surface submitted to that influence is more capable of deformation. It is, consequently, of small extent when the support is rigid, and extends further when the latter is flexible. The disadvantage of these variations, for the subject which now occupies us, is that the flexure of ties increases with the deformation of the support; in order to do well it would then be necessary to eliminate the hygrometric and spongy ballast, and consolidate the roadbeds susceptible of notable deformation.

Recapitulating, it can be said that the tie, such as actually exists, is an elastic material resting on a support subject to deformation (the ballast), very little elastic (the roadbed). Its slight rigidity causes it not to rest on its whole length, and to distribute unequally the pressure on its support, the parts nearest to the load being submitted to a severer compression, that is to say, to a greater deformation. This deformation subsists by reason of the feeble elasticity of the roadbed, and at the end of a short time the tie rests on its extremities; it is a well understood question of a tie well tamped at the moment of laying, and established upon a roadbed of uniform resistance.

TAMPING.

Here naturally arises the problem of tamping the tie; on that question engineers are divided, because they have not perhaps analyzed in a sufficient manner the given data of the problem. How many times have I heard asked of the heads of sections the length which they desired, in order to make the track solid? And how many different replies have I heard, to the effect that the problem appeared unsolvable, so that each section foreman was allowed to make his own rules!

As a matter of fact, this does not make any trouble under actual

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†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.

condition; all the tamped beds, whatever they be, lead to the same result; the tie always rests on its extremities. It is necessary, however, to guard against a tamped bed over the whole length of the tie, because it might cause its unwedging and make it center bound.

But the actual situation can be remedied, and in a general manner; it is not necessary to seek the length of the tamped bed for a tie whatever it be, that is to say the length of its bed intended to distribute the pressure as uniformly as possible over the ballast, and to prevent consequently its deformation, but—what is quite a different matter—the length of the tie should be studied, in order that it may undergo the least flexure. The first problem, such as is proposed, is unsolvable; the second, we have seen, offers a very clear and very precise solution. The length of the tie of least flexure being determined by experiment, nothing is more simple than to ascertain the best length for the tamped bed. Thus it has been found that the tie ought to have a length between 7.05 ft. and 7.22 ft.; the tamped bed will have a total length equal to twice the breech of the tie. The whole is symmetrical in comparison with the load, and consequently the pressure will be distributed nearly uniformly over the support. It would be mischievous to extend the tamped bed on the side of the center, because the tie would be deformed in an unequal manner, as we have seen.

LENGTH OF TIE OF LEAST FLEXURE.

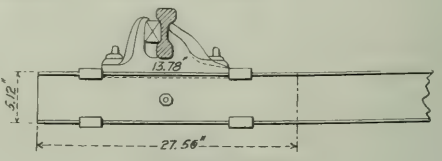
An objection can be put forth against the shortening of the tie on account of the obligation to avoid the cracks which are produced at the extremities in consequence of the introduction of the screw spikes. This useless length, it has been said, is a necessary evil; I do not think so, for, if the theory of the tie of least flexure is admitted as exact, nothing prevents consolidating the extremities with a special shoe, or a screw spike, as is done by certain French companies, the Eastern, for example.

But that is not all, and if it is desired to reduce the deformation to its minimum, which is necessary in order to allow an increase of speed, it is also necessary to have recourse to the measure extolled since 1897 by Mr. Coüard. That is to say, it is necessary to give to the tie the highest possible moment of resistance: that

COMPOSITE TIES.

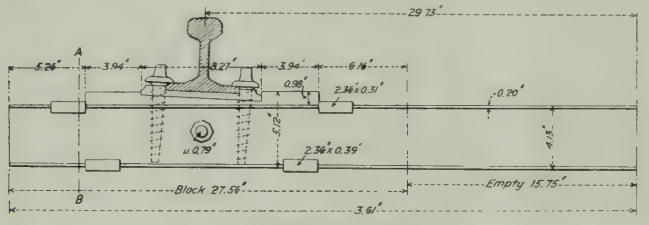
The experimental composite tie, which has behaved in an absolutely satisfactory manner, is not perhaps the only model of this kind which could be conceived. Made with a metallic skeleton, which gives to it a great rigidity, which is to be desired, containing two wooden blocks, on which the fastening is made, and which distribute the pressure on the roadbed, it presents all the advantages which one could wish: rigidity and simplicity. No rivets, no bolts; the compression of the two materials is obtained by clamping the skeleton by means of metallic cross bars. It is true that the price of such a tie is high, and that it could not be commonly employed; on tracks of much traffic this objection would not have great value. The security of traffic, the economy of maintenance by the reduction of deformation remain to be put in the balance with a higher cost price.

But one of the inventors, Mr. Michel, understood how well founded this objection could be for lines of less frequent traffic, and has designed another type of tie, constituted with the same materials, wood and steel, but formed of more simple elements. The metallic parts are formed of two pieces of channel iron, containing between them two wooden blocks in the form of a parallelopiped. The assemblage is made by means of four cross bars per block. The new model allows the realization of a series of types of resistance, diverse and, consequently, of variable price, according to the resistance. (Figs. 33, 34 and 35.)



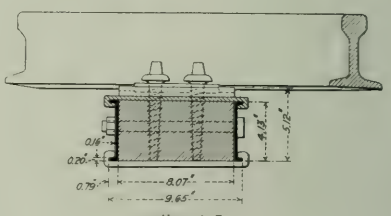
Track with Double Head.

Fig. 34.



Half Elevation (U Iron) Composite Tie. Michel System.

Fig. 33.



Section A-B.

Fig. 35.

of the wood tie, brought to the standard of the steel, is only 36, while that of the composite tie reaches 87, and is never less than 60.

The experiments which we have made naturally condemn all steel ties in the form of a trough; for, on the one hand, their resisting moment, less than that of the wood ties (30) is too weak, and on the other hand, the tamped bed is almost impossible to make, even with reduced dimensions which would lead to a less deformation. The moment of resistance could only be increased in two ways, and neither is practically capable of realization; it would be necessary either to increase the thickness of the metal, and then the tie, already too costly, would have a prohibitive price, or else it would be necessary to increase its depth, and the inconvenience of a bad tamped bed would be still more noticeable. Ties in the form of a trough should, therefore, be abandoned, and their general use would be an error, which would be regretted in the future. I am not referring to the reduction in gage of the track produced in consequence of the permanent flexure by the tie, nor of the fastenings, which certainly constitute a weak point, but confine myself simply to the defect of rigidity of this type, and to the difficulty of tamping.

The reduction of the flexure of ties is actually a necessity; it will correspond also to a reduction in the longitudinal movement, and will diminish the deformations which we have pointed out. The study which I have made with composite ties compared with ordinary ties confirms this view. The transverse flexure is diminished at the same time as the longitudinal movement, which produces the disorganization of the splices. These facts do not require explanation; it is certain that the increase of the bending moment ought to lead to a less deformation of the track, and that experiment has confirmed what theory has presaged for a long time. It has also been possible to establish, thanks to the composite tie, that there was a length of tie of which the deformation was minimum, and that the more general problem of the zone of influence of a load resting across a support on a material capable of deformation has been set forth.

The tie thus made presents the same advantages as the first one experimented with, rigidity and facility for compactness of the attachment, but it does not rest absolutely on the same principles. The squeezing was obtained, at least in the first conception of the inventors, by the rising of the wedge; in this case, on the contrary, it becomes perfect, as soon as the beam is formed, because the cross bars make the elements, wood and steel, which compose it, act jointly. This tie is not open to the charge that it has the grave defect of comprising a great number of pieces, for it is an armored beam, which only exists after the assemblage is effectuated. It would be possible to make the same criticism of an armored cement beam, or, indeed, even against a compound beam; both are created only when their elements are reunited. The tie in question is definitely an armored wooden beam.

The assemblage can be made with the perfection and solidity which it is proposed to have for it, as was shown in experiments undertaken at the laboratory of the Ecole des Ponts et Chaussées. The tie submitted to the test was composed of two pieces of channel iron, 5.51 in. deep, 0.20 in. thickness of web and 11.42 in. width of flange, bound together with cross bars of 2.36 in. by 3.94 in. Each of the oak blocks creosoted, at least superficially, was 27.56 in. long, 5.51 in. deep and 8.27 in. wide. The assemblage of the elements was made by placing the girdle constituted of channel iron against the wood, and by introducing the cross bars between the flanges of the channels by force. This procedure of squeezing was primitive, since it was arranged only by primitive means.

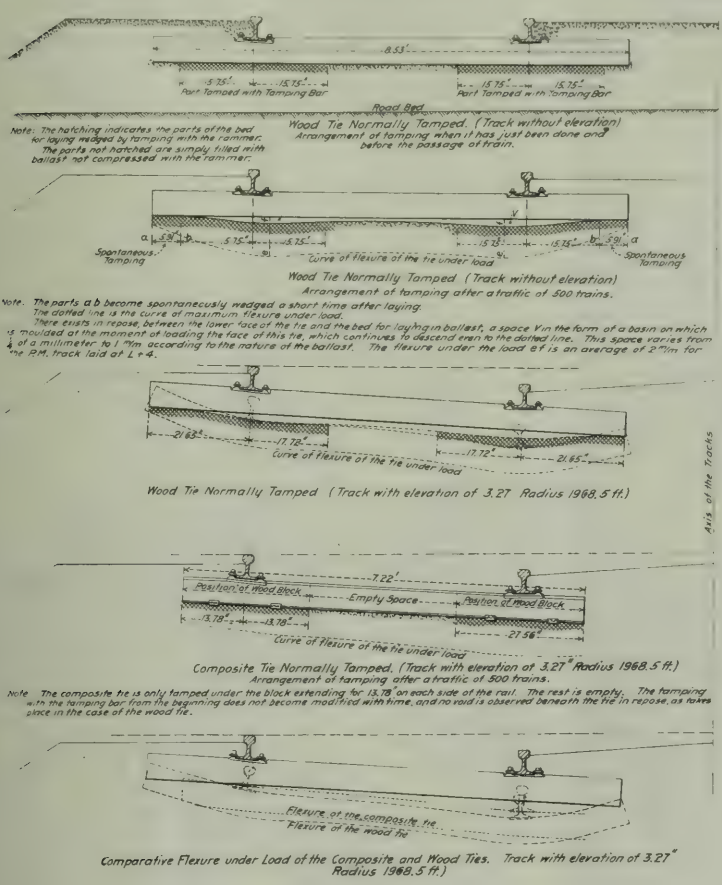
Nevertheless, it was sufficient, since the sliding of the piece of wood along the metallic body required a force of 8.8 net tons. The pressure obtained under the action of four clamps being 13.2 net tons, the coefficient of friction of wood against the iron was 0.3. The dislocation of such a beam is therefore not to be feared, and it is well to remark that under a similar force the wood tie would be either broken or near breaking, and that the steel tie would be on the point of bending (flexure of 0.91 in.).

But the assemblage can be assured by a methodical pressure,

and the above limit may be exceeded, if necessary. The pieces to be united will be placed under a press, and the heated cross bars will be introduced between the flanges of the channels; there will thus be realized, if it is desired, a total pressure of 39.6 net tons, which supposes a tension of 9.9 net tons per cross bar. Each of them having a section of 0.93 sq. in. would not be stressed to more than 21,334 lbs. per sq. in., which is acceptable. As to the wood, it would only be stressed to 526 lbs. per sq. in., about one-tenth of the breaking load.

It may be asked if the pressure, being obtained, will be maintained in spite of the effects of variations of temperature. I cannot cite experiments with figures for support; however, I will cite the first ties, which, placed in the track for four years, and submitted in consequence to all the temperature changes, have behaved well with a total pressure less than that which has since been realized. No yielding has been produced, and the central wedge could never be raised, except for a few millimeters. The proof has then been made experimentally that yielding is not possible under the conditions of test; but I do not wish to limit myself to this demonstration, and I am having executed at this moment a set of experiments relative to the effect of temperature variations on the clamping of beams made like the ties.

There is another point which I am having studied at the same time, and which deserves special mention. It is the hardening of the material by the effect of compression, a hardening which will diminish the sinking of the rail in its support, and consequently the deformation of the track and the stress on the fastenings. It is a general law; the compression of the material gives a resistance to it which it has not in a natural state. Mr. Considère, in a note inserted in the *Annales des Ponts et Chaussées* (second quarter of 1904), has shown that the resistance of cement was increased in the proportion of 1 to 6. The same fact should exist with wood; it is fitting to establish it, and to show every advantage which can be derived from it. It is probable that, thanks to this hardening, the fastenings will present a greater resistance and that they can be submitted to greater forces.



Figs. 30, 31 and 32.

The best wood, whether for ordinary ties or of blocks for composite ties, is heart oak. It is not necessary to creosote it; it is sufficient to use a coat of tar and lime to protect its upper face from the action of inclement weather. The experiment made on the tracks on the line from Mouchard to Bourg produced excellent results; it demonstrated that this treatment was successful in maintaining ties which would have been rejected with brief delay without the preservative. The latter does not prevent, at the end or on the sides, the slow and progressive seasoning of the tie.

The tie may also be seasoned by floating it for five or six months to eliminate elements of decay, but this process is long, and not very practicable because of the long drying subsequently required. If the oak contains sap, which is unfortunately very common, the floating can serve to preserve the beam; but creosoting is a disadvantage rather than an advantage. The sap alone absorbs the creosote in a sensible manner, and after the injection forms an impenetrable envelope, under the protection of which the sap, not being able to evaporate, enters into fermentation and attacks the wood. It is undoubtedly better not to creosote sap oak.

The same thing does not hold true for pine, spruce or beech. These woods season rapidly and are capable of absorbing a quantity of creosote sufficient to render antiseptic the small amount of sap which still remains after seasoning (about 20 per cent.). But it is necessary to creosote to refusal, which requires the employment of at least 55 lbs. of antiseptic liquid for a tie of 8.53 ft.; under these conditions the sap is, so to speak, surrounded by creosote, and any fermentation is impossible. With a smaller dose, the sap not being given immunity, enters into fermentation, and decay commences; this has been observed when the amount of creosote is reduced to 35½ lbs.

Besides these methods of preservation of ties, attention should be directed to the covering of their upper part by ballast, the employment of plates which protect the seat of the fastenings, and consequently the fastenings themselves. Perhaps it would be well, in the case of secondary companies, where the ties often perish by the fastenings and the decay of their sockets, to place in default of a plate, a hoop-iron shim, whose only purpose would be to cover the seat of the fastenings. On the P. L. M., notably, where a plate is employed, the decay of ties is scarcely produced, except in the central part. The fastenings are still good, except when they have undergone excessive turning, and then the tie ought to be rejected. This is not true on lines where the rail rests directly on the tie, and where the fastenings are absolutely uncovered; rust attacks the screw spike and the wood which surrounds it. The fastening becomes bad before the tie has become unfit for usage. From that arises the necessity for having recourse to a method for consolidation of the fastenings, which is not generally necessary on tracks provided with plates. It is the same in the case of the ties laid with even joints, for those of the following end, notably, often perish at their fastenings by reason of the hammering which they support at the joint. The wood in which the screw spike is engaged is torn, and the piece should be rejected. It holds that at the end of a certain time this piece is left in the air; the fastenings support the weight of the beam and finish by tearing the wood.

(To be continued.)

Hand Brakes and Their Use on Steep Grades.*

The committee finds that a large percentage of cars in service have inefficient hand-brakes. The percentage of brake power is too low, the construction is faulty and cars are not kept in repair. In mountain grade service hand-brakes are used a good deal, but where trainmen have to work fast, they do not set the brakes tight enough; they ought to allow a little time so the lost motion in the trucks can be taken up. The Interstate Commerce Commission, in its annual report, has referred to the neglected condition of hand-brakes, which is increasing since the general introduction of air-brakes. The percentage of hand-brake power on freight cars having

*Abstract of committee report to the Air Brake Association, at its annual convention, Columbus, Ohio, May 14; Mark Purcell, Chairman.

10-in. brake cylinders, and on all heavy passenger cars, should be at least 40 per cent. of the light weight of the car. The levers should be such that the hand-brakes will work in harmony with the air-brakes. In tests made with an air-brake instruction car on a mountain grade, when running at 50 miles an hour, it was found that the speed rose, after the brakeman began to apply the hand-brake, to 55 miles an hour, before the speed began to lessen; a fact indicating that when it is necessary to apply hand-brakes on a grade very prompt action should be taken. Testing with one car on a 2.2 per cent. grade, with a brake power of 27 per cent. of the weight of the car, the distance required to stop from a speed of 12 miles an hour was 1,200 ft.; from 40 miles an hour, 5,280 ft.; from 50 miles an hour, with 37.5 per cent. brake power, 3,600 ft. In these tests the pull on the hand-brake chain was 1,000 lbs., as shown by dynamometer tests. A train of a number of cars would not show so good results as this, as, in this case, force was applied to the brake wheel at frequent intervals throughout the stop.

Many passenger-car trains are found with hand-brakes which do not work in harmony with the air-brakes. In case it is desired to leave a train standing on a grade this is a dangerous condition. With such cars, to be safe, the air-brake should be bled while the hand-brakes are being set. With vestibule cars the old-fashioned brake wheel cannot be used, and a lever is necessary. The best type of lever is about 24 in. long and similar to the Lindstrum design.

Considering freight trains more in detail, the committee finds that on the average train with 8-in. air-brake cylinders the hand-brake power is about 11 per cent., which may be increased to 22 per cent. by using a club (length not stated), which, it is estimated, will double the power exerted by the brakeman. Even with the use of a club the hand-brake power on loaded cars with 10-in. air cylinders is only about 15 per cent. With 10-in. cylinders the rate of leverage for the hand-brake is reduced; hence it will be found that after 10-in. cylinders come into general use, the average hand-brake power available will decrease, unless the hand-brake rigging is changed.

The committee concludes with a recommendation that the best means of securing a higher standard for mountain service be discussed, for it is frequently difficult to handle trains on mountain grades by means of air alone.

Compression of Steel Ingots by Wire Drawing.*

Most of the physical defects in steel have their source in the process of solidification, which takes place in the ingot mould where the molten steel is allowed to cool into solid form before forging or rolling. In the cooling process the metal is affected by three injurious forces—contraction, crystalization and liquation or segregation. Many attempts have been made to overcome these injurious effects by using various forms and materials in making ingot moulds, by subjecting the solidifying ingots to compression by the Whitworth system and by other methods of subjecting the ingot to mechanical work. Of these the Whitworth system of compression during solidification has been, until recently, on the whole, the most satisfactory. At the steel works of St. Etienne in France a new process, known as the Harmet process, has recently been tried with remarkable results. Briefly, it consists of compressing the ingot during solidification by wire drawing. A tapered ingot mould is used, smaller at the top than at the bottom, and an hydraulic plunger, forming the bottom of the ingot mould, is forced upward, compressing the solidifying steel into the contracted volume at the top of the mould.

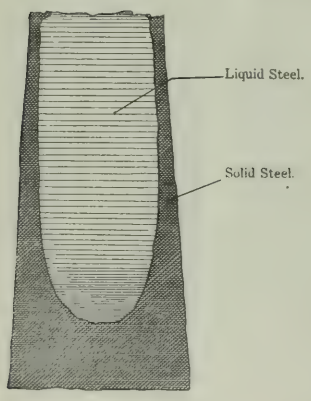


Fig. 1.



Fig. 2.

In order to clearly understand the principle of the Harmet process it is necessary to briefly explain the action of the liquid steel in solidifying, when poured into the ordinary ingot mould. The steel, at a temperature of about 2,000 deg., comes in contact with the cold walls of the mould, and immediately solidifies in a thin shell containing a mass of liquid steel in the center, as shown in Fig. 1. Almost instantly this shell shrinks and separates from immediate contact with the walls of the mould. Little by little during cooling the liquid mass in the center becomes plastic and attaches itself progressively to the thin shell first formed, adding to its thickness. In the interior is left a hollow corresponding to the volume of shrinkage. If the ingot after cooling is divided through its vertical axis (see Fig. 2) a large cavity is found in the upper part, due to the metal flowing downward by its own weight to fill up the hollows left in the lower part due to shrinkage. Besides this, a hollow space is formed in the center itself after solidification, on account of the failure of the supply of liquid metal to fill the new cavities. These defects or "pipes" are usually visible to the naked eye throughout the whole of the upper half of the ingot, and under the microscope they can often be seen in the lower half. The steel in cooling, after solidification, contracts within itself and produces stresses and oftentimes small cracks and fissures, which it is impossible to detect with the naked eye. Proper subsequent reheating and working, however, almost entirely remove these defects.

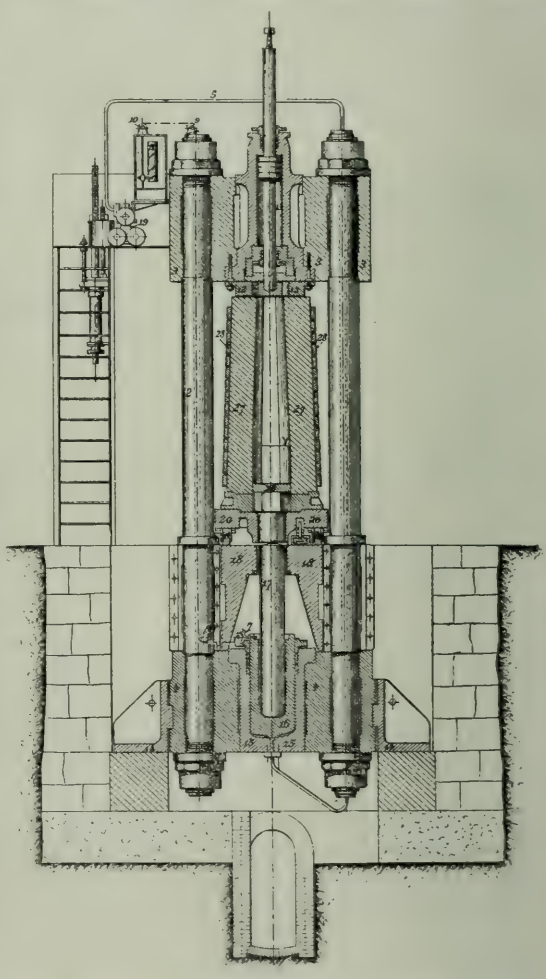


Fig. 3—Section Through Harmet Ingot Wiredrawing Machine.

The steel in solidifying crystalizes throughout its mass. These crystals have little cohesion between themselves, and when stresses, due to contraction within the metal, are set up, they offer low resistance and cracking occurs easily. The crystalization of the steel is promoted by any cause tending to delay the solidification, such

*An abstract of an article printed in the Journal of the United States Artillery, March, 1905, prepared from data furnished by Major E. L. Zalinski, U. S. A., retired, and reprinted here through the courtesy of Captain Andrew Hero, Jr., U. S. A., Editor of that journal.

as lining the upper part of the mould with refractory material, and also by the contraction of the ingot which separates from the cold wall of the mould. Except for the possibility of the development of internal cracks, due to contraction, the formation of crystals is not serious, for the structure of the steel can be much improved by subsequent annealing and forging processes.

The metalloids which enter into the composition of steel have a tendency to separate from the iron. The carbon is the most mobile, being attracted in turn towards the main fluid part of the mass, finally concentrating where solidification last takes place, that is, in the head of the ingot. Chemical analysis of an ordinary ingot will show from 10 to 20 per cent. more carbon in the head of the ingot than in the bottom and corresponding higher percentages of sulphur and phosphorous.

The combination of these three defects results in the fact that a steel, although absolutely perfect in the liquid state as regards chemical composition and quality, is, after cooling in the ingot mould, permeated with defects; the upper portion is affected with pipe, the whole mass is crystalized and seamed with cracks and torn by internal stresses, while the chemical composition is rendered irregular by segregation. The metal, in this state, is commercially useless, and mechanical treatment by rolling or forging must be relied on to correct, as far as possible, the defects which were allowed to occur during solidification. The upper end must be cropped, the cracks and fissures have to be rewelded, the internal stresses relieved and the crystalization broken up and reduced; the segregation, however, remains unaltered, and defects due to this cause can only be discovered later in tests on specimens taken after finishing the material.

The Whitworth process consists of compressing with a static pressure acting on the top of the ingot. In spite of the great pressure applied, the effect of it extends only to the exterior of the ingot, which in cooling rapidly forms a crust with the rigidity of a column and thus arrests the force applied, and protects the whole of the central part against the pressure from above. The Harmet process, as developed at St. Etienne, is designed, not so much to remedy the defects developed in the ingot as to forestall their development. We have seen that the formation of the pipe is due to the fact that the outer shell of the ingot is permanently fixed, and the subsequent shrinkage of the central mass, therefore, leaves hollows in the center. If this external shell is forced inwards on the central mass, and compelled to follow the shrinkage movement or even to close in at a rate somewhat quicker than that at which the volume diminishes, the formation of cavities and internal faults will be avoided. This is exactly the result attained by compression by wire drawing. The compression of the steel is applied to the whole surface of the ingot diminishing its volume by closing in all sides but the top on the central mass.

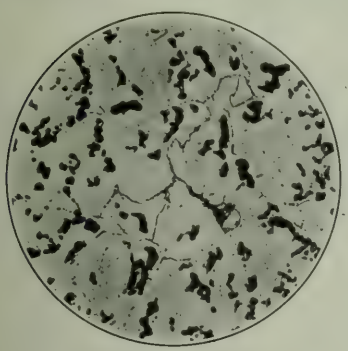


Fig. 4—Non-compressed Metal (Fissured).

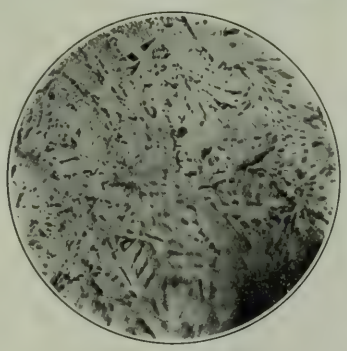


Fig. 5—Compressed Metal.

The defects, due to the formation of coarse crystals and to segregation, are due to retardation in cooling. Instantaneous solidification is, of course, impossible, and these defects cannot be completely overcome, but with the wire drawing process they can be greatly diminished for the following reasons:

(a) The ingot mould is a large mass of metal which rapidly absorbs a quantity of heat, and it is kept in constant contact with the solidifying ingot by the gradual advancement of the ingot under pressure from below.

(b) Steel contracts in passing into the solid state and pressure hastens the transition. This results in shortening the time of solidification and reduces the crystalization.

(c) Segregation is reduced because of the fact that as pressure is applied to the ingot from below the metal is forced upwards and comes in contact with the comparatively cool upper part of the mould. This tends to rapidly cool the top of the ingot and prevents segregation.

Fig. 3 shows the hydraulic compressing machine installed in the steel works at St. Etienne. The machine asserts a pressure of 1,200 tons and is suitable for compressing ingots weighing from five to six tons. It consists essentially of an upper head carrying the stripping cylinder and piston, and a lower head carrying the forging ram, the two being tied together with four large tie bolts. The car for carrying the ingot mould is made of cast-iron, and in the center is a movable plug which forms the bottom of the ingot mould. The car is run over the bottom head and securely locked in position when ready for compressing. The ingot mould is of cast-iron bound with hoops. The inner walls are straight at the bottom for about one-fourth of the height, and from there up are given a taper of 1 in 30. The upper end of the hydraulic plunger is made spherical so as to prevent the movable plug in the ingot car, which is being forced up through the mould, from tilting to one side. When the car with the mould containing the liquid steel is brought under the press, pressure is applied to the hydraulic ram, and the plug, forming the bottom of the mould, is gradually forced up into the mould. The rate of advance is slightly more rapid than the contraction of the cooling steel in order to compress the core of the ingot, but care is exercised not to allow the metal to flow over the top edge of the mould. The rate of advance of the plunger depends on the characteristics of the steel which is being handled, and is in practice determined experimentally by removing the stripping plunger and mounting a mirror at an angle of 45 deg. above the top of the ingot mould, so that the condition of the surface at the top of the ingot can be observed. The rate of advance is adjusted so as to keep the metal just even with the top of the mould, but not allowing it to overflow. This rate of advance is determined experimentally and recorded by an automatic device attached to the machine which registers the curve of plunger displacement; in subsequent workings the plunger is made to advance at a speed corresponding to the experimental curve obtained, the operator manipulating the pressure valves in such a way as to cause the indicator to exactly follow the curve already determined. The time required for compressing ingots varies with the size of the ingot. Small ingots, weighing about 120 kilograms, require at least eight minutes, and this time should be lengthened for best results to 10 minutes. Experiments showed that at the end of five or six minutes the metal was still pasty in the center, and that if the compression was stopped at that point small cavities would still be left in the center of the ingot. At the end of eight minutes solidification is complete, and if the ingot was taken to the mill immediately on leaving the press and there treated physically it would give a perfect metal. However, if it is allowed to cool further after eight minutes of compression the ingot remains solid, but severe internal stresses are set up by subsequent shrinkage. At the end of 10 minutes absolute soundness in metal is assured, but even then it is preferable to work the ingot immediately on leaving the press and before it is allowed to cool further.

The results obtained from the process may be considered under two heads, commercial and scientific. It is claimed that the cost of the process is not much greater than that of the ordinary processes, and that the saving in crop ends from ingots is more than sufficient to make up for the slightly increased cost of compression. The French government specifies that uncompressed steel ingots shall have the top 28 per cent. cropped, but accepts ingots made by the Harmet process with 5 per cent. crop ends, a saving of 23 per cent. The process not only eliminates the defects due to contraction but effects a forging of the metal in the ingot, thus reducing the subsequent work in the rolling mill or under the hammer. Test pieces cut from compressed ingots without forging or rolling showed as good results under tensile and impact tests as test pieces cut from compressed ingots of the same composition which had been forged with a reduction of two times in the cross sectional area.

The physical results from the process are even more remarkable. The compression extends throughout the whole mass and give a sound metal thoroughly homogeneous in the very center of the ingot. There is a marked diminution of segregation, the chemical analyses at the top and bottom of the ingot being substantially the same. The compressed ingot has a grain of a visibly finer structure and the large cleavages, often found in sections cut from uncompressed ingots, are not found. The photographs reproduced herewith show the relative structure of the compressed and uncompressed ingots. The minute cracks, shown in the uncompressed ingot, constitute a starting point for rupture, and the unexpected failures of steel are often due to such small defects.

The Harmet process is employed commercially on a large scale at the steel works at St. Etienne, and the results obtained are most satisfactory. The compressed metal has been used with success for armor plates, projectiles, crank shafts, etc. The Ordnance Department of the United States Army has ordered for test in this country a 10-ton ingot, which will be used in making gun forgings. The process is used at Cammels' in England and Beardmore's Works at Glasgow, where there is an installation for compressing ingots weigh-

it is from 20 to 40 tons used in making armor plates; it has also been installed by John Brown & Company. As yet it has nowhere been introduced in the United States.

Proposed New Union Station at Toronto.

The Grand Trunk and the Canadian Pacific have recently completed plans for a new union station at Toronto, Canada. It will occupy a site close to the present station on a tract of land recently acquired to permit the necessary enlargement of present facilities to be made. The present union station buildings are situated between Simcoe and York streets, south of Station street. The new tract is an irregular area bounded on the west by York street, on the north by Front street, and on the south by Esplanade street, which latter will be closed as a thoroughfare west of Yonge street. The location of the closed portion, and therefore the southerly boundary of the new tract, is indicated by the light dotted lines which form a continuation of the unclosed portion shown at the easterly side of the general layout plan, and extend somewhat



Proposed New Union Station at Toronto.

irregularly to a point just south of the junction of York and Station streets. The new tract extends east of Bay street to about the location of the proposed new street. The cost of the new station and grounds is estimated at about $2,000,000. The following description and accompanying plans were sent us by R. S. Logan, Assistant to the Second Vice-President of the Grand Trunk.

The proposed passenger station building, including baggage buildings and service plant, are to be erected on the southerly side of Front street, between York and Bay streets, and will occupy the entire frontage between these streets. The express building now existing west of York street will be retained for the express service of the Grand Trunk, and a new express building of similar dimensions and with the same general relation to the passenger building will be erected east of Bay street for the express service of the Canadian Pacific. The northerly line of the passenger buildings is to be generally 65 ft. from the southerly line of Front street, leaving a plaza of this width for carriage and foot walk purposes. The station building is generally 100 ft. wide, and between the building and the tracks there is a concourse 90 ft. wide for the general circulation of passengers.

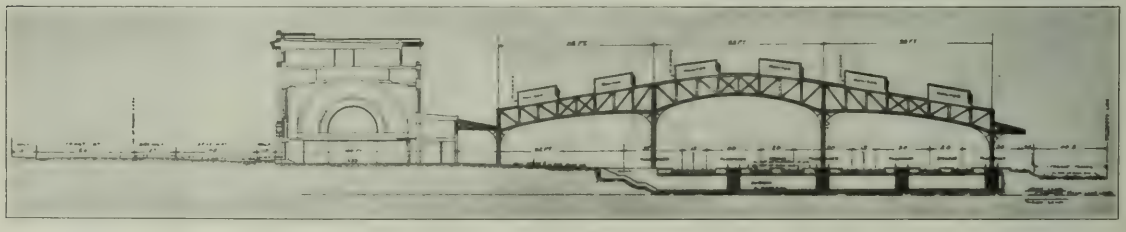
The track layout consists of nine through tracks and two stub tracks, so arranged that there are five platforms for passengers and two platforms for the exclusive trucking of baggage and express matter. The station tracks are connected up at each end with an interlocking switching system so that they properly join the four main tracks on the east and the two main tracks on the west, generally with double-track leads, to give the greatest facility to the train movements. The passenger platforms will be 1,400 ft. long, this distance being sufficient for the longest trains, though it may be increased if found necessary. They are about 20 ft. wide throughout.

The new tracks at a point opposite the center of the station will be 4 ft. higher than the present tracks, and the platforms are designed to be 8 in. above the top of the rail. This gives a difference of level of about 5 ft. between the grade of the platform and the grade of Front street, which difference is overcome by three steps at the waiting room entrance and inclined surfaces transversely on the concourse between the tracks and the station, and on the plaza between the station and Front street. None of the inclined surfaces exceed a slope of ⅜ in. per foot. The passages for exit are without any steps whatever. By this arrangement the station and platforms are, in effect, level with the street, a condition which permits of the best possible treatment of any type of a railroad station.

In order to accomplish this it has been found necessary to provide for the removal of the present York street overhead bridge and to substitute for it an overhead bridge just east of Bay street. It is also suggested that this latter bridge can be made to take care of the traffic at the Yonge street grade crossing, so that the necessity of a bridge at the latter street can be avoided. Foot bridges at any necessary point of crossing can be built without interfering with the raising of the tracks.

In order that it may not be necessary for any passenger to go upon any track at grade, and to make the station absolutely safe and fully up to modern methods and requirements, a subway 50 ft. wide is provided opposite the center of the station, so that any platform may be reached by means of easy stairways with landings. The total height of stairways for this purpose is about 10 ft. This method allows all trains to come to a stop directly opposite the center of the station, thus making the least distance for passengers to walk to and from the station and trains.

The baggage and express trucks are to be kept as much as possible on special trucking platforms, 10 ft. wide, which extend the whole length of the station and which are adjacent to four of the nine through tracks. On these four tracks it is intended that trains having the bulk of express and baggage matter will be run. The baggage and express trucks cross the track area by subways beneath the tracks and leading to the basement of the baggage and express buildings. The trucks will be raised and lowered between the subways and the platforms by means of electric elevators. There are three of these cross subways, one leading to the baggage room, one to the express building at the east end, and one to the express building at the west end of the station.

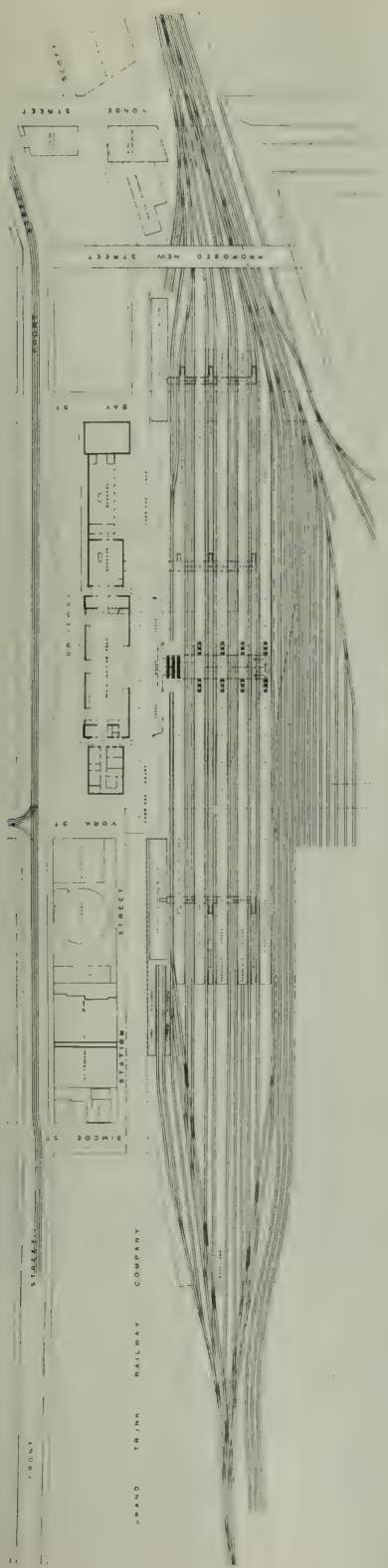


Section Through Main Waiting Room and Passenger Subway; Train Shed Construction; Toronto Union Station.

A train-shed roof will cover the main portion of the platforms and the concourse. It will be 800 ft. long by 315 ft. wide, covering about six acres. The main structure will be in three spans and there will be a connecting roof between the train shed and the station building. This roof will be a steel structure and will be lighted and ventilated.

At each end of the station concourse are spaces for a carriage court, for the accommodation of cabs, carriages and baggage transfer wagons, so that it will not be necessary to pass through the station building to get a carriage.

At the extreme easterly end of the station a service building is provided for supplying all heat, light, steam, hot water, compressed air, refrigeration, etc., for the use of the station building and trains.



Proposed General Layout; Toronto Union Station.

The general layout of the station yards and grounds, including the approach tracks, does not interfere in any way with the present freight yards of either railroad company.

The station building is planned primarily with a view to convenience and spaciousness, and consists of a main central building with two service wings. In the main building, on a level with the tracks, is located the general waiting room containing 17,242 sq. ft., which is 5,000 sq. ft. larger in area than the Grand Central Station of New York City, or the present station in Toronto. Access to the waiting room is obtained directly by three spacious openings containing nine doors each directly from the plaza, or Front street. Egress to the trains is obtained by three similar openings, containing each nine doors, leading to the concourse.

Ticket, telegraph and telephone booths, information bureau, news stands, ample parcel room and other conveniences are provided along the four sides of the waiting room, where they are easily accessible and visible.

A broad passage at the east end leads directly to the baggage room, which is located in the east service wing. The area of this room, including the basement and first floor, is 28,000 sq. ft., or 15,000 sq. ft. larger than the present baggage room, and 6,000 sq. ft. larger than the baggage room at the Grand Central Station of New York, which is one of the largest in the United States. A similar passage at the west end of the waiting room leads directly to the west service wing, in which are located waiting rooms for men and women, each provided with ample toilet accommodations, the women having in addition retiring rooms. Barber shop, boot blacks and other conveniences, together with a well-equipped, spacious lunch counter, are likewise provided in this section of the building.

Spacious passages running north and south are placed at each end of the waiting room, between the waiting room and the baggage room on the east, and between the waiting room and service wing just mentioned on the west. These passages are intended mainly for exits, so that the traveling public, in arriving, will pass through and out without crossing the waiting room. Passengers departing can enter by the east passage, check their baggage and buy their tickets without confusion or delay. Carriage courts both east and west of the main building are available for cab service. The east court is likewise available for transfer companies and baggage service.

It is especially to be noted that the main waiting room, as planned, cannot conveniently be used as a thoroughfare, which will increase its efficiency and comfort. This main waiting room extends to a height of three stories, and is lighted by 14 large windows, seven on the north and seven on the south. A gallery extends around all four sides of the room at the height of the second story of the service wings, the north gallery giving access to a series of roomy offices for the use of the employees directly in charge of the station traffic. On this floor in the west wing is a large dining room, serving rooms, kitchen and all accessories. In the east wing is a large hall for the segregation and handling of immigrants, with retiring rooms and toilet rooms for both sexes, and ample accommodations for the officers in charge of this service.

In the story extending over the entire waiting room and in the top or third story of the service wings, accommodations about 6,000 sq. ft. in excess of those existing in the present station in Toronto are provided for the general offices of both railroad companies. Two staircases, each with two elevators, are provided, one at the east and the other at the west end of the main waiting room, giving access to the galleries, offices and other service.

The architectural treatment of the exterior is designed with a view of obtaining a monumental effect in a simple, dignified and reposeful manner; of expressing clearly on the exterior the function of each part of the building on the interior. Thus, the main waiting room is clearly suggested by the large windows and the solid basement treatment, the wings indicating clearly the subordinate function which they have to perform; so likewise the baggage and service buildings. The treatment will be maintained on the interior of the building on the same lines. The style of architecture is classic, and though inspired as to detail from the fine examples of the eighteenth century, is treated so as to be distinctly modern in its expression and to clearly indicate the purpose of the building as a whole, and of each part of the building as well. It is intended to build the exterior of some light stone.

Air Brake Control on Heavy Grades of Trains Composed Exclusively of Fully Loaded 100,000 Lbs. Capacity Cars.*

This important problem has not yet been solved to the entire satisfaction of all concerned; or, if the problem has been solved, conditions have not been fully complied with. In the year 1906 and in the early part of the current year one of the large railroads set out to minimize the difficulties in handling heavy coal trains down 3 or 4 per cent. grades, and the writer was appointed a com-

*From a paper presented at the fourteenth annual convention of the Air-Brake Association, by T. L. Burton.

mittee of one to present to you the details of the results obtained in solving the problem.

The grade is 5½ miles long. The minimum grade is 173 ft., maximum 190. This grade is in the heart of the anthracite coal region, and traffic is extremely heavy. From the summit to the base the cars are dropped down by an engine and crew over a 3.4 per cent. grade in trains averaging 1,120 tons each. The yard at the summit is about one-half mile long, is small and narrow and congested. A train leaves the summit every 30 to 36 minutes (average). It has been the practice to control the speed of the trains by hand-brakes, but since the introduction of 100,000-lb. capacity cars difficulties have been encountered.

As a first means of precaution the air-brakes were coupled up upon 50 per cent. of the cars to be used in case of emergency with hand-brakes, but the results were not satisfactory. The next step was to couple up the air-brakes on all cars, the same to be used only in cases of emergency. This practice also failed to produce satisfactory results, and the brake pipe pressure was increased from 70 lbs. to 90 lbs. All engines were equipped with Westinghouse combined automatic and straight air-brakes. Rigid rules were enforced covering adjustment of piston travel on cars, but still the speed of the trains would get beyond the trainmen. While no wrecks occurred, the train could not always be stopped when desired, and accidents were averted only by having a clear track at the foot of the grade.

Owing to the heavy grade and severe conditions, the railroad officials did not feel safe in suddenly changing from the old practice of using both hand and air-brakes, unless they could first be referred to other roads on which conditions were equally severe. These officials desired to visit some place where trains of 1,100 tons, made up exclusively of 100,000-lb. capacity cars, sometimes loaded in excess of their rated capacity, were being handled down 3 to 4 per cent. grades without the assistance of hand-brakes, and a road having such conditions was looked for, but in vain. This was a surprise, especially in view of reports concerning the wonderful work of the railroads in the west.

* * * A trial trip was arranged to be made down the grade with a train of twenty 100,000-lb. capacity cars, loaded in excess of their capacity, and equipped with "K" triple valves, and with the Westinghouse Air-Brake Company's three-position (15-30 lbs.) retaining valves, the latter having been for some time standard on this road. The trial train was handled down the grade under the supervision of the writer, and under the personal observation of a number of the officials of the railroad and some visitors. The make-up of the train, condition of brakes and method of handling same were as follows: The locomotive was equipped with the Westinghouse Air-Brake Company's standard automatic brake, two 9½ in. pumps, plain triple valves on locomotive and tender, duplex pump governor, main reservoir of 73,000 cu. in. capacity, combined automatic and straight air-brake, and schedules SWA and SWB. The feed valve was adjusted to 90 lbs. brake-pipe pressure with the brake valve handle at running position, and 130 lbs. pressure with the brake valve handle on lap, or application position. The straight air-brake reducing valve and safety valves were adjusted to standard pressures of 45 and 53 lbs., respectively.

The steam pressure carried on the boiler was 155 lbs., and the weight of the locomotive and tender was 393,900 lbs.

Cars in train	20
Kind of cars	100,000 capacity, steel, coal
Average light weight, per car	41,855 lbs.
Total light weight of train	837,110 "
Average loaded weight per car	142,900 "
Total weight of train	1,429 tons or 2,858,000 "

The brake equipment was as follows:

Detached auxiliary reservoirs and cylinders, 10-in. and K-2 triple valves. Standard 15-30 lb. retaining valves, used in the 30 lb. position.

The braking power, based on 60 lbs. cylinder pressure, was as follows:

Braking power per car	35,820 lbs.
" " per train	716,560 "
" " percentage on empty cars, average	85.6
" " percentage on loaded cars, average	25.0

In making the terminal test, before starting from the summit, all brakes were examined and found to be operative. The piston travel had been adjusted in accordance with the rules of the company for this heavy service, but two or three brakes leaked off through defective retaining valve pipes.

The train was successfully handled down the severe grade as indicated below, with 5-lb. brake pipe reductions. The grade and speed of the train are as follows:

Maximum grade	190 ft. per mile, or 3.6 per cent.
Minimum grade	173 " " " 3.3 "
Average grade	175 " " " 3.4 "
Length of grade	5.5 miles
Running time of train on grade	25 mins.
Average speed of train on grade	13.2 miles per hr.

This was not only the heaviest train that ever went down the mountain, but it had by far the heaviest tonnage per car, or per brake, that had previously been considered practicable to handle with safety.

The following is an interesting comparison:

Tonnage handled with standard brake (assisted by hand brakes)	1,120
Tonnage handled with "K" valves (no hand brakes)	1,429
Increased tonnage handled per brake, "K" valves	78.75 per cent.
Time consumed on grade with standard valve, assisted by hand brakes	40 mins.
Time consumed on grade, "K" valve (no hand brakes)	25 mins.
Maximum average speed allowed with old brake	8.25 mls. pr hr.
Average speed maintained with "K" valves	13.20
Increased speed with "K" valves, over old practice	61 per cent.

While the tonnage of the test train was 27 per cent. heavier than was considered safe to handle under the old method of braking, and the speed was 61 per cent. higher, it was necessary to use steam in the locomotive cylinders through one or two curves, in order to maintain a desired minimum speed, notwithstanding that the brake pipe reductions were only five pounds. The usual practice of applying the brakes on straight lines and releasing at the entrance to curves was followed, and while on straight track and heaviest part of grade, a 12-lb. application stopped the train from the maximum speed maintained while descending the grade, in a distance of 430 ft.

The light brake pipe reductions and short time brakes were held applied, also made the locomotive and tender brake practically inoperative, thus increasing the work required of the train brakes.

The temperature of the wheels was as nearly uniform at the foot of grade as could be expected, there being a marked absence of cold, or excessively hot wheels, indicating that each brake was doing its share of work, notwithstanding that several brakes leaked off through the retaining pipe. The uniform temperature of wheels at the foot of the grade demonstrated that the retarding feature of the triple valves on the cars with defective retainer pipes performed, in part, the function of retaining valves.

The results of the tests were so thoroughly satisfactory to the railroad officials present at the test, and were considered such a decided improvement over the old method of using hand brakes in conjunction with the air-brakes, that immediate steps were taken to control the speed of the trains on the grade in the future with the air-brakes exclusively. The author of this paper is therefore of the opinion that where cars are equipped with the improved quick service, retarded release, triple valve and "three position" retaining valves, no difficulty should be experienced in successfully handling 100,000 lbs. capacity cars, fully loaded, down approximately 200-ft. grades, provided the brakes are properly maintained and the braking power is, at least, 80 per cent. to 85 per cent. of the light weight of the car.

Cost of Safety Devices on Harriman System.

The following table has been compiled in the office of J. Kruttschnitt, Director of Maintenance and Operation of the Union Pacific System and the Southern Pacific Company. It shows the expenditures for safety devices from June 30, 1898, when the present management took control, to May 1, 1907. These are divided into two groups: one, safety devices on roadway, the other, safety devices on cars and engines. The cost of roadway protection is about $1,000,000 greater. The total cost of such expenditure during this period is nearly $12,000,000. The present operated mileage of the Union Pacific System is 5,404 miles, and of the Southern Pacific Company 9,192 miles. The table of expenditures follows:

Union Pacific System and Southern Pacific Company.
Expenditures June 30, 1898, to April, 1907, for Safety Devices on Roadway, Equipment, Etc.

	Union Pacific.	Oregon Short Line.	Oregon R. & Nav.	Pacific System.	Sunset-Central.	Total.
Block signals	$1,617,109	$354,363	$430,302	$2,232,083	$825,537	$5,459,894
Distant switch signals	169,950	7,630	.....	50,900	18,552	247,032
Interlocking railroad crossings	170,000	32,032	20,845	109,550	234,983	567,410
Crossing bells and gates at highways	12,000	1,734	.....	32,300	6,755	52,789
Total, roadway expenditures	$1,969,059	$395,759	$451,147	$2,424,833	$1,085,826	$6,326,624
Automatic couplers	$270,217	$180,792	$103,403	$988,474	$420,763	$1,963,649
Air brakes and high speed attachments	527,591	137,846	206,723	1,515,001	909,028	3,296,189
Train signals	8,391	.....	.....	27,982	.....	36,373
Grab irons and hand holds	37,061	62	.....	.....	.....	37,123
Electric and acetylene headlights	32,979	10,138	10,544	87,075	32,828	173,564
Total equipment expenditures	$876,239	$328,837	$320,676	$2,618,532	$1,362,619	$5,506,896
Total, road and equipment	$2,845,298	$724,596	$771,816	$5,043,365	$2,448,445	$11,833,520

GENERAL NEWS SECTION

NOTES.

A report says that 200 Russian and 1,200 Chinese have been shipped to Mexico to work on the Cananea, Yaqui River & Pacific.

Agents of the Rock Island are giving lectures in eastern Colorado to teach the farmers how to cultivate the land by dry farming.

The Dowling bill, providing for a connecting railroad between the Brooklyn bridge and the Williamsburg bridge, in New York City, passed the Senate May 21.

Two thousand freight handlers on the Buffalo docks are reported to have stopped work on May 20, demanding an increase of wages from 17½ cents to 20 cents an hour.

The headings of the north tube of the Belmont tunnel under 42d street to Long Island City met May 16. It is believed that the south tube will be connected through in August.

W. G. McAdoo, President of the Hudson & Manhattan Railroad Company, is quoted as saying that by October 1 the line from Hoboken to 14th street and Sixth avenue would be in operation.

A press clipping says that the Rock Island sold 100,000 decks of cards on its trains and at stations during the past year, netting a profit of $15,000. The backs of the cards bore the road's advertisement.

It is announced that the rates on canned goods, carloads, from St. Louis to Texas common points, are to be advanced June 17 from 51 to 54 cents, and that the rate of 51 cents will be canceled for the entire year.

Several hundred Italian trainmen employed by the New York, New Haven & Hartford went out on strike, May 20, following the refusal of the road to grant a demand for a 10 per cent. increase in their wages, which are now $1.50 per day.

The Chicago & Milwaukee Electric Railroad has petitioned the Interstate Commerce Commission to compel the Illinois Central to enter into joint traffic agreements covering articles of merchandise and to establish the basis of division of through rates.

The pier occupied by the Southern Pacific's Morgan line of steamships, at the foot of Spring street, New York, was destroyed by fire May 17. The loss is estimated at $500,000. One of the company's ocean steamers and several smaller craft were lying at the pier, but were saved.

The first attempts at turning the current on the new electrical overhead system of the New Haven road between New York and Stamford are reported to have set up induced currents which seriously affected the transmission of messages on the telegraph and telephone wires within 50 ft. of the track.

At time of writing, the New York longshoremen's strike is still unsettled. A few coastwise companies have raised their schedule of wages, but the transatlantic lines are all standing out. Italians are being brought to the docks on steamboats to act as strike-breakers, but have difficulty in doing the work.

The Chicago, Rock Island & Pacific pleaded guilty on May 20 to two of the 12 counts for rebating and was fined $1,000 on each. The indictment charges the road with granting a rebate of 5 cents a hundred pounds on sugar shipped by the Woolson Spice Co., of Toledo, Ohio, to St. Joseph, Kansas City and Atchison.

The Attorney-General of Indiana has given out an opinion to the effect that the new 2-cent railroad passenger fare law does not apply to interurban roads within the state. It is believed that the law may be found unconstitutional, on the ground that it is class legislation, because it includes one kind of common carrier and not another kind.

A bill has been introduced in the Massachusetts legislature to prohibit the merger of transportation companies, and the investment by one transportation company in the stock of another. The petition accompanying the bill says it is designed to prevent the contemplated merger of the New York, New Haven & Hartford and the Boston & Maine.

The engineers and firemen of three trains, two on the New Haven road and one on the Harlem, were arrested at Mount Vernon, N. Y., May 21, for the violation of a city ordinance against the use of soft coal on locomotives in the city limits. To one of the trains there was attached a United States mail car. Each arrest caused a delay and angered the commuters.

The Eleventh avenue bill, providing for a subway for the New York Central's west side freight tracks in New York City between Thirtieth and Sixtieth streets and an elevated structure across Manhattan Valley, cost to be divided between the railroad and the municipality on a basis to be agreed upon by the Board of Estimate and Apportionment and the corporation, passed the New York Senate May 21.

Injunctions have been issued by the United States Circuit Court, Judge Pritchard, restraining the Corporation Commission of Virginia from publishing its order putting the 2-cent passenger rate in effect in that state, and restraining the Corporation Commission, the Attorney-General and the Assistant Attorney-General of North Carolina from publishing and putting into effect the new law providing for a passenger rate of 2¼ cents.

The United States Geological Survey within a few weeks will establish, probably in the Pittsburg district, an experiment station for the purpose of testing explosives used in coal mining, the ultimate object being, if possible, to reduce the number of mine disasters resulting from gas and coal dust explosions. Miners' safety lamps will also be tested at this station, and explosive investigations conducted both in the laboratory and in the mines.

Official figures just compiled show that the Pennsylvania Railroad Company on May 4 had 45,496 shareholders, the largest number in its history and twice as many as it had ten years ago. The average number of shares held is 137. Of the total number of shareholders, 21,028 are women. The company states that the increase in wages granted by the company in the last few months amounts annually to more than the total dividend of $12,262,491 paid in 1902.

Better Rails Needed.

Charles M. Schwab, formerly President of the United States Steel Corporation, says that better rails are becoming absolutely necessary on account of the increasing speed and weight of trains. The open-hearth steel rail, he thinks, will first supplant, to a large extent, the Bessemer rail. He criticises the shape of the present rail, not for its service qualities, but because it is responsible for the composition. The head of the rail is too heavy and the flange too light. The impurities, which cause the breaking of the top of the rail, are due to the fact that it has to be rolled while very hot, for which the heavy top is largely responsible. It is not to the open-hearth rail that the railroads must finally look. Eventually neither railroads nor people will be content with anything short of the very best, which is a nickel or some other alloy steel rail, which will cost something like three times as much as the present rail. In connection with these statements an official of the Carnegie Steel Company at Pittsburg is reported to have declared that on a recent run of the 18-hour Pennsylvania Special between New York and Chicago, 20 rails were broken.

Rate Reductions After Complaint.

A number of cases have within the last few days been announced by the Interstate Commerce Commission in which it was not necessary for the commission to pass judgment on the merits of the original complaints as the railroads in question had made reductions after the filing of the complaints but previous to their decision.

One of these was the case of the National Petroleum Association against the Pennsylvania and a long list of other railroads forming through routes to the Pacific coast. The complainant last October protested against the rates from Ohio and Pennsylvania to the coast on petroleum and its products, and claimed that the charge of $105 each for return of cylinder oil cars from Pacific coast terminals to Missouri river points should be abrogated. It was alleged that the Standard Oil refineries at Whiting, Ind., had an immense advantage in shipments to the coast. The railroads, after the complaint was filed, discontinued the most objectionable practices and changed their rates, so that the complaint is now dismissed, there being no need to hear it.

The alleged unreasonable and discriminatory rates were: From Toledo and Findlay, Ohio, 90½c. per 100 lbs. in tank cars and barrels, carloads; from Cleveland, Ohio, 93c.; Marietta, Ohio, 95½c.; from Pittsburg, Freedom, Oil City, Titusville, Warren and Bradford, Pa., 98c.; these rates being made up of the locals to Chicago applying from the respective points mentioned, plus the through rate of 78½c. from Chicago to Pacific coast destinations.

It was claimed that the rates above shown were in and of themselves unreasonable, and that as compared with the rate of 78½ cents applying from Chicago and common points, including Whiting, Ind., said rates were unjustly discriminatory. Complainant, therefore, asked that this rate of 78½ cents from Chicago and com-

mon points be made to apply from the several cities east of Chicago enumerated.

The railroads filed answers, denying the allegations and the case was assigned for hearing at the office of the commission in Washington May 21, 1907. The defendant carriers, however, since answering, have published tariffs, naming a uniform through rate of 90 cents per 100 lbs. to apply from Chicago and common points, including Whiting, Ind., and also from the several points east of Chicago named in complaint to San Francisco and other Pacific coast points. The charge of $105 for the return of empty tank cars from Pacific coast destinations has also been abolished. In view of the facts and upon request of complainant the case was dismissed without prejudice.

In a second complaint of the National Petroleum Association against the Pennsylvania and various other roads it was alleged that the through rate on petroleum products from Oil City, Pa., to Freeport, Ill., via Chicago, was 25.5 cents per 100 lbs., whereas the combination rate on Chicago was only 23 cents. The carriers in their answers signified willingness to reduce the rate to 23 cents and subsequently put this rate in effect. Therefore the complaint was dismissed.

A third case was that of the Kalamazoo Tank & Silo Co. against the Michigan Central and the Chicago, Milwaukee & St. Paul. The complainant shipped one carload of silos, knocked down, from Kalamazoo, Mich., to Elkhorn, Wis., via Chicago, on which it was charged a joint through rate of 28 cents per 100 lbs., whereas at the same time the carriers' combination rate on Chicago between the same points on the same commodity was only 17 cents; similar improper adjustments in rates between points not given were alleged. After the case was at issue the carriers reduced their joint through rate from Kalamazoo to Elkhorn to 16 cents per 100 lbs., and at the hearing they conceded that the 28-cent rate was excessive to the extent of a difference between that rate and 17 cents, and agreed that improper adjustments in rates between said other points should be corrected. The commission holds that complainant should be awarded reparation on the specific shipment on the basis of such difference in rates, and that as to other matters mentioned in the case the complaint be dismissed.

Still another case was that of the Manufacturers' Club of Terre Haute, Ind., against the Louisville & Nashville and the Big Four. The complaint alleged that rates on coke from Kentucky and Virginia ovens to Terre Haute were unreasonable as compared with rates on coke from such points of origin to Chicago and other specified points. After the complaint was filed the carriers made the rates to Terre Haute the same as those to Chicago. In view of these circumstances the complaint was dismissed.

Railroad Justified in Moving Station.

The Interstate Commerce Commission has announced its decision in the case of Cornelius J. Jones and others against the St. Louis & San Francisco. This complaint arose because the railroad moved its station at Chase, I. Ter., 3½ miles west to a junction point which another road also called Chase. The complainants sought restoration of station facilities at Chase and demanded damages. The conclusions of the Commission are as follows:

The obligation to provide station facilities at a given point along the line of a railroad may arise under the terms of the charter of a company, or may be imposed by statute, and some authorities assert that the duty exists also at common law; but the Commission is not the proper forum to which to appear for the enforcement either of a charter, statutory or common-law obligation, as it has no authority to issue the writ of mandamus and possesses no common-law jurisdiction.

The contention that the Commission has power, under the Rate Law to require a common carrier to locate or relocate and maintain a station at a given point is open to doubt; but, without deciding this question, it is manifest that the Commission should not exercise such power unless all the facts and conditions clearly indicate that the interests of the general public in the locality involved are materially impaired by the lack of such facilities.

The record does not show that the interests of the general public have been materially impaired by the removal of the station to the new point, and under the circumstances named complainants are not entitled to an order requiring defendant to re-erect and maintain a station at old Chase.

The defendant having the lawful right, in the public interest as well as in its own interest, to move its station to the new point, it can not be held liable for damages alleged to have been sustained as a consequence of such action.

Railroad Keeping Pace with Irrigation.

The railroad just finished by the Southern Pacific from Hazen, Nevada, to Fallon, 16½ miles, is a straight line from northwest to southeast across the Truckee Irrigation territory. The new road is a branch of the California & Nevada line. At present, with the exception of two miles near Fallon, the road passes through an absolute desert, but the government irrigators will soon turn this territory into a rich agricultural section.

The Truckee project was the first one undertaken by the government under the law of 1902. An ample supply of water will be provided to irrigate 350,000 acres of rich land in western Nevada. It includes the Carson sink country, which, the government experts say, will make exceptionally fertile farming land as soon as water is available. The country around the state capital is also included.

The main feature of the irrigation work is a canal 30 miles long to divert water from Truckee river to the channel of Carson river, where a storage reservoir is to be built. This canal, with several hundred miles of lateral ditches, is already finished and water is ready for delivery to about 50,000 acres, 30,000 of which are public lands open to homestead settlement. When the settlers come they will find the Hazen-Fallon Railroad ready to distribute their products to the surrounding mining districts, which will form the settlers' market. The railroad is already of great service to the irrigation construction forces in transporting supplies and materials.

Virginia Railroads to Resist.

All the railroad companies operating in Virginia have decided to resist in every legal way the orders of the State Corporation Commission fixing a maximum passenger rate and putting into effect a single uniform freight classification. Except for certain branches where the total traffic is light, the passenger rate is made 2 cents a mile for the following roads: the Norfolk & Western, the Chesapeake & Ohio, the Atlantic Coast Line, the Seaboard Air Line, the Southern, the Richmond, Fredericksburg & Potomac, the Washington Southern, the New York, Philadelphia & Norfolk, the Virginia & Southwestern, and the Louisville & Nashville. Twenty-four other roads are allowed to charge from 2½ to 3½ cents per mile. The uniform freight classification, to be known as Virginia Classification No. 1, is ordered into effect July 1 on all of the roads above mentioned, except the Richmond, Fredericksburg & Potomac and the Washington Southern.

In the preliminary hearings before the commission, the railroads raised in their defense not only the usual objections to the constitutionality of the law and the proceedings under it, but also attacked the methods by which the commission sought to determine the profitableness of intrastate as compared with interstate transportation. The commission conceded that it was impossible to ascertain exactly the earnings, expenses and property employed in exclusively Virginia business, but asserted that the testimony submitted by the defendants and facts otherwise brought out enabled the commission to ascertain all those matters "with sufficient practical accuracy for the purposes of this proceeding."

Notwithstanding a mass of testimony submitted by several carriers to show that the cost of conducting intrastate business was materially greater than that of conducting interstate business, the commission decided that such was not the case. The commission strengthened itself in this position with the argument—one likely to amaze the average railroad operating official—that it was the interstate business as distinguished from the bulk of that within state lines, in which the heaviest motive power and rolling stock were employed, necessitating the largest expenditure on roadbed, track and bridges, and entailing the greatest wear and tear on the property. The inference which the commission obviously intends to convey is that railroads employ heavy equipment to the detriment of their own profits, and only because the nature of the traffic compels its use. It is to be hoped that this will not escape the appreciative eye of Mr. James J. Hill.

After reducing to a per mile basis the earnings of the railroads on business in Virginia during 1906, as reported to the commission, the commission reaches the conclusion that the railroads are earning in that state 6 per cent. on the following valuations of their property:

Norfolk & Western	$98,000 a mile.
Chesapeake & Ohio	82,000 "
Atlantic Coast Line	85,000 "
Seaboard Air Line	62,000 "
Southern	45,000 "
Richmond, Fredericksburg & Potomac	127,000 "
Washington & Southern	90,000 "
New York, Philadelphia & Norfolk	85,000 "

In determining a reasonable valuation of the property, the commission entirely discards the amount of bonds and stocks issued and says that the current market value of the securities is too subject to manipulation and depends too much on earning capacity to be a criterion. To fix the future earning capacity by the value of the property and then to ascertain that value by the present earning capacity as reflected in the market value of the securities would be reasoning in a circle. Original cost and cost of reproduction are in many cases impossible to determine.

The commission specifically disavows the theory that the taxable value of railroad property should be the same as its commercial value, but holds that such values should bear some reasonable relation to each other. Finally the commission points out the great familiarity of its own members with the railroad property of the state from their personal inspection of the physical property. The commission justifies itself in availing itself of this personal knowledge as one factor in the determination. But all of the foregoing considerations, the commission declares, entered into their deliberations, their final judgment being a composite result of them all.

By this process the commission has decided that the entire Vir-

ginia property of no railroad company is worth more than $50,000 a mile for the entire mileage in the state, while the property of most such companies is worth less.—*Wall Street Journal.*

Fire Exits in New York Subway.

At 14 points in the New York subway, between City Hall and 59th street, where air chambers have been put in for ventilation, fire exits have been provided which can be used by passengers on subway trains in emergencies. These are marked by large signs lighted by shaded electric lights. A door opens into the air chambers at the side of the local tracks and an iron ladder leads to the top of the pit, which is covered by open gratings. The section of the grating above the ladder can then be lifted up, giving egress to the sidewalk.

Railroads and the Rate Law.

Charles A. Prouty, of the Interstate Commerce Commission, has recently been quoted as follows:

The railroads of the United States are to be complimented on the disposition they have shown to abide by the Rate Law.

Scores of questions have been raised under the new law on which the railroads might have demanded a decision by the courts before obeying the orders of the Commission, or accepting its construction of the law, but in every instance they have promptly and cheerfully co-operated with the Commission. On the other hand, the Commission has tried to avoid imposing unnecessary hardships on the railroads in meeting the new conditions. It is demonstrated beyond doubt that the railroads are in hearty sympathy with the interstate commerce law and that the rebate and kindred evils are practically abolished. The great majority of railroad officials are honest and fair-minded, but they have been living under a cloud raised by few unscrupulous and dishonest men. To-day every railroad official can follow his inclination to treat all shippers alike, without fear that some official of a competing road will secretly pay rebates in one form or another.

The law is designed to protect the railroads as well as their patrons. Railroad managers recognize to-day that it is their greatest protection against extravagant legislation by individual states. Had the railroads always observed the Interstate Commerce law as they do to-day, I believe they would not have had forced on them such a flood of state laws reducing passenger fares to 2 cents a mile, providing for "reciprocal demurrage," and other hostile legislation. Many railroad officials believe now that the authority of the Interstate Commerce Commission will have to be extended to the operation of the railroads, in addition to their traffic, in order to protect them from state laws like those requiring freight cars to be moved not less than a specified number of miles daily, or unjust laws on reciprocal demurrage.

Public Utilities Bill Passed.

The public service commissions Act, commonly known as the Public Utilities Bill, the principal of the reform measures supported by Governor Hughes, passed the New York State Senate on May 22 by a vote of 41 to 6. On May 15, a week earlier, it passed the Assembly by a unanimous vote. After it was passed by the Senate the Assembly unanimously concurred in the Senate's amendments. The passage of the bill in the Senate was hastened by an "emergency message" of the Governor.

Rates on Oil from Kansas to Missouri.

The Interstate Commerce Commission has announced its decision in the case of E. M. Wilhoit v. the Missouri, Kansas & Texas as follows:

At the date of filing complaint the carriers' rate on refined oil from Erie, Kan., to Joplin, Mo., 69 miles, and to St. Louis, Mo., 400 miles, was 17 cents per 100 lbs.; but later the rate from Erie to Joplin was reduced to 15 cents, which is the rate prevailing from other oil-shipping points in Kansas to Joplin. The rates to Joplin, St. Louis and Kansas City from these producing points are apparently adjusted with a view to affording the shippers equal opportunities in the markets. The Commission holds that to make distance the sole factor in determining a reasonable rate would introduce undue discrimination and create chaotic commercial conditions. The complaint is dismissed.

Railroads as Shippers: Astray Shipments.

In its tariff circular, No. 13-A, the Interstate Commerce Commission makes two administrative rulings. The first is that under the law a carrier or a person or corporation operating a railroad or other transportation line, cannot as a shipper over the lines of another carrier be given any preference in the application of tariff rates on interstate shipments. In other words, one carrier shipping its fuel, material, or other supplies over the line of another carrier, must pay the legal tariff rates applicable to the same commodities shipped by an individual. The Commission suggests that there may be some instances, such as the movement of needed fuel, in which, in order to keep the trains or boats moving, such traffic could be given preference in movement without creating unjust or unwarranted discrimination.

The second ruling relates to the return of astray shipments. The Commission is of the opinion that in instances where through error or oversight on the part of some agent or employee the shipment is billed to a wrong destination or is unloaded short of destination or is carried past, carriers may return such astray shipments to their proper destination or route without the assessment of additional charges, and may arrange for such movement of such astray shipments for each other on mutually acceptable terms without the necessity of publishing, posting and filing tariffs under which it will be done.

Meeting of the Burlington Association of Operating Officers.

An account of the organization, history and method of operation of the Burlington Association of Operating Officers, together with something of what it had accomplished, was given in these columns about a year ago (June 6, 1906). As indicated in that article, the objects of these meetings are to promote closer relations between the various departments, to bring about uniformity of standards and practices and to advance the interests of the company in every way.

The 1907 meeting was recently held at the Auditorium Hotel, Chicago. Yearly meetings have been held since 1898. Prior to that time they were semi-annual, the last gathering being the thirty-ninth. The meetings are conducted in much the same way as the Master Mechanics' and Master Car Builders', papers being presented and discussed and the discusson reported verbatim. The proceedings are published in pamphlet form. Recommendations made at the meetings are referred to the management for final approval, after which instructions are issued making them standard practice.

Over 60 subjects were handled at the recent meeting, about one-third of which were unfinished questions from former meetings. There were 33 new subjects, offering a good variety. For example, the question of cross-tie timber, its source and cultivation; ventilation of passenger cars; uses and economy of concrete, and many other phases of railroad work were considered. Several individual papers were presented, one bearing the caption "He Supposed So" being especially interesting. The short, snappy discussion of subjects under the head of topical discussions creates much interest on account of members only being allowed five minutes for each question. During the life of the association something over 1,050 subjects have been handled.

A dinner given in the evening of the second day of the meeting, at which Second Vice-President Willard presided as toastmaster, was greatly enjoyed by the members. The officers for the coming year are: Chairman, H. E. Byram, General Superintendent, Lincoln, Neb.; First Vice-Chairman, A. Forsyth, Superintendent Shops, Aurora, Ill.; Second Vice-Chairman, E. Bignell, Division Superintendent, Lincoln, Neb.; Secretary, S. D. Brown, Chief Clerk to General Superintendent Motive Power, Chicago.

Manufacturing and Business.

The American Steel Foundries have moved their Chicago office from the First National Bank building to the Commercial National Bank building.

Walter D. LaParle, Chicago, heretofore handling a line of railroad supplies, will hereafter devote his entire time to the interests of the Beaver Dam Malleable Iron Co., Beaver Dam, Wis.

The charter of the Davis Pressed Steel Company expired by limitation on May 1, and the Davis Solid Truss Brake Beam Company, Wilmington, Del., is now making the Davis solid truss brake-beams.

At the annual meeting of the General Electric Co., S. L. Schoonmaker and Marsden J. Perry were elected Directors, succeeding Eugene Griffin, deceased, and T. K. Henderson. The other Directors were re-elected. B. E. Sunny and J. R. Lovejoy, Manager of Sales, have been elected also Vice-Presidents.

The American Car & Equipment Co., Chicago, has recently received the following orders: Assumption Coal & Mining Co., Assumption, Ill., 50 gondola cars of 80,000 lbs. capacity; New York, Auburn & Lansing, 50 flat cars; Sioux City Brewing Co., Sioux City, Iowa, 10 refrigerator cars; Stewart & Mathews Co., St. Paul, Minn., one private car.

J. G. Platt, who recently resigned as Master Mechanic of the Franklin works of the American Steel Foundries, Chicago, on account of his health, has been appointed mechanical representative of the Hunt-Spiller Manufacturing Corporation, Boston. Before going to the American Steel Foundries he was for many years Engineer of Tests of the Erie.

Charles C. Mickle, of Philadelphia, has been appointed General Manager of the Trojan Car Coupler Co., with office at New York, succeeding Harvey N. Loomis, retired. The company recently removed its Troy and St. Louis shops to Columbus, Ohio, where all its car couplers are now made. The Chicago office has been removed to 503 Western Union building.

The Pittsburg Automatic Vise & Tool Company have completed all their plans for the exhibiting at the Master Car Builders' and Master Mechanics' convention at Atlantic City, June 13-20, of the largest vise yet built. The tool will be operated by electricity, the double swivel movement being visible at all times. The vise weighs 695 lbs. and has a jaw opening of 15 in.

Silk, McClellan & Co., Chicago, is a new firm in the railroad supply business. In active management are two young men who have had considerable experience in the supply business and many friends in the railroad field. They are making a line of high-grade car specialties. Edward E. Silk has been in the railroad supply business for about seven years. Previous to that time he was with the Central of New Jersey and for two years was Associate Editor of the *American Engineer and Railroad Journal*. He is a graduate of Purdue University, where he took a mechanical engineering course. Benjamin S. McClellan has also been in the supply business for about six years and before that was for eight years in charge of the car shops of the Illinois Central at New Orleans, and for three years in charge of the West Albany passenger car shops of the New York Central. The specialties the firm is making include a line of dust-proof, air-tight window fixtures, special sash locks, desk sash ratchets, universal steam couplers and hose bands. The main office and factory is at Fifty-eighth street and Normal avenue, Chicago. They have complete sets of blue prints and illustrated matter to mail on request.

Iron and Steel.

Bids recently opened by the purchasing agency of the Panama Canal at Washington, D. C., for 5,000 tons of rails delivered at Colon for railroad construction on the Isthmus were: Maryland Steel Company, $158,750, and the United States Steel Products Exporting Company, $162,250.

The Illinois Steel Company has orders for 65,000 tons of rails from the Northern Pacific for 1908 delivery. Other orders include 10,000 tons for the St. Louis & San Francisco, 10,000 tons for the Illinois Central, and 4,000 tons for the Great Northern. It is said that another company has orders for 10,000 tons from the St. Louis & San Francisco. There are inquiries for about 100,000 tons. Orders for Bessemer rails for next year's shipment now aggregate about 370,000 tons and the open hearth orders 220,000 tons for the Tennessee Company and 25,000 tons for the Bethlehem mill, making a total of all kinds for 1908 of 615,000 tons.

OBITUARY NOTICES.

J. B. Winston, formerly and for many years Treasurer of the Richmond, Fredericksburg & Potomac, died on May 20 in Richmond, Va. Mr. Winston was 77 years old.

E. P. Lord, General Manager of the H. K. Porter Company, died recently in Pittsburg. Mr. Lord was born in Massachusetts in 1860, and graduated from Yale University in 1881, afterward taking the post graduate course at Stevens Institute of Technology. He began railroad work on the Pennsylvania, serving at Renova, Pa., and Altoona, and then being made Assistant Superintendent of Motive Power of the Lines West, at Fort Wayne, Ind. In 1892 he went to the Cleveland, Cincinnati, Chicago & St. Louis as Superintendent of Motive Power, but after a year resigned to become Superintendent of the H. K. Porter Company, of which he was later appointed General Manager.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Association of Railway Telegraph Superintendents.

The twenty-sixth annual meeting of this Association is to be held at the Marlborough-Blenheim, Atlantic City, N. J., June 19 and 20, 1907. Hotel accommodation has been arranged for as follows: One person from $4 a day to $8; for two persons occupying double room $8 a day to $12 on the American plan, or from all of the above rates an allowance of $2 a day for each person will be made if the rooms are rented on the European plan.

The Pullman Co. announces that it will extend to delegates attending the convention and dependent members of their families, the same courtesies as heretofore, viz., upon presentation of receipts showing full fare paid to the convention together with proper credentials of the association, to its representative at Atlantic City, passes will be issued for a return trip to delegates attending the convention who are connected with railroads and in active service.

A partial list of the papers to be read follows:

"Education of Telegraphers in Railroad Work," by H. C. Hope.

"The Superintendent of Telegraph, What he is *versus* what he is not," by F. E. Bentley.

"Maintenance and Operation of Telephone Service on Railroad Company's Lines," by S. L. Van Akin, Jr.

"Opportunities in the Telegraph Service," by G. W. Dailey.

"Experiments with Concrete Poles," by G. A. Cellar.

"Visible Supply of Telegraph Poles," by W. W. Ashald.

"Operation and Maintenance of Railway Telegraph Service," by J. C. Browne.

"Wireless Telegraphy," by Wm. Maver, Jr.

"Standard Telegraph Line Construction," by C. H. Bristol and D. R. Davies.

"Dry Batteries," by U. J. Fry.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Erie.—James N. Hill and Ogden Mills have been elected Directors, succeeding James J. Hill and D. O. Mills, resigned. J. N. Hill was elected also a member of the Executive Committee, succeeding Samuel Spencer, deceased.

Lehigh Valley.—J. J. Morrison, Auditor of Disbursements, has been appointed Auditor, and his former office has been abolished.

Operating Officers.

Chicago, Milwaukee & St. Paul.—C. F. Morrison has been appointed Superintendent of the James River division, with office at Aberdeen, S. Dak., succeeding G. G. Mason, resigned.

Chihuahua & Pacific.—H. C. Ferris, Superintendent of the Toledo & Ohio Central, has been appointed General Manager of the Chihuahua & Pacific, succeeding C. L. Graves, who resigned early this month to go into other business.

Mexican International.—W. S. Martin, General Manager, has resigned, effective May 31, to go to another company.

Michigan Central.—See Northern Pacific.

New York, New Haven & Hartford.—John P. Hopson, who was recently appointed Superintendent of the New York division, was born at Wallingford, Conn., in 1852. After a common school education he began railroad work in 1867 at Branford Station, on the Shore Line, now part of the New York, New Haven & Hartford. After serving as station agent at different points until 1882, he went into other work for three years. He then returned as agent at South Norwalk in 1885, and two years later was appointed Superintendent of the New York, Rutland & Montreal, now part of the Rutland Railroad. He resigned the next year, and after doing some special work for the Housatonic Railroad, now merged with the New Haven, he was appointed Superintendent of the New Haven & Derby, now part of the New York, New Haven & Hartford. He was made Superintendent of the Berkshire division when it was formed in 1892, and in 1902 was appointed also Superintendent of the Naugatuck division, where he remained until his recent promotion.



John P. Hopson.

Northern Pacific.—C. M. Levey, Third Vice-President, with office at Tacoma, Wash., has been transferred to St. Paul in charge of maintenance and operation of all the company's lines. H. J. Horn, General Manager, has been made General Manager in charge of maintenance and operation in Montana, North Dakota, Minnesota and Wisconsin, with office at St. Paul. H. S. Nutt, General Superintendent of the Michigan Central, has been appointed General Manager of the Northern Pacific at Tacoma, in charge of maintenance and operation of lines in Washington, Idaho and Oregon.

The new Fargo division consists of the lines from Fargo, N. Dak., to Jamestown, including the Casselton, the Cooperstown and the Fargo & Southwestern branches, this territory having been heretofore a part of the Dakota division. J. H. Raver has been appointed Superintendent of the new division, with office at Fargo.

Toledo & Ohio Central.—See Chihuahua & Pacific.

Trinity & Brazos Valley.—The headquarters of J. M. Lee, Superintendent, have been removed from Fort Worth, Tex., to Teague.

Union Pacific.—T. J. Foley has been appointed Superintendent of Terminals at Omaha.

Versailles & Sedalia.—H. F. Reddig, General Superintendent, has resigned to go to another company.

Traffic Officers.

Chicago & Alton.—T. C. Frew has been appointed General Agent at Pittsburg.

Great Northern.—W. W. Broughton, Freight Traffic Manager, has been appointed General Traffic Manager.

Illinois Central.—A. N. Dale, General Agent at St. Louis, has resigned and his office has been abolished.

New York Central Lines.—B. B. Mitchell, Freight Traffic Manager of the lines east of Buffalo, has been appointed General Freight Traffic Manager of all New York Central lines. Francis LaBau, Assistant Freight Traffic Manager, succeeds Mr. Mitchell. H. D. Carter, General Freight Agent, has been appointed First Assistant Freight Traffic Manager of the lines east. W. S. Kallman, General Freight Agent of the West Shore, has been appointed Second Assistant Freight Traffic Manager of the lines east. I. H. Hubbell, First Assistant General Freight Agent of the N. Y. C. & H. R., has been appointed General Freight Agent of the New York Central & Hudson River and of the West Shore. W. A. Newman, Second Assistant General Freight Agent, succeeds Mr. Hubbell. D. E. Gelatt, Division Freight Agent at New York, succeeds Mr. Newman.

Northern Pacific.—H. N. Kennedy has been appointed General Agent at Spokane, Wash., succeeding G. A. Mitchell, promoted.

Trinity & Brazos Valley.—J. E. Fields, chief clerk in the General Freight Agent's office at Fort Worth, has been appointed Assistant General Freight Agent, with office at Galveston, Tex.

Engineering and Rolling Stock Officers.

Atchison, Topeka & Santa Fe.—J. E. Whiteford, General Foreman at Fort Madison, Iowa, has been appointed General Roundhouse Inspector, with office at Albuquerque, N. Mex. He will have supervision, under the direction of the Superintendent of Motive Power, of all methods and practices in roundhouse work.

Chicago, Burlington & Quincy.—A. C. Adams, Master Mechanic of the Lehigh Valley at Sayre, Pa., has been appointed Master Mechanic of the Alliance division of the Chicago, Burlington & Quincy, with office at Alliance, Neb., succeeding G. M. Reynolds, resigned.

Lehigh Valley.—See Chicago, Burlington & Quincy.

Mexican Central.—M. Parra has been appointed Master Mechanic of the Tampico Terminal division.

New York Central & Hudson River.—C. E. Lindsay, who was recently appointed Engineer of Maintenance of Way of the Electric division, was born in Pihladelphia in 1865. In 1881 he worked as chainman on the Pennsylvania, and then entered the University of Pennsylvania, graduating with a C. E. degree in 1885. For six months afterward he was surveyor for the Philadelphia Board of Underwriters, and then went to the Union Pacific on location and construction work. In the summer of 1886, he went to Cincinnati on construction work for the Pennsylvania Lines West, and two years later was made Assistant Engineer at Fort Wayne, Ind. In 1890 he was appointed Engineer of Maintenance of Way of the Cincinnati division, and in 1898 went to the Southern as Division Engineer of the Washington division. Three years later he went to the New York Central as Division Engineer of the Pennsylvania division, which was then being rebuilt and extended. In 1903 he was transferred to the Mohawk division, where he remained until his recent appointment.

John V. Newbert, who succeeds Mr. Lindsay as Division Engineer of the Mohawk division at Albany, was born in Pennsylvania, and graduated from the Pennsylvania State College in 1899. He immediately began railroad work on the New York Central. He was in the accountant's office at New York, and then in an engineering corps on the River division. He was then made assistant supervisor of track of this division, after which he was transferred to the Western division. After serving as acting supervisor of track at Batavia, N. Y., he was made Assistant Engineer in the office of the Division Engineer at Albany. He then came to New York as Assistant Engineer in the office of the Engineer of Maintenance of Way, and later in the Assistant General Manager's office, where he remained until his recent promotion.

Northern Pacific.—J. D. Koren has been appointed Division Engineer of the Idaho and Pasco divisions, with office at Spokane, Wash., succeeding A. C. Terrell, transferred.

Pennsylvania.—J. C. Glass, Master Mechanic of the Allegheny division, has been appointed Master Mechanic of the Conemaugh division, with office at Verona, Pa. D. E. Cassidy has been appointed Assistant Master Mechanic of the Conemaugh division.

LOCOMOTIVE BUILDING.

The Usina Sao Bento has ordered one locomotive from the Baldwin Locomotive Works.

The Midland Valley has ordered five locomotives from the Baldwin Locomotive Works.

The Sung Ning Railway has ordered one locomotive from the Baldwin Locomotive Works.

The White Pass & Yukon has ordered one locomotive from the Baldwin Locomotive Works.

The Wisconsin Steel Company has ordered one locomotive from the Baldwin Locomotive Works.

Monsieur De Cerjat, France, has ordered two locomotives from the Baldwin Locomotive Works.

The Parana Railway, Brazil, has ordered two locomotives from the Baldwin Locomotive Works.

The Southern Lumber Company has ordered one locomotive from the Baldwin Locomotive Works.

The Detroit, Toledo & Ironton has ordered four locomotives from the American Locomotive Company.

The Coudersport & Port Allegheny has ordered one locomotive from the Baldwin Locomotive Works.

The Mahoning Ore & Steel Company has ordered two locomotives from the Baldwin Locomotive Works.

The National Tube Company, Pittsburg, has ordered one locomotive from the Baldwin Locomotive Works.

The Charlestown & Western Carolina has ordered four locomotives from the Baldwin Locomotive Works.

The Indiana Steel Company, Chicago, has ordered 12 switching locomotives from the H. K. Porter Company.

The Cincinnati, Georgetown & Portsmouth has ordered one locomotive from the Baldwin Locomotive Works.

The Colombian Trading Company, 12 Broadway, is in the market for narrow gage locomotives for Colombian lines.

The Anglo Newfoundland Development Company has ordered one locomotive from the Baldwin Locomotive Works.

The La Dicha & Pacific has ordered three locomotives from the Atlantic Equipment Co. (American Locomotive Co.).

The Solvay Process Company, Syracuse, N. Y., has ordered one locomotive from the American Locomotive Company.

The Long-Bell Lumber Company, Kansas City, Mo., has ordered two locomotives from the Baldwin Locomotive Works.

The Portland Railway, Light & Power Company, Portland, Ore., has ordered two locomotives from the American Locomotive Company.

The New South Wales Government Railways are getting prices from the Baldwin Locomotive Works on 30 freight, 15 passenger and five tank locomotives.

The Nevada Northern, which is controlled by the American Smelting & Refining Company, has ordered two locomotives from the American Locomotive Co.

Albert Zucker, an engineer and contractor of Buenos Ayres, is in the market for locomotives for Argentine railroads. His temporary headquarters are at the offices of the United States Steel Products Export Co., Battery Park building, New York.

The Cauca Railroad, which is being built in Colombia by the Colombian Pacific Railroad, has been figuring on two 3-ft. gage consolidation locomotives. E. H. Mason is President and General Manager.

The Copper River & Northwestern, now building in Alaska, is reported to have ordered six saddle-tank locomotives for construction work from the Atlantic Equipment Co. (American Locomotive Co.), and to be contemplating the purchase of other new equipment. M. K. Rogers, President and General Manager, Seattle, Wash.

The Idaho & Washington Northern has ordered two 75-ton, simple, 10-wheel locomotives, with cylinders 19 in. x 26 in., and two 100-ton, simple, consolidation locomotives, with cylinders 22 in. x 28 in., from the Baldwin Locomotive Works, for August and October delivery, and two 75-ton Shay geared locomotives from the Lima Locomotive & Machine Company.

The Duluth, South Shore & Atlantic, as reported in the *Railroad Gazette* of May 10, has ordered six simple consolidation (2-8-0) loco-

motives and three 10-wheel (4-6-0) locomotives from the Baldwin Locomotive Works. The specifications are as follows:

General Dimensions.

Types of locomotives	Consolidation.	Ten-wheel.
Weight, total	172,000 lbs.	145,000 lbs.
Weight on drivers	152,000 lbs.	112,000 lbs.
Diameter of drivers	55 in.	64 in.
Cylinders	20 in. x 28 in.	19 in. x 26 in.
Boiler, type	Straight top; radial stayed.	Extended wagon top.
" working stm. press.	190 lbs.	
" number of tubes	339	320
" diameter of tubes	2 in.	
" length of tubes	14 ft. 6 in.	13 ft.
Firebox, length	96 in.	102 in.
" width	60 in.	40 in.
" material	Worth steel.	
Heating surface, total	2,700 sq. ft.	2,300 sq. ft.
Tank capacity	5,500 gals.	5,000 gals.
Coal capacity	10 tons.	9 tons.

Special Equipment.

Couplers	Gould
Injector	Ohio
Piston rod packings	U. S. metallic
Valve rod packings	U. S. metallic
Safety valve	Consolidated
Sanding devices	Leach
Sight-feed lubricators	Michigan
Springs	Railway Steel Spring Co.
Tires, driving wheel	Latrobe
Tires, truck wheel	Latrobe
Tires, tender wheel	Latrobe
Other specialties	Johnston blow-off cocks

The Central of Brazil has ordered from the American Locomotive Company, for October, 1907, delivery, three Mallet compound, 5-ft. 3-in. gage locomotives. They will have Westinghouse air-brakes.

General Dimensions.

Type	Mallet Compound
Weight on drivers	208,000 lbs.
Total weight	208,000 "
Tractive effort	42,500 "
Diameter of cylinders	17½ and 28 in.
Stroke of pistons	26 in.
Diameter of drivers	50½ "
Rigid wheel base	9 ft.
Total wheel base	27 ft. 8 in.
Boiler, type	Straight top
" diameter	64¼ in.
" working steam pressure	200 lbs.
" heating surface, total	2,350 sq. ft.
Tubes, diameter	2 in.
" length	18 ft.
Firebox length	90⅛ in.
" width	65¼ "
Grate area	40 ft.
Tank capacity	4,500 gals.
Coal capacity	8½ tons

CAR BUILDING.

The Houston Electric Co. has ordered 10 cars.

The Canton-Hankow Railway is in the market for 40 flat cars.

The Sherman & Dallas Interurban Electric has ordered 15 cars.

The Union Pacific is reported in the market for three dining cars.

Capt. L. Johnson, Waycross, Ga., is inquiring for a standard gage gasolene motor car.

The Tramway Rural, Buenos Ayres, is reported to be in the market for 75 electric cars.

The Richmond, Fredericksburg & Potomac is said to be figuring on several steel coal and box cars.

The New South Wales Government Railways are expected to be in the market shortly for several cars.

The Colombian Trading Company, 12 Broadway, is in the market for narrow gage cars for Colombian lines.

The Aurora, Elgin & Chicago has ordered two interurban motor cars from the Hicks Locomotive & Car Works.

The La Dicha & Pacific has ordered several cars from the Atlantic Equipment Co. (American Locomotive Co.).

The Bolivia Railway, in which Speyer & Co. are interested, will shortly be in the market for several gondola cars.

The Midland Valley is reported to have ordered 500 coal cars and 250 box cars from the Mount Vernon Car Mfg. Company.

The Manistee & Northeastern is in the market for 50 flat cars of 80,000 lbs. capacity and 25 flat cars of 60,000 lbs. capacity.

The Solvay Process Company, Syracuse, N. Y., has ordered six Hart convertible cars from the Rodger Ballast Car Company.

The Atchison, Topeka & Santa Fe has ordered 250 tank cars of 10,500 gallons capacity from the Pressed Steel Car Company.

Hegeler Brothers have ordered 15 tank car underframes mounted on 80,000-lb. capacity trucks from the Bettendorf Axle Company.

The Dairy Shippers' Despatch, Chicago, is figuring on 50 refrigerator cars. This company intends to buy a total of 200 new cars.

The Atlanta, Birmingham & Atlantic, it is reported, is about to place orders for 1,000 coal cars, 500 flat cars, 200 box cars and 30 cabooses.

The New York & Queens County (Electric) is reported to have ordered 40 steel passenger cars from the American Car & Foundry Company.

The Standard Equipment Company, Pittsburg, has ordered five Hart convertible cars of 80,000 lbs. capacity from the Rodger Ballast Car Company.

The General Chemical Company, New York, has ordered 10 tank cars of 200 gallons capacity mounted on 100,000-lb. capacity trucks from the Bettendorf Axle Company.

The Nevada Northern, which is controlled by the American Smelting & Refining Co., has ordered 50 gondola cars of 100,000 lbs. capacity from the National Dump Car Co.

The Solvay Process Company, Syracuse, N. Y., has ordered 25 tank cars of 10,000 gallons capacity mounted on 100,000-lb. capacity trucks from the Bettendorf Axle Company.

The Copper River & Northwestern, now building in Alaska, is reported to have ordered fifty 36-ft. dump cars, thirty-four 18-ft. dump cars and six flat cars of 60,000 lbs. capacity. M. K. Rogers, President, Seattle, Wash.

Albert Zucker, an engineer and contractor of Buenos Ayres, is in the market for cars for Argentine railroads. His temporary headquarters are at the offices of the United States Steel Products Export Co., Battery Park building, New York.

The Chilian Government Railways Administration is expected to be in the market shortly for several passenger and freight cars. The contracts will be placed through Wessel, Duval & Co., D. R. Grace & Co., or some other New York export house.

The Louisiana Railway & Navigation Company, as reported in the *Railroad Gazette* of May 10, has ordered 400 wooden box cars of 60,000 lbs. capacity from the Western Steel Car & Foundry Company. The dimensions for these cars were published in the *Railroad Gazette* of May 10.

The Idaho & Washington Northern, as reported in the *Railroad Gazette* of May 10, has ordered three 70-ft. standard passenger cars, one 60-ft. Pullman standard baggage car, and one 60-ft. Pullman standard express car from the Pullman Company; 100 41-ft. flat and 25 40-ft. box cars, both of 80,000 lbs. capacity, from Haskell & Barker, for May and June delivery; 25 40-ft. steel cars of 100,000 lbs. capacity from the Ralston Steel Car Company. The special equipment for passenger, baggage and express cars includes:

Draft rigging	Westinghouse
Trucks	Pullman
Wheels	Page

RAILROAD STRUCTURES.

Brandon, Man.—The Canadian Pacific, it is said, has given a contract to Kelly Bros., of Winnipeg, for putting up a machine shop here to cost $20,000.

Galveston, Tex.—The Galveston Terminal Company has given a contract to James Taylor, of Fort Worth, for a new freight house and warehouse. Work is to be started at once and is to be finished by September 5.

Harmarville, Pa.—Plans, it is said, are being made by the Pennsylvania for building a stone arch bridge on the Conemaugh division at this place to replace the structure carried away by floods. The new bridge will cost about $50,000.

Lima, Ohio.—The Schoepf Syndicate, which controls the Indiana, Columbus & Eastern Traction Company, is reported to have secured a site for a union station to cost $150,000.

New Orleans, La.—A contract for putting up the new union passenger station and train shed at Canal and Basin streets, to cost $500,000, has been let to James Stewart, of New York.

New York, N. Y.—The Board of Aldermen has passed a resolution appropriating $1,600,000 for building a new bridge over the Harlem river at Madison avenue.

Portage la Prairie, Man.—Plans, it is said, have been made for a passenger station to be used by the Grand Trunk Pacific and the Midland (Great Northern). The station is to be 33 ft. x 176 ft., and will cost $30,000.

Rensselaer, N. Y.—A report will soon be made by the Rensselaer Chamber of Commerce on the proposition to build a viaduct over the New York Central and Boston & Albany tracks at Third avenue.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Atlantic Northern & Southern.—Local reports state that this company, projected to build a line from Kimballton, Iowa, south to Atlantic, is to be financed by the Palmer Engineering Company

of Kansas City, and work is to be started shortly. J. W. Cuykendall is President, and J. E. Bruce is a Director. (Mar. 15, p. 380.)

BALTIMORE & OHIO SOUTHWESTERN.—This company is building a new 600-car yard at Oakley, a suburb of Cincinnati, Ohio.

BATON ROUGE, HAMMOND & EASTERN.—Contract for building this proposed line from Baton Rouge, La., east, it is said, has been let to John Scott & Sons, of St. Louis. Work is to begin immediately between Baton Rouge and Hammond, and steel for the bridges has been ordered, and the entire right of way from Baton Rouge to Hammond has been cleared. (April 26, p. 598.)

BESSEMER & LAKE ERIE.—An officer writes respecting the proposed extension of the Western Allegheny, that a line has been located from Kaylor, Pa., northeast to a connection with the Franklin & Clearfield at Reidsburg, but that nothing further has been done. (May 3, p. 631.)

CANADIAN PACIFIC.—This company, it is said, is planning to make improvements to reduce the grade at the "Big Hill" between Field, B. C., and Hector, the steepest rise on the whole line. The change will cost about $500,000, and involves the cutting of two long curving tunnels, one on each side of the Kicking Horse river, and putting up three bridges. The grade on this seven-mile section will be reduced from 4½ per cent. to 2¼ per cent. It is expected that this work will be commenced during the early summer, and contracts asked for within a few weeks.

Necessary right of way, it is said, has been secured for the proposed branch line from New Westminster, B. C., to Eburne, and bids for the work will be called for immediately. The line, which will be 9½ miles long, is to be finished and ready for operation by October.

FREDERICKSBURG TERMINAL.—Under this name a company is being organized to build a line from Fredericksburg, Tex., south to a connection with the San Antonio & Aransas Pass, 24 miles. It is proposed to use 17 miles of an old grade. T. D. Smith, Fredericksburg, Tex., is interested.

FRIO VALLEY.—Incorporated in Texas with $125,000 capital to build a line from a point on the Southern Pacific between Sabinal and Yucca northwest to Leakey, about 40 miles. General offices at Leakey. The incorporators include: E. E. Wolf, M. Wolf, G. G. Pryor, W. E. Bradway and Sidney Rosenthal, all of Chicago, Ill.; R. Carrillo, of New York; E. M. Tillman and A. J. Ball, of Dallas; S. H. Weis and M. L. Oppenheimer, of San Antonio.

GRAND TRUNK PACIFIC.—Work has been started in New Brunswick, on Division five, between Edmundson and the Quebec boundary. Lyons & White, who have the contract for this section, have sublet the work in small sections.

J. D. MacArthur, of Winnipeg, who has the contract for work on this road from Winnipeg east to Peninsula Crossing, 245 miles, has sublet 25 miles to the Eastern Construction Company, of Ottawa.

GREENVILLE & KNOXVILLE.—An officer writes that this company is building with its own forces a line from Greenville, S. C., north via Travellers Rest, Marietta, River View, River Falls and Flat Rock to Hendersonville, N. C., 56 miles. About 19 miles graded and 14 miles of track laid to Marietta. Contracts for part of the work are to be let about July 1. Forty miles of the road will be through the Blue Ridge mountains. There are to be two steel bridges, two steel viaducts and four short tunnels. W. D. Patterson, President, Atlanta, Ga., and J. N. Johnston, Chief Engineer, Travellers Rest, S. C.

HOBOKEN MANUFACTURERS' RAILROAD.—This company was recently incorporated in New Jersey with $800,000 capital to build a line paralleling the Jersey Junction and the branch lines of the Erie and West Shore, connecting with the Delaware, Lackawanna & Western on the south, and extending north to the tracks of the Hoboken Shore Railroad near Willow avenue and Fifteenth street, Hoboken. The Shore road skirts the water front of Hoboken from Fifth street north, and furnishes railroad facilities for the steamship company. This road has been leased by the Hoboken Manufacturers' Railroad.

ILLINOIS & FOX RIVER CENTRAL.—Incorporated in Illinois with $50,000 capital and office at Chicago, to build a line from Chicago through Cooke, Will, Grundy and La Salle counties to Ottawa. The incorporators include: William N. Makutcheon, N. Luster, N. Gulano, J. F. Gearon and J. F. Hope, all of Chicago.

ILWACO RAILROAD.—See Oregon Railroad & Navigation Co.

LAWTON, WICHITA FALLS & NORTHWESTERN.—This company, which has projected a line from Lawton, Okla., south to Wichita Falls, Tex., 49 miles, it is said has surveys made, rights of way secured and the necessary capital for carrying out the work. Contracts are to be let in August. A. J. Robinson, Chief Engineer, Frederick, Okla.

LORAIN & WEST VIRGINIA.—See Wabash.

LOUISVILLE & NASHVILLE.—See Morganfield & Atlanta.

MEMPHIS & GULF.—This company, which filed its charter in 1903, has recently been incorporated in Mississippi with $10,800,000 capital to build a line from Memphis, Tenn., south via Meridian, Miss., thence to the Gulf of Mexico, 350 miles. The incorporators include: H. B. Cornell, A. S. Lyman and C. P. Blair, of New York; L. H. Moen, Newark, N. J., and C. H. Pond, Moorhead, Mass. C. H. Pond is President, and R. B. Sims, Treasurer.

MEXICO, SANTA FE & PERRY TRACTION.—An officer writes that contracts are to be let next month for building this proposed electric line from Mexico, Mo., northeast via Molino and Santa Fe to Perry, 27 miles. The work will include two steel bridges and three trestles. S. L. Robison, President, Mexico, and C. O. Thon, Chief Engineer, Brilleville. (May 10, p. 663.)

MORGANFIELD & ATLANTA.—This company, it is said, completed its line from Morganfield, Ky., south to Providence, 28 miles. This is reported to be a Louisville & Nashville project. (March 17, p. 387.)

NEVADA ROADS.—A bill has been passed, authorizing W. P. Jennings, of Salt Lake City; H. E. George and H. Gently, of St. Thomas, Nev., to build a line from Moapa, Nev., on the San Pedro, Los Angeles & Salt Lake to the Grand Gulch mining district, 150 miles. It is planned to build 25 miles this year.

NEW YORK CITY TUNNELS.—A junction of the two sections of the north tube of the Belmont tunnel from Forty-second street, Manhattan, with the one from Long Island City was made on May 16. According to the plans this is to be finished and ready for the operation of trains by the New York & Long Island about August 1. It will probably be about two months before connection is made in the second or southeast tunnel. Mr. Belmont and associates secured the tunnel rights and franchise from the Steinway syndicate, which began work in February, 1904, and was suspended and taken up by the new owners early in 1905.

NEW YORK SUBWAYS.—Bids are wanted June 13 by the Board of Rapid Transit Railroad Commissioners, 320 Broadway, New York, for building sections of route No. 9 as follows: From a line crossing Centre street about 40 ft. north of Pearl street, and the southeasterly side of Park Row. This work will consist principally of an underground railroad station, together with the tracks running through it and extending for short distances north and south. Suitable cross-overs, turn-outs and sidings are also to be provided. The tunnels are to have a height of not less than 13 ft. in the clear, and a maximum width of 15 ft. for each track, except at curves, etc. Separate bids are asked for the construction of pipe galleries on the west side of Centre street.

For the section in Delancey street, between the Bowery and Norfolk street, and separate bids for the pipe galleries through Delancey street.

For the section from the north side of Broome street and curving through Cleveland place (formerly Marion street) and private property into the new Delancey street extension, and thence under said extension and under and across the Bowery, and under Delancey street to a point about 225 ft. east of the center line of the Bowery. Separate bids wanted for the pipe galleries through Delancey street and the new extension.

OREGON RAILROAD & NAVIGATION CO.—The Ilwaco Railroad Company has asked for incorporation in the state of Washington. The new company is to have a capital of $350,000, and is being formed as a reorganization of the Ilwaco Railway & Navigation Company, which extends from Baker's Bay, at the mouth of the Columbia river, north along North Beach to Nahcotta, on Shoalwater bay, 16 miles. The new corporation will take over the property of the I. R. & N., including the new line under construction, from Ilwaco east up the Columbia via Cook's Landing to Knappton. The incorporators are William Crooks, R. Blaisdell and H. F. Connor.

OWENSBORO & ROCKPORT TERMINAL & BRIDGE COMPANY.—This company, recently organized to build from Owensboro, Ky., north to Northport, Ind., 12 miles, including a bridge over the Ohio river, it is said, will let contracts early this fall for the work. (Mar. 29, p. 468.)

PENINSULAR (ELECTRIC).—An officer writes that contracts were to be let early this month and work is to be started shortly on an electric line from Bartow, Fla., west via Mulberry, Plant City, Collinstown and Thonotosassa to Tampa, 50 miles. E. C. Stuart, President, Bartow, Fla., and the Evers Engineering Company, Cleveland, Ohio, Engineers. (Apr. 26, p. 599.)

PENNSYLVANIA LINES WEST.—The double-track work on the Pittsburg, Cincinnati, Chicago & St. Louis between Columbus, Ohio, and Bradford Junction, 83 miles, is nearing completion. In April, 1905, this work was started from Woodstock, to which point double track had been laid, west to Urbana, about 15 miles. This section required about 305,000 yds. of grading and 5,600 yds. of masonry construction, and involved the reduction of the grade from 0.9 per cent. to 0.7 per cent. At Woodstock the tracks were raised and grade crossings eliminated. East of Urbana two important road

crossings were eliminated, the streets being built under the tracks. New freight and passenger facilities were added at Covington. Work on the double-tracking from Urbana to St. Paris is still under way. The grading on this section amounts to 1,000,000 yds., and the masonry 11,100 yds. The grade on Blue Hill, west of the Mad river, has been reduced from 1.1 per cent. to 0.7 per cent., and more than one-third of the grading is finished and nearly three-quarters of the masonry. From St. Paris to Jordans, beside the second track work, an eastbound freight track has been laid, involving 196,000 yds. of grading and 5,100 yds. of masonry. The maximum eastbound grade has been cut down from 0.85 per cent. to 0.7 per cent. This finishes the double-tracking except through Piqua, where the tracks occupy a street.

Pittsburg, Cincinnati, Chicago & St. Louis.—See Pennsylvania Lines West.

Riverside & Gulf.—Incorporated in Texas with $50,000 capital and office at Milvid in Liberty County. The company is planning to build a line from Wallisville, Chambers County, north to Liberty and Polk counties to a point on the Trinity river, about 50 miles. The incorporators include: E. H. Green, Jr., and W. H. Brown, of Beaumont; C. S. Vidor, A. W. Miller, C. H. Moore, B. I. Sparks, R. E. Meese, B. Moore, K. Moore and M. R. Zincke, of Galveston.

Saratoga & Encampment.—This company, which is building a line from Walcott, Wyo., south to Encampment, 45 miles, has started track-laying from Walcott to Saratoga, 25 miles, and expects to soon have trains running over this section. Grading work under way between Saratoga and Encampment.

Savannah & Southwestern.—An officer writes that contracts will shortly be let for building this proposed line from Clyde, Ga., via Glenville, Boxley, Douglas, Moultrie and Cairo, Ga., and Quincy, Fla., Bristol and Blountstowe to St. Andrews Bay, about 350 miles. There are to be two steel bridges, each 100 ft. long. Harvey Granger, President, and D. B. Dunn, Chief Engineer, Savannah, Ga. (May 17, p. 695.)

South & Western.—Contract is reported let by this company to the MacArthur Construction Company, for building an extension from Alta Pass, N. C., south to Marion, 30 miles. The work on this section will be the heaviest on its proposed extension south, necessitating the piercing of about 18 tunnels.

Toledo & Ohio Central.—Plans, it is said, are being made to extend the line from St. Mary's, Ohio, west to Celina, 10 miles. The line, if built, will parallel the Lake Erie & Western.

Wabash.—On the extension building under the name of the Lorain & West Virginia, from Wellington, Ohio, north to Lorain, about 35 miles, tracklaying has been finished and ballasting work is now under way. Of this, 15 miles were finished last year. It is expected to have the line in operation about July 1.

Western Allegheny.—See Bessemer & Lake Erie.

Wichita Falls & Northwestern.—This projected line from Wichita Falls, Tex., northwest to Mangum, Okla., about 90 miles, an officer writes, has been finished from Wichita west for 20 miles. The work includes a 4,200-ft. trestle over the Red river. J. A. Kemp, President, and J. W. Field, Chief Engineer, Wichita Falls.

RAILROAD CORPORATION NEWS.

Augusta, Winthrop & Gardiner Street Railway.—See Lewiston, Augusta & Waterville Street Railway.

Brooklyn Rapid Transit.—Meetings of the stockholders of the Brooklyn Union Elevated have been called for June 10, to approve a mortgage for $20,000,000, and of the stockholders of the Nassau Electric for June 11, to approve a mortgage for $5,000,000. The bonds to be issued under these mortgages are to refund the Brooklyn Rapid Transit, of which these companies are subsidiaries, for advances made and hereafter to be made by the parent company for the improvement of the smaller companies. The New York State Railroad Commission has recently consented to mortgages by the South Brooklyn for $4,000,000, the Canarsie Railroad for $2,000,000 and the Sea Beach Railway for $2,000,000, all these companies being subsidiaries of the B. R. T., and the mortgages being made for the same reasons as those of the Brooklyn Union Elevated and the Nassau Electric.

Canadian Northern.—This company has acquired a controlling interest in the $4,300,000 capital stock of the Quebec & Lake St. John, which runs from Quebec to Roberval, on Lake St. John, 189 miles, with a branch from Chambord, near Roberval, northeast 51 miles to Chicoutimi, at the head of navigation on the Saguenay river. It connects with the Canadian Northern at Riviere a Pierre Junction, 57 miles from Quebec. A branch from La Tuque Junction to La Tuque Falls, 40 miles, has just been finished and surveys have been made under the name of a subsidiary company for an extension from Roberval to Chute a L'Ours, 30 miles. The principal traffic is lumber.

Chicago Great Western.—Application has been made to the New York Stock Exchange to list $2,000,000 additional 4 per cent. debenture stock, of which there is $26,127,089 outstanding.

Chicago, Milwaukee & St. Paul.—In an interview at Aberdeen, S. Dak., last Saturday, President Earling said that trains would be running over the St. Paul's Pacific extension as far as Butte, Mont., by next January. The extension, which is under way from Glenham, S. Dak., west, is being pushed with all possible speed.

Cleveland, Cincinnati, Chicago & St. Louis.—This company has sold to a syndicate headed by Moffat & White and J. & W. Seligman & Co., New York, $5,000,000 four-year, 5 per cent. notes, dated June 1, 1907. They are being offered to the public, for delivery on that date, at 96½ and accrued interest. The proceeds are for improvements.

Delaware & Hudson.—This company has sold to Kuhn, Loeb & Co., J. P. Morgan & Co., and the First National Bank of New York, $10,000,000 equipment trust bonds. Though they are secured on new equipment, the whole principal matures in 15 years, instead of in installments.

Erie.—This company has borrowed $5,000,000 from J. P. Morgan & Co., giving for it one-year notes. The terms are similar to those of the $5,500,000 borrowed from the same firm early in April, except that, it is said, the new money will not cost the railroad company so much as before. (April 12, p. 532.)

Grand Trunk.—See Wabash.

Hocking Valley.—See Kanawha & Michigan.

Interborough-Metropolitan.—The directors have authorized an issue of $15,000,000 collateral trust, 5 per cent., three year notes, which, it is understood, are not to be issued until market conditions are more favorable. The notes are to be secured on $8,000,000 Metropolitan Street Railway notes and blocks of the stock of subsidiaries of the Metropolitan Street Railway. It is stated that the Interborough-Metropolitan has sold about $3,000,000 6 per cent., six months notes to provide mostly for construction.

Jackson Consolidated Traction.—See Michigan United Railways.

Kanawha & Michigan.—A meeting of the stockholders has been called for June 4, to authorize an issue of $2,500,000 second mortgage, 20 year, 5 per cent. bonds redeemable at par and interest on any interest day. Most of the proceeds will be used to pay off $2,241,000 floating debt. The Hocking Valley, which controls the road and holds most of the notes constituting part of the floating debt, is to buy half of the new bonds and a syndicate is to be formed to take the remainder. It is stated that this refunding plan will allow of the beginning of dividend payments on the $9,000,000 outstanding K. & M. capital stock, so that a semi-annual dividend of 1 per cent. may be declared on July 1. The merger of the Kanawha & Michigan and the Hocking Valley has been under consideration since last summer. A few months ago it was announced that a refunding plan had been agreed on to be operative only in case the consolidation with the Hocking Valley did not go through. (March 8, p. 322.)

Kansas City Southern.—It is said that the Chairman of the Board will propose to the Board of Directors that half of the net income after charges be distributed as dividends. An initial dividend of 4 per cent. was declared on the $21,000,000 preferred stock on April 3, 1907, and if distributions be made as suggested above, a dividend of about 2 per cent. on the $30,000,000 common stock could be paid out of earnings for the current fiscal year.

Lewiston, Augusta & Waterville Street Railway.—Under this name the Lewiston, Brunswick & Bath Street Railway and the Augusta, Winthrop & Gardiner Street Railway have been consolidated. The roads have 90 miles of line in and near Augusta and between Auburn and Bath. About 60 miles of connecting roads will be built.

Lewiston, Brunswick & Bath Street Railway.—See Lewiston, Augusta & Waterville Street Railway.

Michigan United (Electric).—This company is negotiating for most of the $1,000,000 capital stock of the Jackson Consolidated Traction Company, which owns and operates 30 miles of street and interurban lines in and near Jackson, Mich. The smaller company is to be merged with the Michigan United, giving the last named company in all about 185 miles of road.

Quebec & Lake St. John.—See Canadian Northern.

Wabash.—According to press despatches from Detroit, this company has finished arrangements to buy the Grand Trunk's line from Niagara Falls, Ont., via Welland Junction, to Windsor, 226 miles. The Wabash has had trackage rights over this line for some years.

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EDITORIAL ANNOUNCEMENTS.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Old and New Methods of Rail Making... 729
- Valuation of Railroads 730
- The Public Utilities Bill..... 731
- New Publications 732

ILLUSTRATED:
- An Attractive Suburban Station on the Pennsylvania Lines. 733
- Phillips Automatic Train Stop..... 734
- A Modern Tariff 735
- Proposed Union Station at Ottawa 745
- Mountain Scenery on the Moffat Road.... 749
- Proposed East River Bridge: New York Connecting Railroad. 750

MISCELLANEOUS:
- The Prussian Railroad System. 732
- Further Aspects of the Southern Situation 735
- Public Utilities Bill. 736
- Track Deformations and Their Prevention 746
- Plain Words from a Canadian Judge..... 748
- Traffic Through the "Soo" Canals and the Detroit River. 748
- Unnecessary Empty Car Movements between Chicago Terminals 752
- Foreign Railroad Notes: Disadvantages of Metal Ties. ..... 733; Hungarian Gages ..... 744; Prussian State Railroads ..... 744; German Coal Production. 744

GENERAL NEWS SECTION:
- Notes 753
- Trade Catalogues 755
- Meetings and Announcements 756
- Elections and Appointments..... 756
- Locomotive Building 757
- Car Building 758
- Railroad Structures 758
- Railroad Construction 759
- Railroad Corporation News 760

VOL. XLII., No. 22. FRIDAY, MAY 31, 1907.

OLD AND NEW METHODS OF RAIL MAKING.

Rail makers claim that excessive rail breakages are due to the increased fiber stresses under modern heavy engines and cars. The record of at least one western road is contrary to this assertion as shown by the following extract from a letter recently received from the general manager:

"The average rail section rolled at this time for main track weighs from 80 to 90 lbs. to the yard, and the average engine axle loading is from 40,000 to 50,000 lbs. The average rail section rolled 18 to 20 years ago for main track weighed 60 lbs. per yard, and the record of locomotive builders for that period shows that the average engine axle loading was from 25,000 to 32,000 lbs. The resulting fiber stresses under these two conditions are practically the same.

The record of breakages of 60-lb. and 80-lb. rail on this system for the year 1906 discloses rather surprising results, bearing in mind that the same engines with more than 40,000 lbs. axle loads were used in regular service on both weights of rail:

Mileage of 80-lb. rail rolled 1898 to 1906....30 per cent. of total.
Mileage of 60-lb. rail rolled 1881 to 1887....70 per cent. of total.
Breakages of 80-lb. rail..25 per cent. of total number rails broken.
Breakages of 60-lb. rail..75 per cent. of total number rails broken.

One 80-lb. rail was broken for each 20.5 miles of track laid with 80-lb. rail; one 60-lb. rail was broken for each 16.3 miles of track laid with 60-lb. rail, but when we consider that the fiber stress in the 60-lb. rail exceeded the stress in the 80-lb. rail, under actual loading, by 49 per cent., it is apparent that the 60-lb. rail, subjected as it is to so much heavier deflection under its load than the 80-lb. rail, must be a rail of better quality than the 80-lb. rail with which it is compared."

The 80-lb. rails of recent rolling had, on the whole, a better chemical composition than the old light rails of 20 years ago. The difference in quality appears, therefore, to be due to differences in the mechanical and heat treatment during manufacture. Throughout the many recent discussions of rail failures, reference has frequently been made to the old John Brown rails imported from England between 1860 and 1870. These rails, low in carbon and all other hardening constituents, have given from 30 to 35 years' service before wearing out, not breaking. They were made by hammering the ingot into a bloom and rolling and rerolling at low temperature with frequent reheating. An output of 100 tons a week was exceptional. The whole secret of their long life was in the mechanical work put into the metal at low temperature, permeating to every part of the finished rail. Contrast this with the present methods of rail making. The ingot, 20 in. to 24 in. square, heated to a white heat and insufficiently cropped, is bloomed by a few heavy passes in one mill and immediately run into the rail mill where it is finished, in some cases, in seven passes and run to the cooling beds at a bright red heat. Such methods will produce 1,800 tons a day, but at the expense of violating most of the fundamental principles of the steel makers' art.

Last year at the meeting of the Iron and Steel Institute, Albert Ladd Colby, in defending the output of American rail mills, said:

"The gradual increase in the daily output of American rail-mills during the last decade is not due to an increase in the speed of the rail train, prompted by a reckless desire for increased tonnage, independent of the quality, strength and finish of the product, but to radical improvements resulting in a much better balance between the producing and finishing ends of the mill."

It is not alone, however, the speed of the rail train which determines the quality of the finished rail. Fifteen or twenty years ago the almost universal practice was to reheat the blooms before rolling into rails, and 13 to 15 passes were usually given in the mill. The engines and rolling mills of those days were not powerful enough to reduce an ingot in three passes, and a bloom in seven passes. No attempt was made to finish a white hot ingot in one heat far above the critical temperature of 825 deg. It is putting the cart before the horse to hold the rails before the last pass; the previous overheating and lack of effective mechanical work leave the mass of metal in the interior of the head coarse and weak and cold rolling can only give a thin, hard shell, which soon wears off, exposing the soft metal underneath. With modern mill practice the only way to secure hardness and wearing qualities throughout the head is to increase the carbon to a point where the rail is brittle because of the unavoidable presence of high phosphorus.

The value of annealing rails before finishing and thereby overcoming most of the faults of overheating and rapid working has long been recognized, but sadly neglected, because it introduces a halt in the continuity of the whole process of rail making from the blast furnace to the gagging presses. Robert Job has said:

"The toughness and elasticity of the fine granular structure produced by annealing at the proper temperature permit an increase in the hardening contents considerably beyond the point which otherwise would be safe, thus obtaining greater capacity for wear. Unfortunately, annealed rails, with their freedom from brittleness and internal strain are of hardly more than

theoretical interest, since they cannot be obtained in any considerable quantities under present conditions."

In view of the present deplorable conditions it would seem that any process of improving the quality of rails is of more than theoretical interest.

VALUATION OF RAILROADS.

Along with the closing sessions of the state legislatures, after the enactment of their astonishing budgets of anti-railroad legislation, there comes a general belief that the attention, both of the national government and of the state governments, will be turned next winter toward valuation of railroads. In some localities the intention is to use such valuation primarily as a basis for taxation, but the idea that is in the air goes further than this. As suggested by the President of the United States, and as already taken up by a number of states, notably Virginia, Kansas and South Dakota, it indicates the effort to establish a basis for restriction of new issues of capital and for limitation of the rates charged passengers and shippers. We have already discussed the valuation plan, and accepted as our point of view that of Henry Fink, who points out the two cardinal objections, that cost is not identical with value, and that capitalization or value of property has nothing whatever to do with the reasonableness of rates. Yet we believe that the railroads of the country must face a widespread movement for valuation for the purposes named above, and it is of interest to consider both the procedure of the appraisers and the results of the effort to restrict rates and new capital to conform with their findings.

Since the earliest days of taxation, a rough sort of valuation has been placed upon railroad properties, and the crudities of all the systems employed for this purpose have been glaring and well known. In 1903 the Interstate Commerce Commission prepared a 12-year review of state railroad taxation. Up to 1902, the last year covered by this study, it may be said roughly that 32 states and territories ordered the general value of the property to be taken as a basis of taxation, this general value often being specified to include the appraised value of roadbed, track and other property, real and personal, and sometimes, but not always, franchises as well. Ten states in 1902 specified gross earnings arising from business within the state, as a taxation basis either in whole or in part, and in one case (Texas) gross receipts from passenger traffic were made an additional basis besides the general value of the property. Net earnings were made part or all of the basis in Delaware and Virginia, and appraised value of capital stock was required to be made the principal basis (subject to certain deductions) in Connecticut and Massachusetts; one of the two bases in Pennsylvania and Kentucky, and was also made a secondary specified consideration in Delaware, the District of Columbia, Mississippi and New York.

It is easy to understand that the results from all this diversity and from the quite indefinite restriction laid down by statute should have been generally unsatisfactory to commonwealth and to carrier alike. In a report issued this year by an investigating committee of the Wyoming lower house, some of these difficulties are pointed out. A committee finds that the valuation in 1906 was approximately the same as the valuation in 1891, for the simple reason that the appraisers had no idea how to go about their business, and were therefore disposed "to assess the railroads as nearly as possible in accordance with the amount assessed against them the previous year, without regard to actual value and without regard to the assessment on other property. There was nothing before the board in 1906, the records of which we have examined, from which to determine any value; only two roads, the Oregon Short Line and the Chicago & North-Western, fixed opposite the items the value thereof, and in these cases the value given is only from 20 to 30 per cent. of the actual value."

The Wyoming investigating committee expresses the belief that the so-called "stocks and bonds" method, that is, determination of the true value of a road by adding the average value of all the stocks and bonds through a given period, as determined by market prices, would perhaps come nearer to the truth than any other single method, and in this we concur. But the Virginia State Corporation Commission demurs to this point of view and says it knows of no more reliable method of arriving at the value of railroads than to give consideration to the following matters taken together:

1st. The original cost of the property so far as it can be shown.
2d. The amount of the capital and bonded debt of the company applicable to the property in the state.
3d. The market value of the stock and bonds.
4th. The cost of reproducing the property anew in its present condition so far as it is shown.
5th. The cost of reproducing the property in its present condition so far as it is known.
6th. The properly assessed value of the property for purposes of taxation.
7th. The personal knowledge of the property by the Commission.

This curious tangle of ideas, which starts with a non-relevancy and ends with a guess, illustrates pretty well what may be expected of the legislative mind when it turns its attention to valuation. We venture respectfully to suggest that there never lived a statistician who could make seven separate valuations along the lines suggested which would have any useful relation to each other. Of course a stock and bond valuation is the best, because it shows what the people of the country are willing to pay for a certain railroad, without attempting to formulate all the intangible items that cause their belief, including management, which we challenge any equalization board to value by rule.

We are not disposed to quarrel with the attempts to ascertain a reasonable and sane basis for the taxation of railroad property. In some states this taxation is notoriously low at the present time; in some states it is notoriously high, principally for the reason that in the absence of any one reasonable way of determining the road's value it is taxed in each and every way that shows its head, for the benefit both of the commonwealth and of local bodies. As we see the essentials of state taxation they are, first, that a commercial value be placed upon the property, not a physical value which means nothing, and then that the property be so taxed that it will bear a burden proportionate to that of the other commercial values in the same commonwealth. We are frank to admit that there are some states where the railroads have evaded payment of their just proportion, but it is also obvious that there are a number of states where the railroads are forced to pay far more than their just proportion. We do not suppose that a valuation based upon the market price of stocks and bonds is going to be an easy and an all-sufficient method, because, with this valuation established, there remains an apportionment of it between the several states covered by a single system. The apportionment could perhaps be made on the basis of gross earnings arising from traffic carried within the state. It certainly could not be made on the basis of the cost of building or even of replacing the lines as they exist, unless the valuation for purposes of taxation is to be definitely admitted a different one from the true commercial value of a property.

But the clear and important moral of these abortive state attempts at fixing the value of railroad properties is that the thing cannot be done on a physical basis, and that appraisal of cuts, fills, bridges, stations and rolling stock in no way indicates what a road is worth. This is a cardinal principle which the state or national appraisers ought to keep in mind, although they probably will not do so. It should be clearly understood by everybody that a physical valuation will be a wrong valuation. An attempt to determine by such a valuation whether or not a railroad is overcapitalized and to restrict its future issues because the commission or appraisal board believes that the value of a property is overstated in the securities outstanding against it, must lead to very grave injustices and to the restriction of legitimate railroad enterprise. An attempt to use such a valuation or any other valuation as a basis for determining whether or not rates are reasonable is pure folly. To give but a single example of this, suppose we assume that there are two competing railroad routes between cities 300 miles distant, one railroad being the first comer, long established, and a branch of a prosperous system, had, let us assume, not only the choice of routes, but was supplied with abundant funds to build a substantial low-grade line. The other road, reaching the same points by a more roundabout route, had difficulty from the start in finding construction funds and was compelled to build a line abounding in grades and curves. Now it may easily come to pass that the first of these lines may have three times the capital debt outstanding that the second has, and yet it may be doing its business far more efficiently and may be making more money out of it. If an appraisal board decides that it is overcapitalized and reduces its freight charges on that account, the result will presumably be to bankrupt the younger competing line which is under no suspicion of overcapitalization, but must meet the lowest rate between the two points if it expects to do any business.

Examples could be multiplied indefinitely to show that rates and capital are things that have no connection with each other in any region where there is competition direct or indirect (and this includes practically the whole length and breadth of the United States, for competition means not alone the necessity of providing transportation at the rate set by others, but also the necessity of that manufacturers of every commodity be enabled to get their goods

to market as cheaply as other manufacturers in the same line of business do, whether they are located on the same railroad or not). We can freely say, therefore, that we see no good or useful object to be attained in a physical valuation of railroads as a basis of taxation, capitalization or rate making, nor in a commercial valuation as a basis of rate making, and we believe that attempts to restrict the issue of new capital are highly perilous to the interests both of the railroads and of the country they serve, unless these attempts are carried out with a degree of wisdom not ordinarily found. The kind of administrative wisdom we need for such a task is that of an Albert Fink or a Henry Fink; the kind we are pretty sure to get is that of the Virginia commission quoted above, with its inconsequential and self-contradictory ways of arriving at a valuation.

THE PUBLIC UTILITIES BILL.

The legislature of the state of New York has passed, by unanimous action in the Lower and all but unanimous action in the Upper House, the Public Service Commissions Law, or the Public Utilities Bill, as it is generally called. This was vetoed on Tuesday of this week by the Mayor of the city of New York on two general grounds, first, that although it extends the power of the public authorities over public service corporations, it violates the principle of home rule in that the New York City Commissioners are to be appointed by the Governor; and, second, that as there is no provision for making the commissions bi-partisan or non-partisan, they can be used under a partisan Governor to influence and coerce corporations and to secure from them money with which to corrupt the electorate. The bill, however, is likely to be repassed over his veto. This law embodies the ideas of Governor Hughes for control of public service corporations in the state of New York. Politically, it is a remarkable example of the passage of a bill by the force of public opinion, said public opinion being in the main ignorant of its provisions and effect. "Hughes is in favor of it," and for this reason so is the average citizen.

The bill itself is advanced public service legislation in that it recognizes in terms of law new ideas, which have only recently been generally accepted, of the duties of quasi-public corporations. Railroads, street railways, express companies, car companies, freight line companies, pipe lines, gas and electric companies are all made subject to the authority of two public service commissions, whose powers extend as far or farther than the "strongest" commission of the most radical western state. The commissions are to have much more than the rate-making power, usually the extreme mark of commission authority. As was said in the *Railroad Gazette* of April 26, 1907, in which the unamended bill was reviewed, it grants extraordinary powers in the regulation of the details of railroad operation. One of the sections there quoted and characterized as almost surely dangerous, that giving power to the commissions to regulate the number and efficiency of employees, has been omitted from the final draft of the bill; the other, giving power to order changes in the time schedule and number of trains or cars, is still included.

The correct corollary of clothing commissions with such complete powers is to get able men as commissioners. This is attempted in two ways: The salary of each commissioner is to be $15,000 a year, half as much again as the Governor's money compensation, and the commissioners are appointees of the Governor and removable at his pleasure, this on Governor Hughes' argument that if the commissioners are bad the Governor can be directly held responsible.

On another page we print the law in full. It is important enough to be read from beginning to end by railroad officers in New York or any other state. Without attempting to summarize or discuss it all it may be worth while to comment on certain of its provisions. The state is divided into two districts, the first including New York City, the second all other counties of the state, with a commission of five members in each district. The control of steam railroads throughout the state will come almost entirely under the authority of the commission of the second district whose headquarters are to be at Albany; similarly, street railway lines about New York City will, in most cases, be brought under the authority of the commission of the first district. Each commissioner, the counsel and the secretary to each commission and all additional officers and employees (whom the commission has the power to employ at its pleasure) are to be and be deemed to be public officers. No person shall be a commissioner or hold any position under a commission who owns stock or bonds in any corporation subject to this law. The officers of each commission shall be open for business from 8 a.m. to 11 p.m. every day in the year. This does not give the commissions the appearance of a sinecure. No commissioner, officer or employee may be offered a free pass or transportation, nor may any commissioner or employee suggest, request or recommend directly or indirectly to any corporation under its authority the appointment of any person to any position or employment. Any person who refuses to answer a question or produce papers when ordered so to do shall be guilty of a misdemeanor. The commission shall not be bound by the technical rules of evidence. No person shall be excused from testifying on the ground that his testimony may incriminate him, but no person having so testified shall be prosecuted or punished for any wrongdoing so disclosed, except perjury committed by him in his testimony. Nothing in this section, however, is to be construed as in any way giving to any corporation immunity of any kind. All actions at law under the act shall be preferred over all other civil causes, except election causes, in all courts of the state of New York. These are some of the more striking of the general provisions in article I.

Article II provides that every corporation shall furnish safe and adequate service at just and reasonable charges, to be determined by judgment of the commissions. Railroads are to build switch and side track connections when reasonably practicable and justified by the amount of business to be done; this to be decided by the commissions. Every common carrier shall file with the commission sworn copies of every contract, agreement or arrangement with any other common carrier relating in any way to transportation of passengers, freight or property. The commissions have power to make regulations for distribution of freight cars to shippers, for switching, for loading and unloading, for demurrage charges and for weighing of cars and freight. No contract in any receipt or bill of lading shall exempt any railroad for any liability from loss, damage or injury caused by it to freight or property. In any action to recover damages sustained by delay in transit, the burden of proof shall be on the carrier to show that such delay was not due to its negligence. No carrier shall be allowed to prevent the continuous carriage of freight and property from a shipping point to destination.

Article III defines the powers of the commissions in respect to railroads and other common carriers. Complaints may be made to the proper commission by any person, upon which the commission shall cause a copy of the complaint to be forwarded to the corporation complained of, accompanied by an order requiring that the complaint be satisfied or that the charges be answered in writing within a specified time. Rates, fares, regulations, practices, equipment, appliances, service repairs or changes, time schedules, number of cars and trains, accidents and accounts of common carriers all come within the power of the commissions. No company shall have the right to carry on any new construction without first obtaining the approval of the proper commission. No railroad franchise or any rights under such franchise shall be transferred nor any agreement made without similar approval. No railroad corporation shall acquire *any part* of the capital stock of any other railroad in New York State, unless authorized. Except for purposes of collateral security, with the consent of the commission, "no stock corporation of any description, domestic or foreign, shall purchase or acquire, take or hold more than 10 per cent. of the total capital stock issued by any railroad corporation or street railroad corporation or other common carrier organized or existing under or by virtue of the laws of this state." No stock, bonds or other securities for capital account may be issued without the commissions' authority. The commissions shall have no power to authorize the capitalization of any franchise for an amount in excess of the amount actually paid to the public authorities as consideration for its grant. The capital stock of a corporation formed by consolidation of two or more other corporations shall not exceed the sum of the par value of the capital stock of the corporations so consolidated.

Article IV. contains the provisions relating to gas and electric corporations and the regulations of the prices of gas and electricity. Over such companies the commission has sweeping powers, which include fixing the standard quality of gas and electricity, uniform methods of accounting for such corporations, approval of issues of new capital and, on complaint, fixing the maximum price of gas and electricity. The following is a significant provision on this last point:

"If it be alleged and established in an action brought in any court for the collection of any charge for gas or electricity, that a price has been demanded in excess of that fixed by the commission or by statute in the municipality wherein the action arose, no recovery shall be had therein, but the fact that such excessive

charges have been made shall be a complete defense to such action."

Article V abolishes the present Board of Railroad Commissioners, the Commission of Gas and Electricity, the Inspector of Gas Meters and the Board of Rapid Transit Railroad Commissioners.

These comments on the bill make clear the advanced character of many of its provisions. An effective criticism of the whole plan is that the same men are to control gas and electricity and railroads. Although this is logical in grouping these companies under the general head of public service corporations, experience plainly shows that a commission with far less power would have its hands full in dealing with railroads alone. Another criticism is that the commissions' powers violate the rule laid down by President Hadley in his *Railroad Transportation* that in general the more power a commission has the less good it will accomplish. The Massachusetts Railroad Commission established in 1869 is, of course, the classical example. Its power lay in its ability to secure publicity. It had able men as its members and accomplished much. According to President Hadley, "the possession of active general power is a hindrance." Whether or not this will be the case with the new commissions, which combine large provisions for publicity with large powers, will be most important to see. No doubt, as in the case of the Massachusetts commission, their success will depend more than anything else on the quality of the men who are their members.

NEW PUBLICATIONS.

The Design of Walls, Bins and Grain Elevators. By M. S. Ketcham, New York, 1907. *The Engineering News* Publishing Co. Cloth; 6½ in. x 9 in.; 394 pages. Price, $4.

With the possible exception of column formulae there is no subject included under the head of mechanics of materials which presents such diversified theory as the subject of retaining walls, which is the basis of all theoretical discussion of the stresses in bins and other similar structures. The practical application of the theory of the stability of retaining walls is not perhaps so difficult as many capable engineers would lead us to believe by their disregard of mathematical analysis in favor of rule of thumb. The author in his introduction truthfully points out the fallacy of a common argument against retaining wall formulas, that many walls which theory shows are on the point of failure have not failed. In the application of the theoretical analysis to such a case the fault is not in the theory but in the data to which the calculations are applied. Professor Ketcham's work is based largely on Rankine's theory, but he also recognizes Coulomb's theory and the formula deducted by Professor William Cain. The opening chapters are devoted entirely to mathematical and graphical discussions of these three theories which after all do not result in wide differences of design when applied to any one specific problem. The author considers not only plain masonry and concrete retaining walls, but the stresses in reinforced concrete walls, and follows this with chapters describing experiments made to determine the pressures and angles of repose of different materials. Chapters six to nine inclusive illustrate examples of numerous retaining walls which have recently been built, together with some data as to their cost. Much more than half of the book is taken up with discussion of the theory and practice of various types of hoppers, coal bins, etc. Part III. includes the theory and practice of steel and concrete grain elevator bins with numerous examples selected from actual practice. The illustrations cover a wide range of work, but many of the drawings have been reproduced on such a small scale that the detail is lost in the maze of printed notes giving dimensions of members.

Open-Hearth Steel Castings. By W. M. Carr, Cleveland, Ohio, 1907. Penton Publishing Co. Cloth; 118 pages. Price, $1.50.

This is a collection in book form of a series of articles published in the *Iron Trade Review* and the *Foundry*, giving a complete exposition of the methods involved in the manufacture of open hearth steel castings by both the basic and acid processes. The author writes for the practical foundryman and does not go into complex technicalities. The chapter headings include composition of melting stock, furnace construction, fuels, manipulation of heats, relation between composition and physical properties, discussion of the causes of blow holes and cracks in steel castings, heat treatment and annealing, repairs of steel castings and a chapter giving the estimated cost and profit from an open hearth steel foundry. The author estimates that a five-ton furnace can be added to the equipment of an active iron foundry for $10,000, and, making a conservative estimate of the output, he shows a net profit of more than 30 per cent. per year.

Thermal Conductivity of Concrete. By Ira H. Woolson. New York, 1907.

This pamphlet is reprinted from the proceedings of the American Society for Testing Materials and contains a record of some experiments made by Prof. Woolson to determine the heat conducting properties of concrete and the effect of the exposure of concrete to high temperatures with special reference to the adaptability of this material as fireproof in building construction. The tests, while not altogether conclusive, show that concrete offers an extremely high resistance to the passage of heat.

Overhead Contact Lines. By Joseph Mayer. Published by the Author, No. 1 Broadway, New York.

Mr. Mayer's contributions on this subject, which were published in the *Railroad Gazette* and in the proceedings of the American Society of Civil Engineers, have here been expanded and complete calculations given for the design of a new form of overhead suspension. The author claims that the new suspension which he has designed is a safe and durable structure which can be erected at about half the cost of the overhead structures now in use.

Design of a Railway Bridge Pier. By Charles Derleth, New York, 1907. *Engineering News* Publishing Co. Pamphlet. Price, 50 cents.

This pamphlet gives an outline of the method of calculating the general features of a masonry pier to carry the superstructure of a railroad bridge. The calculations are based on the conditions found for pier No. 8 of the Baltimore & Ohio bridge at Havre de Grace, Md.

The Prussian Railroad System.

The whole of the railroads within the kingdom of Prussia are not yet owned by the government. There are still 73 private railroads with a mileage of about 1,750 miles. Gradually, no doubt, they will all be absorbed, for the government has the right to take them over. On the other hand, the Prussian government works the Hessian railroads as well as most of the Prussian, the two together amounting in round figures to 22,500 miles. In addition it works about 1,250 miles of government railroads. It will be seen that the total Prussian and Hessian railroads worked by the Prussian state railroad system is nearly equal to the whole railroad mileage of the United Kingdom.

The Prussian Minister of Public Works is also Minister of Railways. Indeed, with one exception, the Minister of Public Works has always been a railroad man. He is the supreme authority over the Prussian state railroad system. He is assisted, in the first place, by an Assistant Secretary for Railroads. In the second place, there are five great departments immediately subordinate to him and the Assistant Secretary—administrative, financial, traffic, construction, and technical. In addition, the Minister has under his orders a great body of inspectors who act as his eyes and ears. All the advantages of unification being thus secured—and they are many—both in reducing expenses and in insuring uniformity of practice, the government soon found the need for decentralization.

Just as the King is the head of the Prussian army, and through the Minister of War and the great General Staff ensures centralization, yet decentralization is also provided for by dividing the whole military force into Army Corps, so in the state railroad system decentralization is also carried out. The whole network of 22,500 miles is divided into a number of districts. In the densely-peopled manufacturing and industrial parts of the kingdom the number of districts is large, while in the purely agricultural districts it is small. For example, there is only one district in the province of East Prussia, and another in West Prussia. But in the Rhine Province there are as many as four. The principle kept in view when fixing the area of a district is that the president of the board of the district shall be in a position to supervise his district down to the smallest detail. But the framers of this system also desired to admit the public served to some voice in the management. Accordingly, in each of the districts there is a manager assisted by a board, for the actual working of the lines. And side by side with this board there is a district council comprised partly of railroad officials and partly of representative traders. The traders and the officials have an equal voice. But the functions of the Council are purely advisory. It is consulted as to fixing tariffs, the time-table, and so on. The Minister, in addition to this, is assisted by a provincial council, similar to the District Councils. Thus the users of the railroads have a voice in the management, and though the voice is only advisory, it enables the customers of the lines easily to bring before the officials their case for low rates and fares. Furthermore, these advisory councils can bring before the boards or the Ministry the need for new lines, for extensions, and so on. They can, in fact, apparently bring before the authorities almost any question that they please. Thus the railroad officials, from the Minister down, being in constant communication with leading agriculturists, manufacturers, mine-owners, and traders generally, are kept well acquainted with all the requirements of business. Lastly, the boards are in constant communication with the Chambers of Commerce and of Agriculture.

In addition, there is a special arrangement for the fixing of rates and fares. There exists at the present time a uniform tariff. If any change is to be made General Councils and fixed Tariff Commissions, in which both railroad officials and representatives of industry and agriculture have a seat, have to co-operate. These Councils and Commissions are not Prussian, but German; yet they

prevail throughout Prussia. While, as already said, the District Railroad Councils and the Provincial Railroad Council are merely advisory bodies which are utilized by the Railroad Boards or the Minister, in order to arrive at decisions on tariffs and similar subjects, there sit on the Tariff Commission along with the representatives of the German railroads, the representatives of trade, industry and agriculture, all of them possessing equal voting powers. The resolutions arrived at by these bodies are submitted to the General Council and must be either accepted or rejected by that body. The participation of representatives of trade, both on the District and Provincial Councils and in the Tariff Commission makes it certain that the railroad boards become acquainted with all the views of the different classes of industry.

Further, there is not in Prussia any discrimination between individuals or industries. At the same time, special measures are taken to assist German trade when in competition with foreigners. For example, with the object of favoring the export trade of Germany, export tariffs are created, as a rule in connection with a special German port. On the basis of this tariff goods which are destined for foreign ports are carried at a very low rate to the German port designated. Similarly, the raw materials of manufactures imported from abroad are carried from the port of landing over the Prussian railroads at specially low rates. Thus while every effort is made to prevent the giving of preferential tariffs either to individual Germans or to special German trades to the disadvantage of other Germans, there is an avowed preference given to German importers and German exporters to enable them to compete successfully with foreigners.

Last year the net surplus was 7.52 per cent. of the total amount of capital invested, whereas the preceding year it was only 7.17 per cent., from which it will be perceived that although the railroads were primarily purchased by the government for the promotion of trade, the investment has proved exceedingly profitable, and not only has it been profitable in the past, but it is showing increasing profits year by year. The profits from the railroads are spent in betterments and extensions, and likewise in increasing the locomotives and rolling stock generally. The trade of Germany is growing at so rapid a rate that although new rolling stock is added every year there are complaints each autumn that rolling stock is increasing. It is said that two months ago the orders for the insufficient. Consequently, every year orders for rolling stock are New Year were placed and were so large that they would keep the shops fully employed for the whole of the present year.—*The Statist*, London.

There is in Germany a society for the promotion of the use of wood ties, from which it is natural to expect that all the weak points of metal ties will be brought out. At a recent meeting of this society, a paper was read which said that the effect of the two kinds of ties on the ballast was not sufficiently considered. Within the last 25 years the German railroads have spent $48,000,000 for ballast material, and the cost has increased much faster than the mileage of track ballasted. This was charged to the larger proportion of metal ties. These are not so firm in place as wood ties, and require more tamping, which causes the ballast to be crushed into smaller pieces. The trough-like form of the metal tie holds water and causes the collection of mud under them; and when this is frozen, the high conductivity of the metal tie causes it to thaw and become soft while the body of material under it is still frozen hard. Various opinions were expressed in the discussion of this paper, but there was substantial agreement as to the fact that iron ties are more destructive of ballast than timber ties.

An Attractive Suburban Station on the Pennsylvania Lines.

The Pennsylvania Lines West, Southwest System, have recently completed at Torrence Road, Walnut Hills, a suburb of Cincinnati, Ohio, a small passenger station, which, because of its adaptation to meet certain special local conditions, contains some novel features. Its site is on the side of a considerable hill, the districts it serves lying at both the top and foot of the hill. Accessibility was therefore a primary consideration in determining the character of the facilities to be provided for the convenience of patrons, particularly those desiring to reach the station from the north or uphill side of the tracks. These conditions led to the adoption of an overhead foot bridge rather than a subway for this purpose. The square tower, rising two and one-half stories above the platform, contains a stairway and a baggage elevator running from the basement to the covered foot bridge which leads from the tower to a porte cochere and driveway across the tracks. The foot bridge has a reinforced concrete floor and open timber roof, and is supported on two girders of 77-ft. span. The westbound platform is reached from Torrence Road by the covered stairway bracketed to the side of the high retaining wall across from the station. These covered approaches and the butterfly sheds on each platform provide ample protection against the weather.



Torrence Road Passenger Station.

The station itself is an attractive building of Renaissance design. The walls above the foundations, which are of squared rubble limestone, are a very dark brown pressed brick relieved by band courses and quoins of a lighter shade, and buff colored terra cotta trimmings. The whole being surmounted by a red Spanish tile roof, presents a pleasing contrast to the dark walls and sombre hillside upon which the station stands.

The building is warmed by a hot water system and lighted with electricity, which also drives the elevator for raising and lowering baggage from the basement to the train floor or bridge levels. The train floor contains the general waiting room, ticket office, baggage room, women's waiting room and lavatories, the basement being devoted to boiler rooms and utilitarian purposes. The general and women's waiting rooms and the ticket office are finished in dark Flemish oak, with hardwood floors and tinted plastered walls, and are furnished in the Mission style, presenting a comfortable appearance. The station grounds will be made attractive with sodded slopes and vine covered retaining walls. The

architects were Elzner & Anderson, of Cincinnati. We are indebted to Mr. W. C. Cushing, Chief Engineer of Maintenance of Way of the road, for descriptive data.

Phillips Automatic Train Stop.

An apparatus for automatically applying the brakes on a train, invented by Mr. Raymond Phillips, has now been in service on the North Staffordshire Railway, at Newcastle Junction, England, for about two years. Six signals are fitted with track instruments, and the brake-applying mechanism is fitted to one locomotive. The officers of the road speak favorably of it. In this design there are two separate levers on the engine; one to be struck when passing a distant signal at caution and the other to be struck when a stop signal is passed. At the stop signal the application of the brakes is more forcible than at the distant. Whenever the brake apparatus is worked, an audible and a visual signal are given in the cab, and whenever the tripper, fixed on the track, is moved, either by accident or design, a bell is rung in the signal cabin.

Fig. 3 shows the tracks at Newcastle Junction, where six of these automatic stops are installed. The location of each stop is shown by a dotted line connecting with the signal to which it corresponds.

Fig. 1 illustrates the mechanism fixed between the rails near the distant signal. In the lower part of each case is a slide *a* coupled at *b* to the distant signal wire, or in the event of the distant signal being a controlled signal, to the signal rod. The other end *c* of the slide is attached to a balance weight to insure the slide returning to normal. The trippers *d d* stand 12½ in. above the base of rail when up. They have counterbalance weights *e e* to keep them upright, and they can be turned in either direction when struck by the lever on the passing engine. The levers are in duplicate, as one might be broken or not make proper contact. When the slide *a* is drawn to the left, owing to the signal being cleared, the stop *f* on the slide comes against the counterbalance *e*, and so turns the lever *d* to the right and clear of the lever on the engine.

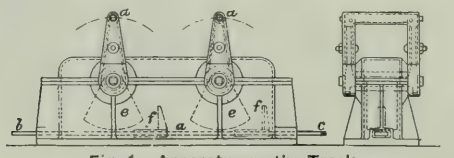


Fig. 1—Apparatus on the Track.

If, however, the signal is "on" the tripper *d* is struck by the lever on the engine.

In the signal box is an electrical repeater with visual indications as to the position of the obstruction. To work this there are electrical contacts on the tripper *d* and thereby the signalman is told if the trip is in proper position when the signal is "on" and whether it has responded to the clearing of the signal when the signal is lowered. Further, a bell is rung whenever the repeater is changed from "on" to "off," whether this is done by the action of the signalman, or by the temporary deflection of the lever, due to its being struck by an approaching train passing the signal in the "on" position. This bell continues ringing until the signalman stops it. The man is thus impressed with the knowledge of the approach of a train.

A similar tripper is fixed at the home signal but not in the same position relatively to the rails as that at the distant signal, and it will strike a second lever on the engine.

Fig. 2 shows the apparatus on the engine. Suspended from the frame is a case in which are two levers *b*, extending about 8 in. below the pivot and engaging the trip *d* (Fig. 1) when the latter is up. One lever is arranged to strike the trip at the distant signal and to apply the continuous brake sufficiently to check the train. The other lever engages the trip at the home signal and applies the brakes sufficiently to bring the train to a stop. In the cab of the engine are two gages c^1 and c^2 containing indicators representing distant and stop signals. When running, these arms are down or "clear," as the vacuum brake reservoir is normally in connection with the gages through the valves similar to *d* which is the distant valve. Should a distant signal be passed in the "on" position the lower part of lever *b* would be turned to the right and the weighted end of lever, e^1, would drop and fall behind the upper part and so hold it. This would allow the piston valve *d* to fall, so cutting off the vacuum from pipe *f* and opening pipe *g* to the atmosphere which would cause the miniature arm c^1 to rise. The other end of lever e^1 is coupled to a piston working in cylinder h^1 which would then be raised and allow air to enter the train pipe through the syren and pipe *j*. This causes the syren to sound and the brakes to be partially applied. In order to release the brake and stop the noise of the syren the three-way cock *k* has to be turned and this connects the reservoir with the lower side of cylinder h^1 through *l*, *m* so that the piston falls and the lever e^1 returns to normal and lifts its weighted end from holding lever *b* off, which would then resume the perpendicular. As the lever e^1 resumed its normal position it would restore piston valve *d* and re-open pipe *f* and close *g* and the distant arm would fall again. The apparatus would then be normal, but to do this the driver has had to turn the three-way cock, otherwise the syren would continue sounding and the brake continue applied.

For the stop signal there are also levers, and a cylinder and similar applications of the brake and sounding of the syren. The

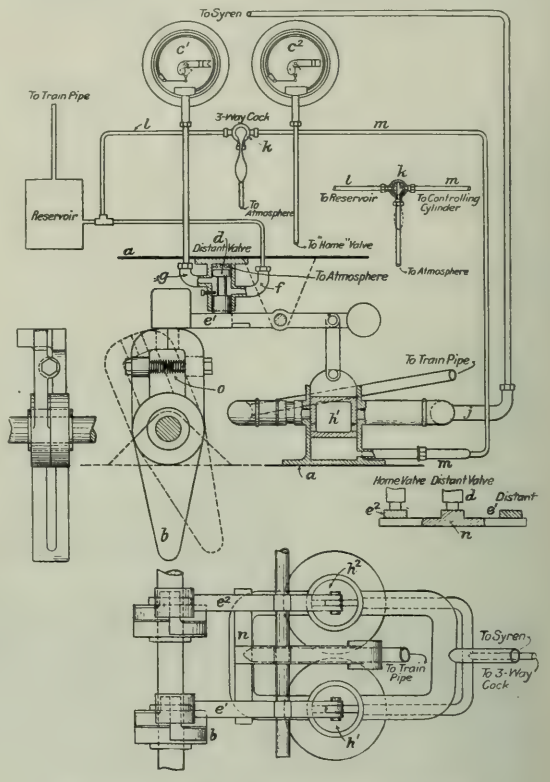


Fig. 2—Arrangement of Apparatus on Locomotive.

lever corresponding to e^1 is e^2 and the cylinder is h^2. But the stop signal lever e^2 controls distant lever e^1, so that both miniature arms will go to "on" when the stop arm is raised. This is to make this form of signaling agree with standard outdoor signaling, and is obtained by using a T lever *n* like the mid-lever of a slot of a signal, and suspending the distant piston valve *d* over the T lever so that when the lever e^2 falls it carries with it lever *n*, so allowing valve *d* to fall. When lever e^1 falls it carries with it lever *n* but not

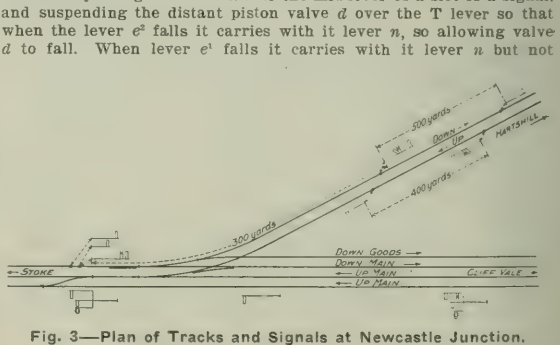


Fig. 3—Plan of Tracks and Signals at Newcastle Junction.

lever e^2. It follows also that a double area is open to the atmosphere when a stop signal is passed at danger, which causes a heavier application of the brakes and which cannot readily be overcome by the engineman.

The lever of the three-way cock is normally down and it is heavily weighted to secure its restoration to that position when turned, so that the bottoms of the cylinders h^1 h^2 are freely exposed to the atmosphere to insure that their pistons rise freely

when the levers e^1 e^2 are operated. The pistons are suspended, so that in the event of anything failing they will fall and apply the brakes.

The striking levers, though mounted on the same shaft, are on separate bushings. Each is made in two parts, like a pair of scissors, and the levers are so constructed that if they broke or if the end was knocked off, the two parts would be forced open by the spring *o*, and so the weighted end of the lever would fall into the opening and apply the brake. Or if the lever was swept away from any cause or any other failure occurred, the piston *d* would fall and apply the brake.

A similar apparatus has also been designed for use with the Westinghouse air-brake. The address of the Phillips Signal Syndicate is Parr street, Liverpool, England.

A Modern Tariff.

We reproduce herewith in full a recently issued tariff of the New York Central & Hudson River and West Shore Railroads covering charges for special freight train movements. The reason for showing the tariff in full just as it stands is to give an example

N. Y. C. & H. R. R. R. TARIFF No. A-6602, I. C. C. No. B-5929, C. R. C. No. 832. NEW RATES.

WEST SHORE R. R. TARIFF No. A-2561, I. C. C. No B-2278, C. R. C. No. 171. NEW RATES.

New York Central & Hudson River Railroad Co.
West Shore Railroad.

IN CONNECTION WITH

Boston & Albany R. R.
Chicago, Indiana & Southern R. R.
Cincinnati Northern R. R.
Cleveland, Cincinnati, Chicago & St. Louis Ry
Dunkirk, Allegheny Valley & Pittsburgh R. R.
Indiana Harbor R. R.
Lake Erie & Western R. R.
Lake Shore & Michigan Southern Ry
Michigan Central R. R.
Rutland R. R.

JOINT FREIGHT TARIFF

OF

CHARGES FOR SPECIAL FREIGHT TRAIN MOVEMENTS.

The charges provided in this Tariff will apply between stations on N. Y C & H. R R R (including stations on St. L. & A. Ry.), also between stations on West Shore R. R. (including stations on Wallkill Valley R. R.), also between stations on N. Y C & H. R. R. R. (including stations on St. L. & A. Ry.) and stations on West Shore R. R. (including Wallkill Valley R. R.), in either direction, and from such stations to stations on the following railroads:

Boston & Albany R. R.
Chicago, Indiana & Southern R. R.
Cincinnati Northern R. R.
Cleveland, Cincinnati, Chicago & St. Louis Ry.
Dunkirk, Allegheny Valley & Pittsburgh R. R.
Indiana Harbor R. R.
Lake Erie & Western R R
Lake Shore & Michigan Southern Ry
Michigan Central R. R.
Rutland R R

Routes—As per Current Class Rate Tariffs.

Issued New York, April 8, 1907. Effective April 15, 1907

H. D CARTER, General Freight Agent, N. Y. C. & H. R. R. R., New York City.

W. S. KALLMAN, General Freight Agent, WEST SHORE R. R., New York City.

IRA H. HUBBEL, 1st Ass't General Freight Agent, New York City

W. A. NEWMAN, 2nd Ass't General Freight Agent, New York City.

L. M. ALLEN, General Eastern Freight Agent, New York City

D. E. GELATT, Division Freight Agent, New York City.

H. F. WEST, Division Freight Agent, Albany, N Y

SENECA KELLY, Division Freight Agent, Syracuse, N Y

E H. CROLY, Division Freight Agent Buffalo N. Y.

E. F. KERSHNER, Division Freight Agent, N. Y. C. & H. R. R. R., Corning, N. Y.

F. L. WILSON, Division Freight Agent, N. Y. C. & H. R. R. R., Watertown, N Y.

A S GAMBLE, Division Freight Agent, N Y C & H. R. R. R., Malone, N Y

C. H. EWINGS, Asst. Freight Transportation, New York City.

ISSUED BY A. C. RUDOLF Chief of Tariff Bureau, New York City

The proper officers of the above-named carriers will certify to the Interstate Commerce Commission concurrence herein (1700) (File A-4908.)

(OVER.)

New York Central Freight Tariff, Front Page.

of the complicated requirements of the present Interstate Commerce Commission rules for filing tariffs. The tariff in question is one of the simplest possible as it is not complicated by names of stations and different routes, but shows simply the regulations for making a certain class of special charges. Yet as shown on its front page it is twice dated, seven times indexed and signed by 14 different railroad officers. Besides this it has to be certified on separate copies by the proper officers of 10 other companies.

The tariff itself is of interest because it adopts definite extra charges above the ordinary rates for extra freight train speed. On shipments of five carloads or over for movements of 100 miles or over (less quantities or distances to be charged for at these minimums) special freight train movements can be secured at the extra rate of $1.25 per train-mile for speed between 10 and 20 miles an hour and $2.50 per train-mile for speed of over 20 miles an hour, it being provided, however, that if in either case the desired fast movement falls below a speed of 10 miles an hour regular freight train rates only will be applied.

Further Aspects of the Southern Situation.

Mr. Finley, of the Southern Railway; Mr. Garrett, of the Seaboard Air Line, and Mr. Murphy, of the Queen & Crescent, have published much interesting comment within the past few months regarding the trouble of railroad companies operating in the South. In an address before the Wilmington, N. C., Chamber of Commerce, March 7, Mr. Emerson, President of the Atlantic Coast Line, brought out certain matters not heretofore placed before public attention. Extracts from this address are printed below:

A law passed by your present legislature reducing passenger rates on certain roads in North Carolina, when applied to the traffic in question, will cost the roads of your state hundreds of thousands of dollars, and would cost the Atlantic Coast Line, based on last year's movement, over $200,000 per year, and at the same time your Railroad Commission is ordering us to increase the number of passenger trains and build new passenger stations.

There is a most remarkable wave of prosperity going over this good land of ours, probably without parallel in the history of the world. Are railroads sharing in this prosperity? The statistics of Atlantic Coast Line Railroad Company for the past nineteen months will answer this question, so far as its road is concerned. They show that for the nineteen months ending January 31, 1907, its gross earnings increased over the previous nineteen months $3,960,861, and expenses (not including expenditures for equipment and similar

1. Special freight train movement will be made between stations on N. Y. C & H. R. R. R. (including stations on St. L. & A. Ry.), also between stations on West Shore R. R. (including stations on Wallkill Valley R. R.), also between stations on N. Y. C & H. R. R. R. (including stations on St. L. & A. Ry.) and stations on West Shore R. R. (including Wallkill Valley R. R.), in either direction, and from such stations to stations on connecting roads parties to this tariff, for shipments which aggregate not less than five times the minimum carload quantity (or subject to regular freight charges based upon five times the carload minimum quantity when less is shipped) and the following special charges will be made in addition to the regular freight charges applicable to ordinary freight train movement:—

(A) For movement at speed 20 miles per hour or less, $1.25 per train mile: movement less than 100 miles will be subject to charge for 100 miles. (See Note)

(B) For movement at speed exceeding 20 miles per hour, $2.50 per train mile: movement less than 100 miles will be subject to charge for 100 miles. (See Note)

(C) If movement contracted at fast speed as above fails and results in speed less than 10 miles per hour, special train charges will be waived and regular freight train rates and quantity minima will apply.

2. The speed per hour under clause B as above will be calculated from the time set for departure of train from point of origin (*) to the time of placing cars on delivery tracks at destination.

3. The foregoing schedule does not apply to circus or "show" traffic and covers maximum of 25 cars for any one train; any excess over 25 cars will be charged for as a separate train.

4. Special freight train movements will only be arranged upon reasonable advance notice and at the option of this Company, when special motive power and crews are available without serious detriment to its other service and the right is reserved to fill out such trains to not more than 25 cars.

5. Special freight train shipments must be way-billed showing the regular charges as freight charges, prepaid or guaranteed. The way-bills must be endorsed on their face "Special freight train movement," and go forward with the train. The special charges based on the rate per train mile unless prepaid must be guaranteed by responsible parties and collection made by the agent at destination and reported as Miscellaneous Freight Earnings.

6. Shipments from or to connecting roads not parties to this tariff handled by special freight train on N. Y. C. & H. R. R. R. or West Shore R. R. will be treated as having originated or being destined to our junctions with such connecting roads.

* Date and hour must be shown upon way-bill.

NOTE.—Shippers must designate on shipping receipt what speed is desired.

New York Central Freight Tariff, Back Page.

items charged to capital account) increased $4,823,837, showing that while "prosperity" brought in nearly four million dollars additional revenue, the same "prosperity" took away, in the way of increased wages, increased cost of material, etc., etc., nearly five million dollars, so that for the last nineteen months the Atlantic Coast Line Railroad Company's share in the "prosperity" is represented by minus $862,976.

There is another phase of this question, which possibly has not occurred to you. It is natural for those who have not had time to analyze the subject to believe that the present great volume of traffic is created wholly by the merchant, the farmer, the fruit grower, etc. It will probably surprise you to know that a material percentage is created by the railroads in their efforts to meet the demand for more equipment, heavier rails, increased terminal facilities, etc.

Our company has ordered in the last two and a half years 10,500 freight cars, 119 passenger equipment cars, and 197 locomotives, the weight of which amounts to about 400,000,000 pounds, making 10,225

carloads, of 20 tons per car, of material which is hauled by some road, and the finished product represents 10,816 cars and locomotives that are hauled to the points of delivery.

Besides, we have ordered within the same period 60,000 tons of steel rail, which means 1,500 cars of 40 tons capacity, which, combined with locomotives and cars, makes a tonnage from these items of about 23,000 cars.

This does not include material received for repairing equipment in use, and other material and supplies of various kinds, which is probably greater in the aggregate than the figures given above.

The coal consumed as fuel by the Atlantic Coast Line Railroad Company loads about 1,500 cars, 100,000 lbs. capacity, per month, or 45,000 cars in the period of two and half years referred to above. All of this coal is hauled by roads reaching the coal fields, and after delivery to us must be hauled various distances, some of it as great as 800 miles, in order to reach the point of consumption.

A railroad has but one source of revenue—that which it derives from the sale of transportation. It, like others, must pay the increased price of material and labor, and it is not only refused the privilege of increasing its charges for transportation under such conditions, but laws have recently been passed, and are being proposed for passage, that materially reduce its charges, and at the same time penalty laws have been enacted to absorb the revenue we are permitted to collect.

Is it fair to say to a railroad: You can only charge so much for your commodity of transportation, and for this you must move it a certain distance within a fixed period, regardless of conditions, or pay a heavy penalty, in addition to actual damages the owner may have sustained? Thus you will see the candle is burning at both ends, and unless corrected, the result is certainly apparent to you all.

Every item we buy has increased in cost within the last three years from 15 to 40 per cent. Our payrolls, representing wages paid employees, increased in December, 1906, over December, 1905, $127,501, or 19.12 per cent.

The agitation and adverse legislation referred to above has made it impossible for a railroad company, no matter how solvent, to secure, on any reasonable basis, further money for additions and improvements, and I note from the daily papers that many roads in the West and Northwest have been compelled to stop all improvements and developments, except those actually contracted for, and for which the money had already been provided; and it must appear to you gentlemen that other roads will be forced into similar action —not because they do not want to continue this great work, but because they are unable to buy material and labor without money, and they are unable to procure money for this purpose.

The Public Utilities Bill.

On May 15, the measure commonly called the Public Utilities Bill, providing for regulation of railroads and public service companies in New York State, the most important of the reform legislation of Governor Hughes, passed the Assembly by a unanimous vote. On May 22, hastened by an "emergency message" from the Governor, it passed the Senate by a vote of 41 to 6. The Assembly immediately concurred unanimously in the Senate's amendments. The bill has been vetoed by the Mayor of New York City and must be repassed over his veto and signed by the Governor before it becomes a law. Not only because this bill is of great importance to all public service corporations in New York State, but, furthermore, as it is likely to be the model for similar public service legislation in other states, it is given below in full.

AN ACT TO ESTABLISH THE PUBLIC SERVICE COMMISSIONS AND PRESCRIBING THEIR POWERS AND DUTIES, AND TO PROVIDE FOR THE REGULATION AND CONTROL OF CERTAIN PUBLIC SERVICE CORPORATIONS AND MAKING AN APPROPRIATION THEREFOR.

The people of the state of New York, represented in Senate and Assembly, do enact as follows:

THE PUBLIC SERVICE COMMISSIONS LAW.

Article I.—Public service commissions; general provisions (Sections 1-23).

Article II.—Provisions relating to railroads, street railroads and common carriers (Sections 25-40).

Article III.—Provisions relating to the powers of the commissions in respect to railroads, street railroads and common carriers (Sections 45-60).

Article IV.—Provisions relating to gas and electric corporations; regulation of price of gas and electricity (Sections 65-77).

Arcitcle V.—Commissions and offices abolished; saving clause; repeal (Sections 80-89).

ARTICLE I.

PUBLIC SERVICE COMMISSIONS; GENERAL PROVISIONS.

Section 1. *Short title.*—This chapter shall be known as the public service commissions law, and shall apply to the public services herein described, and to the commissions hereby created.

Section 2. *Definitions.*—The term "commission," when used in this act, means either public service commission, hereby created, which by the terms of this act is vested with the power or duty in question.

The term "commissioner," when used in this act, means one of the members of such commission.

The term "corporation," when used in this act, includes a corporation, company, association and joint-stock association.

The word "person," when used in this act, includes an individual and a firm or copartnership.

The term "street railroad," when used in this act, includes every railroad by whatsoever power operated, or any extension or extensions, branch or branches thereof, for public use in the conveyance of persons or property for compensation, being mainly upon, along, above or below any street, avenue, road, highway, bridge or public place in any city, village or town, and including all switches, spurs, tracks, right of trackage, subways, tunnels, stations, terminals and terminal facilities of every kind used, operated, controlled or owned by or in connection with any such street railroad; but the said term "street railroad," when used in this act, shall not include a railroad constituting or used as part of a trunk line railroad system.

The term "railroad," when used in this act, includes every railroad, other than a street railroad, by whatsoever power operated for public use in the conveyance of persons or property for compensation, with all bridges, ferries, tunnels, switches, spurs, tracks, stations and terminal facilities of every kind used, operated, controlled or owned by or in connection with any such railroad.

The term "street railroad corporation," when used in this act, includes every corporation, company, association, joint-stock association, partnership and person, their lessees, trustees or receivers appointed by any court whatsoever, owning, operating, managing or controlling any street railroad or any cars or other equipment used thereon or in connection therewith.

The term "railroad corporation," when used in this act, includes every corporation, company, association, joint-stock association, partnership and person, their lessees, trustees or receivers appointed by any court whatsoever, owning, operating, managing or controlling any railroad or any cars or other equipment used thereon or in connection therewith.

The term "common carrier," when used in this act, includes all railroad corporations, street railroad corporations, express companies, car companies, sleeping-car companies, freight companies, freight-line companies and all persons and associations of persons, whether incorporated or not, operating such agencies for public use in the conveyance of persons or property within this state.

The term "gas corporation," when used in this act, includes every corporation, company, association, joint-stock association, partnership and person, their lessees, trustees or receivers appointed by any court whatsoever, owning, operating, managing or controlling any plant or property for manufacturing and distributing and selling for distribution or distributing illuminating gas (natural or manufactured) for light, heat or power.

The term "electrical corporation," when used in this act, includes every corporation, company, association, joint-stock association, partnership and person, their lessees, trustees or receivers appointed by any court whatsoever (other than a railroad or street railroad corporation generating electricity for its own use exclusively), owning, operating, managing or controlling any plant or property for generating and distributing or generating and selling for distribution, or distributing electricity for light, heat or power or for the transmission of electric current for such purposes.

The term "transportation of property or freight," when used in this act, includes any service in connection with the receiving, delivery, elevation, transfer in transit, ventilation, refrigeration, icing, storage and handling of the property or freight transported.

The term "municipality," when used in this act, includes a city, village, town or lighting district, organized as provided by a general or special act.

Section 3. *Public service districts.*—There are hereby created two public service districts, to be known as the first district and the second district. The first district shall include the counties of New York, Kings, Queens and Richmond. The second district shall include all other counties of the state.

Section 4. *Commissions established; appointment; removal; terms of office.*—There shall be a public service commission for each district, and each commission shall possess the powers and duties hereinafter specified, and also all powers necessary or proper to enable it to carry out the purposes of this act. The commission of the first district shall consist of five members and the commission of the second district shall consist of five members, to be appointed by the governor, by and with the advice and consent of the senate, one of whom designated by the governor shall, during his term of office, be the chairman of the commission of which he is a member. Each commissioner shall be a resident of the district for which he is appointed.

The governor may remove any commissioner for inefficiency, neglect of duty or misconduct in office, giving to him a copy of the charges against him, and an opportunity of being publicly heard in person or by counsel in his own defense, upon not less than ten days' notice. If such commissioner shall be removed the governor shall file in the office of the secretary of state a complete statement of all charges made against such commissioner, and his findings thereon, together with a complete record of the proceedings.

Of the members of the commission in each district first appointed hereunder, one shall hold office until February 1, 1909, one until February 1, 1910, one until February 1, 1911, one until February 1, 1912, and one until February 1, 1913; the term of office of each commissioner so appointed shall begin on the first day of July, 1907. Upon the expiration of each of such terms, the term of office of each commissioner thereafter appointed shall be five years from the first of February. Vacancies shall be filled by appointment for the unexpired term.

Section 5. *Jurisdiction of commissions.*—The jurisdiction, supervision, powers and duties of the public service commission in the first district shall extend under this act:

1. To railroads and street railroads lying exclusively within that district, and to the persons or corporations owning, leasing, operating or controlling the same.

2. To street railroads any portion of whose lines lies within that dis-

trict, to all transportation of persons or property thereon within that district or from a point within either district to a point within the other district, and to the persons or corporations owning, operating, controlling or leasing the said street railroads; provided, however, that the commission for the second district shall have jurisdiction over such portion of the lines of said street railroads as lies within the second district, and over the persons or corporations owning, operating, controlling or leasing the same, so far as concerns the construction, maintenance, equipment, terminal facilities and local transportation facilities of said street railroads within the second district.

3. To such portion of the lines of any other railroad as lies within that district, and to the person or corporation owning, leasing, operating or controlling the same, so far as concerns the construction, maintenance, equipment, terminal facilities and local transportation facilities, and local transportation of persons or property within that district.

4. To any common carrier operating or doing business exclusively within that district.

5. To the manufacture, sale or distribution of gas and electricity for light, heat and power in said district, and to the persons or corporations owning, leasing, operating or controlling the same.

6. And, in addition thereto, the commission in the first district shall have and exercise all powers heretofore conferred upon the board of rapid transit railroad commissioners under chapter four of the laws of 1891, entitled "An act to provide for rapid transit railways in cities of over one million inhabitants," and the acts amendatory thereto.

All jurisdiction, supervision, powers and duties under this act not specifically granted to the public service commission of the first district shall be vested in, and be exercised by, the public service commission of the second district, including the regulation and control of all transportation of persons or property, and the instrumentalities connected with such transportation, on any railroad other than a street railroad from a point within either district to a point within the other district.

Section 6. *Counsel to the commissions.*—Each commission shall appoint as counsel to the commission an attorney and counselor-at-law of the state of New York, who shall hold office during the pleasure of the commission. Each counsel to the commission shall, subject to the approval of the commission, have the power to appoint, and at pleasure remove, attorneys and counselors-at-law, to assist him in the performance of his duties, and also to employ and remove stenographers and process-servers.

Section 7. *Secretary to the commissions.*—Each commission shall have a secretary to be appointed by it and to hold office during its pleasure. It shall be the duty of the secretary to keep a full and true record of all proceedings of the commission, of all books, maps, documents and papers ordered filed by the commission and of all orders made by a commissioner and of all orders made by the commission or approved and confirmed by it and ordered filed, and he shall be responsible to the commission for the safe custody and preservation of all such documents at its office. Under the direction of the commission the secretary shall have general charge of its office, superintend its clerical business and perform such other duties as the commission may prescribe. He shall have power and authority to administer oaths in all parts of the state, so far as the exercise of such power is properly incidental to the performance of his duty or that of the commission. The secretary shall designate, from time to time, one of the clerks appointed by the commission to perform the duties of secretary during his absence and, during such time, the clerk so designated shall at the office possess the powers of the secretary of the commission.

Section 8. *Additional officers and employees.*—Each commission shall have power to employ, during its pleasure, such officers, clerks, inspectors, experts and employees as it may deem to be necessary to carry out the provisions of this act, or to perform the duties and exercise the powers conferred by law upon the commission.

Section 9. *Oath of office; eligibility of commissioners and officers.*—Each commissioner and each person appointed to office by a commission or by counsel to a commission shall, before entering upon the duties of his office, take and subscribe the constitutional oath of office. No person shall be eligible for appointment or shall hold the office of commissioner or be appointed by a commission or by counsel to a commission to, or hold, any office or position under a commission, who holds any official relation to any common carrier, railroad corporation, street railroad corporation, gas corporation or electric corporation subject to the provisions of this act, or who owns stocks or bonds therein.

Section 10. *Offices of commissions; meetings; official seal; stationery, etc.*—1. The principal office of the commission of the first district shall be in the borough of Manhattan, city of New York; and the office of the second district shall be in the city of Albany, in rooms designated by the trustees of public buildings. Each commission shall hold stated meetings at least once a month during the year at its office. Each shall have an official seal to be furnished and prepared by the secretary of state as provided by law. The offices shall be supplied with all necessary books, maps, charts, stationery, office furniture, telephone and telegraph connections and all other necessary appliances, to be paid for in the same manner as other expenses authorized by this act.

2. The offices of each commission shall be open for business between the hours of eight o'clock in the morning and eleven o'clock at night every day in the year, and one or more responsible persons, to be designated by the commission or by the secretary under the direction of the commission, shall be on duty at all times in immediate charge thereof.

Section 11. *Quorum; powers of a commissioner.*—A majority of the commissioners shall constitute a quorum for the transaction of any business, for the performance of any duty or for the exercise of any power of the commission, and may hold meetings of the commission at any time or place within the state. Any investigation, inquiry or hearing which either commission has power to undertake or to hold may be undertaken or held by or before any commissioner. All investigations, inquiries, hearings and decisions of a commissioner shall be and be deemed to be the investigations, inquiries, hearings and decisions of the commission and every order made by a commissioner, when approved and confirmed by the commission and ordered filed in its office, shall be and be deemed to be the order of the commission.

Section 12. *Counsel to the commissions; duties.*—It shall be the duty of counsel to a commission to represent and appear for the people of the state of New York and the commission, in all actions and proceedings involving any question under this act, or under or in reference to any act or order of the commission, and, if directed to do so by the commission, to intervene, if possible, in any action or proceeding in which any such question is involved; to commence and prosecute all actions and proceedings directed or authorized by the commission, and to expedite in every way possible final determination of all such actions and proceedings; to advise the commission and each commissioner when so requested in regard to all matters in connection with the powers and duties of the commission and of the members thereof, and generally to perform all duties and services as attorney and counsel to the commission which the commission may reasonably require of him.

Section 13. *Salaries and expenses.*—The annual salary of each commissioner shall be fifteen thousand dollars ($15,000). The annual salary of counsel to a commission shall be ten thousand dollars ($10,000). The annual salary of a secretary to a commission shall be six thousand dollars ($6,000). All officers, clerks, inspectors, experts and employees of a commission, and all persons appointed by the counsel to a commission, shall receive the compensation fixed by the commission.

The commissioners, counsel to the commission and the secretary, and their officers, clerks, inspectors, experts and other employees, shall have reimbursed to them all actual and necessary traveling and other expenses and disbursements incurred or made by them in the discharge of their official duties.

Section 14. *Payment of salaries and expenses.*—1. The salaries of the commissioners, the counsel to the commission, and the secretary to the commission in the first district shall be audited and allowed by the state comptroller, and paid monthly by the state treasurer upon the order of the comptroller out of the funds provided therefor. All other salaries and expenses of the commission of the first district shall be audited and paid as follows: The board of estimate and apportionment of the city of New York, or other board or public body on which is imposed the duty and in which is vested the power of making appropriations of public moneys for the purposes of the city government shall, from time to time, on requisition duly made by the public service commission of the first district, appropriate such sum or sums of money as may be requisite and necessary to enable it to do and perform, or cause to be done and performed, the duties in this or in any other act prescribed, and to provide for the expenses and the compensation of the employees of such commission, and such appropriation shall be made forthwith upon presentation of a requisition from the said commission, which shall state the purposes for which such moneys are required by it. In case the said board of estimate and apportionment, or such other board or public body, fail to appropriate such amount as the said commission deems requisite and necessary, the said commission may apply to the appellate division of the supreme court in the first department, on notice to the board of estimate and apportionment or such other board or public body aforesaid, to determine what amount shall be appropriated for the purposes so required and the decision of said appellate division shall be final and conclusive; and the city shall not be liable for any indebtedness incurred by the said commission in excess of such appropriation or appropriations. It shall be the duty of the auditor and comptroller of said city, after such appropriation shall have been duly made, to audit and pay the proper expenses and compensation of the employees of said commission other than its counsel and secretary, upon vouchers therefor, to be furnished by the said commission, which payments shall be made in like manner as payments are now made by the auditor, comptroller or other public officers of claims against and demands upon such city; and for the purpose of providing funds with which to pay the said sums, the comptroller or other chief financial officer of said city, is hereby authorized and directed to issue and sell revenue bonds of such city in anticipation of receipt of taxes and out of the proceeds of such bonds to make the payments in this section required to be made. The amount necessary to pay the principal and interest of such bonds shall be included in the estimates of moneys necessary to be raised by taxation to carry on the business of said city, and shall be made a part of the tax levy for the year next following the year in which such appropriations are made. The commission may provide that all or any portion of the expenses so incurred and paid by said city as in this section provided, and for which said city shall be liable, shall be repaid, with interest, by the bidder or bidders at the public sale of the rights, privileges and franchises, as provided in chapter four of the laws of 1891, entitled "An act to provide for rapid transit railways in cities of over 1,000,000 inhabitants," and the acts amendatory thereto. The said comptroller shall pay the proper salaries and the expenses of the said commission upon its requisition, for the remainder of the fiscal year after this act shall take effect, from any funds that may have been heretofore appropriated for the board of rapid transit railroad commissioners, which appropriation is hereby transferred to the credit of the public service commission of the first district. In case the said appropriation shall not be sufficient to meet such salaries and expenses, the comptroller of said city is hereby authorized and directed to issue and sell revenue bonds of said city, in anticipation of receipt of taxes, as hereinbefore provided.

2. All salaries and expenses of the commission in the second district shall be audited and allowed by the state comptroller and paid monthly by the state treasurer upon the order of the comptroller, out of the funds provided therefor.

Section 15. *Certain acts prohibited.*—Every commissioner, counsel to a commission, the secretary of a commission, and every person employed or appointed to office, either by a commission or by the counsel to a commission, is hereby forbidden and prohibited to solicit, suggest, request or recommend, directly or indirectly, to any common carrier, railroad corporation or street railroad corporation, or to any officer, attorney, agent or employee thereof the appointment of any person to any office, place, position or employment. And every common carrier, railroad corporation, street railroad corporation,

gas corporation and electrical corporation and every officer, attorney, agent and employee thereof, is hereby forbidden and prohibited to offer to any commissioner, to counsel to a commission, to the secretary thereof, or to any person employed by a commission or by the counsel to a commission, any office, place, appointment or position, or to offer or give to any commissioner, to counsel to a commission, to the secretary thereof, or to any officer employed or appointed to office by the commission or by the counsel to the commission, any free pass or transportation or any reduction in fare to which the public generally are not entitled or free carriage for freight or property or any present, gift or gratuity of any kind. If any commissioner, counsel to a commission, the secretary thereof or any person employed or appointed to office by a commission or by counsel to a commission, shall violate any provision of this section he shall be removed from the office held by him. Every commissioner, counsel to the commission, the secretary thereof and every person employed or appointed to office by the commission or by counsel to the commission, shall be and be deemed to be a public officer.

Section 16. *Annual report of commissions.*—All proceedings of each commission and all documents and records in its possession shall be public records, and each commission shall make an annual report to the legislature on or before the second Monday of January in each year, which shall contain copies of all orders issued by it and any information in the possession of the commission which it shall deem of value to the legislature and the people of the state. Five hundred copies of each report, together with abstracts of the reports to such commission of common carriers, railroad corporations and street railroad corporations, and gas and electric corporations, in addition to the regular number prescribed by law, shall be printed as a public document of the state, bound in cloth, for the use of the commissioners and to be distributed by them in their discretion to railroad, street railroad, gas and electrical corporations and other persons interested therein.

Section 17. *Certified copies of papers filed to be evidence.*—Copies of all official documents and orders filed or deposited according to law in the office of either commission, certified by a commissioner or by the secretary of the commission to be true copies of the originals, under the official seal of the commission, shall be evidence in like manner as the originals.

Section 18. *Fees to be charged and collected by the commissions.*—Each commission shall charge and collect the following fees: For copies of papers and records not required to be certified or otherwise authenticated by the commission, 10 cents for each folio; for certified copies of official documents and orders filed in its office, 15 cents for each folio, and one dollar for every certificate under seal affixed thereto; for certifying a copy of any report made by a corporation to the commission, $2.00; for each certified copy of the annual report of the commission, $1.50; for certified copies of evidence and proceedings before the commission, 15 cents for each folio. No fees shall be charged or collected for copies of papers, records or official documents, furnished to public officers for use in their official capacity, or for the annual reports of the commission in the ordinary course of distribution. All fees charged and collected by the commission of the first district shall belong to the city of New York, and shall be paid monthly, accompanied by a detailed statement thereof, into the treasury of the city to the credit of the general fund, and all fees charged and collected by the commission of the second district shall belong to the people of the state, and shall be paid monthly, accompanied by a detailed statement thereof, into the treasury of the state to the credit of the general fund.

Section 19. *Attendance of witnesses and their fees.*—1. All subpoenas shall be signed and issued by a commissioner or by the secretary of a commission and may be served by any person of full age. The fees of witnesses required to attend before a commission, or a commissioner, shall be two dollars for each day's attendance, and five cents for every mile of travel by the nearest generally traveled route in going to and from the place where attendance of the witness is required, such fees to be paid when the witness is excused from further attendance; and the disbursements made in the payment of such fees shall be audited and paid in the first district in the same manner provided for the payment of expenses of the commission.

2. If a person subpoenaed to attend before a commission, or a commissioner fails to obey the command of such subpoena, without reasonable cause, or if a person in attendance before a commission, or commissioner, shall, without reasonable cause, refuse to be sworn or to be examined or to answer a question or to produce a book or papers, when ordered so to do by the commission, or a commissioner, or to subscribe and swear to his deposition after it has been correctly reduced to writing, he shall be guilty of a misdemeanor and may be prosecuted therefor in any court of competent criminal jurisdiction.

If a person in attendance before a commission or a commissioner refuses without reasonable cause to be examined or to answer a legal and pertinent question or produce a book or paper, when ordered so to do by a commission or a commissioner, the commission may apply to any justice of the supreme court upon proof by affidavit of the facts for an order returnable in not less than two nor more than five days directing such person to show cause before the justice who made the order, or any other justice of the supreme court, why he should not be committed to jail; upon the return of such order the justice before whom the matter shall come on for hearing shall examine under oath such person whose testimony may be relevant, and such person shall be given an opportunity to be heard; and if the justice shall determine that such person has refused without reasonable cause or legal excuse to be examined, or to answer a legal and pertinent question, or to produce a book or paper which he was ordered to bring, he may forthwith, by warrant, commit the offender to jail, there to remain until he submits to do the act which he was so required to do or is discharged according to law.

Section 20. *Practice before the commissions; immunity of witnesses.*—All hearings before a commission or a commissioner, shall be governed by rules to be adopted and prescribed by the commission. And in all investigations, inquiries or hearings the commission, or a commissioner, shall not be bound by the technical rules of evidence. No person shall be excused from testifying or from producing any books or papers in any investigation or inquiry by or upon any hearing before a commission or any commissioner when ordered to do so by the commission, upon the ground that the testimony or evidence, books or documents required of him may tend to incriminate him or subject him to penalty or forfeiture, but no person shall be prosecuted, punished or subjected to any penalty or forfeiture for or on account of any act, transaction, matter or thing concerning which he shall under oath have testified or produced documentary evidence; provided, however, that no person so testifying shall be exempt from prosecution or punishment for any perjury committed by him in his testimony. Nothing herein contained is intended to give, or shall be construed as in any manner giving unto any corporation immunity of any kind.

Section 21. *Court proceedings; preferences.* All actions and proceedings under this act, and all actions and proceedings commenced or prosecuted by order of either commission, and all actions and proceedings to which either commission or the people of the state of New York may be parties, and in which any question arises under this act or under the railroad law, or under or concerning any order or action of the commission, shall be preferred over all other civil causes except election causes in all courts of the state of New York and shall be heard and determined in preference to all other civil business pending therein excepting election causes, irrespective of position on the calendar. The same preference shall be granted upon application of counsel to the commission in any action or proceeding in which he may be allowed to intervene.

Section 22. *Rehearing before commission.*—After an order has been made by a commission, any party interested therein may apply for a rehearing in respect to any matter determined therein, and the commission may grant and hold such a rehearing if in its judgment sufficient reason therefor be made to appear; if a rehearing shall be granted, the same shall be determined by the commission within thirty days after the same shall be finally submitted. An application for such a rehearing shall not excuse any common carrier, railroad corporation or street railroad corporation from complying with or obeying any order or any requirement of any order of the commission, or operate in any manner to stay or postpone the enforcement thereof except as the commission may by order direct. If, after such rehearing and a consideration of the facts, including those arising since the making of the order, the commission shall be of opinion that the original order or any part thereof is in any respect unjust or unwarranted, the commission may abrogate, change or modify the same. An order made after any such rehearing abrogating, changing or modifying the original order shall have the same force and effect as an original order but shall not affect any right or the enforcement of any right arising from or by virtue of the original order.

Section 23. *Service and effect of orders.*—Every order of a commission shall be served upon every person or corporation to be affected thereby, either by personal delivery of a certified copy thereof, or by mailing a certified copy thereof, in a sealed package with postage prepaid, to the person to be affected thereby or, in the case of a corporation, to any officer or agent thereof upon whom a summons may be served in accordance with the provisions of the code of civil procedure. It shall be the duty of every person and corporation to notify the commission forthwith, in writing, of the receipt of the certified copy of every order so served, and in the case of a corporation such notification must be signed and acknowledged by a person or officer duly authorized by the corporation to admit such service. Within a time specified in the order of the commission every person and corporation upon whom it is served must if so required in the order notify the commission in like manner whether the terms of the order are accepted and will be obeyed.

Every order of a commission shall take effect at a time therein specified and shall continue in force for a period therein designated unless earlier modified or abrogated by the commission or unless such order be unauthorized by this or any other act or be in violation of a provision of the constitution of the state or of the United States.

ARTICLE II.

PROVISIONS RELATING TO RAILROADS, STREET RAILROADS, AND COMMON CARRIERS.

Section 25. *Application of article.*—The provisions of this article shall apply to the transportation of passengers, freight or property, from one point to another within the state of New York, and to any common carrier performing such service.

Section 26. *Safe and adequate service; just and reasonable charges.*—Every corporation, person or common carrier performing a service designated in the preceding section, shall furnish, with respect thereto, such service and facilities as shall be safe and adequate and in all respects just and reasonable. All charges made or demanded by any such corporation, person or common carrier for the transportation of passengers, freight or property or for any service rendered or to be rendered in connection therewith, as defined in section two of this act, shall be just and reasonable and not more than allowed by law or by order of the commission having jurisdiction and made as authorized by this act. Every unjust or unreasonable charge made or demanded for any such service or transportation of passengers, freight or property or in connection therewith or in excess of that allowed by law or by order of the commission is prohibited.

Section 27. *Switch and side-track connections; powers of commissions.*—1. A railroad corporation, upon the application of any shipper tendering traffic for transportation, shall construct, maintain and operate upon reasonable terms a switch connection or connections with a lateral line of railroad or private sidetrack owned, operated or controlled by such shipper, and shall, upon the application of any shipper, provide upon its own property a side-track and switch connection with its line of railroad, whenever such side track and switch connection is reasonably practicable, can be put in with safety and the business therefor is sufficient to justify the same.

2. If any railroad corporation shall fail to install or operate any such switch connection with a lateral line of railroad or any such side-track and switch connection as aforesaid, after written application therefor has been made to it, any corporation or person interested may present the facts to the commission having jurisdiction by written petition, and the commission shall investigate the matter stated in such petition, and give such hearing thereon as it may deem necessary or proper. If the commission be of opinion that it is safe and practicable to have a connection, substantially as prayed for, established or maintained, and that the business to be done thereon justifies the construction and maintenance thereof, it shall make an order directing the construction and establishment thereof, specifying the reasonable compensation to be paid for the construction, establishment and maintenance thereof, and may in like manner upon the application of the railroad corporation order the discontinuance of such switch connection.

Section 28. *Tariff schedules; publication.* Every common carrier shall file with the commission having jurisdiction and shall print and keep open to public inspection schedules showing the rates, fares and charges for the transportation of passengers and property within the state between each point upon its route and all other points thereon; and between each point upon its route and all points upon every route leased, operated or controlled by it; and between each point on its route or upon any route leased, operated or controlled by it and all points upon the route of any other common carrier, whenever a through route and joint rate shall have been established or ordered between any two such points. If no joint rate over a through route has been established, the several carriers in such through route shall file, print and keep open to public inspection, as aforesaid, the separately established rates, fares and charges applied to the through transportation. The schedules printed as aforesaid shall plainly state the places between which property and passengers will be carried, and shall also contain the classification of passengers, freight or property in force, and shall also state separately all terminal charges, storage charges, icing charges, and all other charges which the commission may require to be stated, all privileges or facilities granted or allowed, and any rules or regulations which may in any wise change, affect or determine any part, or the aggregate of, such aforesaid rates, fares and charges, or the value of the service rendered to the passenger, shipper or consignee. Such schedules shall be plainly printed in large type; copies thereof for the use of the public shall be kept posted in two public and conspicuous places in every depot, station and office of every common carrier where passengers or property are received for transportation, in such manner as to be readily accessible to and conveniently inspected by the public. The form of every such schedule shall be prescribed by the commission and shall conform as nearly as possible to the form of schedule required by the interstate commerce commission under the act of congress, entitled, "An act to regulate commerce," approved Feb. 4, 1887, as amended by act approved June 29, 1906, and other amendments thereto. Where any similar schedule is required by law to be filed with both commissions they shall agree upon an identical form for such schedule. The commission shall have power, from time to time, in its discretion, to determine and prescribe by order such changes in the form of such schedules as may be found expedient.

Section 29. *Changes in schedule; notice required.*—Unless the commission otherwise orders no change shall be made in any rate, fare or charge, or joint rate, fare or charge, which shall have been filed and published by a common carrier in compliance with the requirements of this act, except after thirty days' notice to the commission and publication for thirty days as required by section twenty-eight of this act, which shall plainly state the changes proposed to be made in the schedule then in force, and the time when the change rate, fare or charge will go into effect; and all proposed changes shall be shown by printing, filing and publishing new schedules or shall be plainly indicated upon the schedules in force at the time and kept open to public inspection. The commission, for good cause shown, may allow changes in rates without requiring the thirty days' notice and publication herein provided for by duly filing and publishing in such manner as it may direct an order specifying the change so made and the time when it shall take effect; all such changes shall be immediately indicated upon its schedules by the common carrier.

Section 30. *Concurrence in joint tariffs; contracts, agreements or arrangements between any carriers.*—1. The names of the several carriers which are parties to any joint tariff shall be specified therein, and each of the parties thereto, other than the one filing the same, shall file with the commission such evidence of concurrence therein or acceptance thereof as may be required or approved by the commission; and where such evidence of concurrence or acceptance is filed, it shall not be necessary for the carriers filing the same also to file copies of the tariffs in which they are named as parties.

2. Every common carrier shall file with the commission sworn copies of every contract, agreement or arrangement with any other common carrier or common carriers relating in any way to the transportation of passengers, property or freight.

Section 31. *Unjust discrimination.*—No common carrier shall, directly or indirectly, by any special rate, rebate, drawback, or other device or method, charge, demand, collect or receive from any person or corporation a greater or less compensation for any service rendered or to be rendered in the transportation of passengers, freight or property, except as authorized in this act, than it charges, demands, collects or receives from any other person or corporation for doing a like and contemporaneous service in the transportation of a like kind of traffic under the same or substantially similarly circumstances and conditions.

Section 32. *Unreasonable preference.*—No common carrier shall make or give any undue or unreasonable preference or advantage to any person or corporation or to any locality or to any particular description of traffic in any respect whatsoever, or subject any particular person or corporation or locality or any particular description of traffic, to any prejudice or disadvantage in any respect whatsoever.

Section 33. *Transportation prohibited until publication of schedules; rates as fixed to be charged; passes prohibited.* No common carrier subject to the provisions of this act shall after the first day of November, 1907, engage or participate in the transportation of passengers, freight or property, between points within the state, until its schedules of rates, fares and charges shall have been filed and published in accordance with the provisions of this act. No common carrier shall charge, demand, collect or receive a greater or less or different compensation for transportation of passengers, freight or property, or for any service in connection therewith, than the rates, fares and charges applicable to such transportation as specified in its schedules filed and in effect at the time; nor shall any such carrier refund or remit in any manner or by any device any portion of the rates, fares, or charges so specified, nor extend to any shipper or person any privileges or facilities in the transportation of passengers or property except such as are regularly and uniformly extended to all persons and corporations under like circumstances. No common carrier subject to the provisions of this act shall, directly or indirectly, issue or give any free ticket, free pass or free transportation for passengers or property between points within this state, except to its officers, employees, agents, pensioners, surgeons, physicians, attorneys-at-law, and their families; to ministers of religion, officers and employees of railroad young men's Christian associations, inmates of hospitals, charitable and eleemosynary institutions and persons exclusively engaged in charitable and eleemosynary work; and to indigent, destitute and homeless persons and to such persons when transported by charitable societies or hospitals, and the necessary agents employed in such transportation; to inmates of the national homes or state homes for disabled volunteer soldiers and of soldiers' and sailors' homes, including those about to enter and those returning home after discharge, and boards of managers of such homes; to necessary caretakers of property in transit; to employees of sleeping-car companies, express companies, telegraph and telephone companies doing business along the line of the issuing carrier; to railway mail service employees, postoffice inspectors, customs inspectors and immigration inspectors; to newsboys on trains, baggage agents, witnesses attending any legal investigation or proceeding in which the common carrier is interested, persons injured in accidents or wrecks and physicians and nurses attending such persons; to the carriage free or at reduced rates of persons or property for the United States, state or municipal governments, or of property to or from fairs and expositions for exhibit thereat. Nothing in this act shall be construed to prohibit the interchange of free or reduced transportation between common carriers of or for their officers, agents, employees, attorneys and surgeons and their families, nor to prohibit any common carrier from carrying passengers or property free, with the object of providing relief in cases of general epidemic, pestilence or other calamitous visitation; nor to prohibit any common carrier from transporting persons or property as incident to or connected with contracts for construction, operation or maintenance, and to the extent only that such free transportation is provided for in the contract for such work.

Provided further, that nothing in this act shall prevent the issuance of mileage, excursion, or commutation passenger tickets, or joint interchangeable mileage tickets, with special privileges as to the amount of free baggage that may be carried under mileage tickets of 1,000 miles or more. But before any common carrier, subject to the provision of this act, shall issue any such mileage, excursion, commutation passenger ticket or joint interchangeable mileage ticket, with special privileges as aforesaid, it shall file with the commission copies of the tariffs of rates, fares or charges on which such tickets are to be based, together with the specifications of the amount of free baggage permitted to be carried under such joint interchangeable mileage ticket, in the same manner as common carriers are required to do with regard to other rates by this act. Nor shall anything in this act prevent the issuance of passenger transportation in exchange for advertising space in newspapers at full rates.

Section 34. *False billing, etc., by carrier or shipper.*—No common carrier or any officer or agent thereof or any person acting for or employed by it, shall assist, suffer or permit any person or corporation to obtain transportation for any passenger, freight or property between points within this state at less than the rates then established and in force in accordance with the schedules filed and published in accordance with the provisions of this act, by means of false billing, false classification, false weight or weighing, or false report of weight, or by any other device or means. No person, corporation or any officer, agent or employee of a corporation, who shall deliver freight or property for transportation within the state to a common carrier, shall seek to obtain or obtain such transportation for such property at less than the rates then established and in force therefor, as aforesaid, by false billing, false or incorrect classification, false weight or weighing, false representation of the contents of a package, or false report or statement of weight, or by any other device or means, whether with or without the consent or connivance of the common carrier, or any of its officers, agents or employees.

Section 35. *Discrimination prohibited; connecting lines.*—Every common carrier is required to afford all reasonable, proper and equal facilities for the interchange of passenger, freight and property traffic between the lines owned, operated, controlled or leased by it and the lines of every other common carrier, and for the prompt transfer of passengers and for the prompt receipt and forwarding of freight and property to and from its said lines; and no common carrier shall in any manner discriminate in respect to rates, fares or charges or in respect to any service or in respect to any charges or facilities for any such transfer, receiving or forwarding between any two or more other common carriers or between passengers, freight or property destined to points upon the lines of any two or more other common carriers or in any respect with reference to passengers, freight or property transferred or received from any two or more other common carriers. This section shall not be construed to require a common carrier to permit or allow any other common carrier to use its tracks or terminal facilities. Every common carrier, as such, is required to receive from every other common carrier, at a connecting point, freight cars of proper standard, and haul the same through to destination, if the destination be upon a line owned, operated or controlled by such common carrier, or if the destination be upon a line of some other common carrier, to haul any car so delivered through to the connecting point upon the line owned, operated, controlled or leased by it, by way of route over which such car is billed, and there to deliver the same to the next connecting carrier. Nothing in this section shall be construed as in anywise limiting or modifying the duty of a common carrier to establish joint rates, fares and charges for the transportation of passengers, freight and property over the lines owned, operated, controlled and leased by it and the lines of other common carriers, nor as in any manner limiting or modifying the power of the commission to require the establishment of such joint rates, fares and charges. A railroad corporation and a street railroad corporation shall not be required to interchange cars except on such terms and conditions as the commission may direct.

Section 36. *Long and short haul.* No common carrier, subject to the provisions of this act, shall charge or receive any greater compensation in the aggregate for the transportation of passengers or of a like kind of property, under substantially similar circumstances and conditions, for a shorter than for a longer distance over the same line in the same direction, the shorter being included within the longer distance; but this shall not be construed as authorizing any such common carrier to charge and receive as

great a compensation for a shorter as for a longer distance or haul. Upon application of a common carrier the commission may by order authorize it to charge less for longer than for shorter distances for the transportation of passengers or property in special cases after investigation by the commission, but the order must specify and prescribe the extent to which the common carrier making such application is relieved from the operation of this section, and only to the extent so specified and prescribed shall any common carrier be relieved from the operation and requirements of this section.

Section 37. *Distribution of cars.*—1. Every railroad corporation or other common carrier engaged in the transportation of freight shall, upon reasonable notice, furnish to all persons and corporations who may apply therefor, and offer freight for transportation, sufficient and suitable cars for the transportation of such freight in carload lots. Every railroad corporation and street railroad corporation shall have sufficient cars and motive power to meet all requirements for the transportation of passengers and property which may reasonably be anticipated, unless relieved therefrom by order of the commission. In case, at any particular time, a common carrier has not sufficient cars to meet all requirements for the transportation of property in carload lots, all cars available to it for such purposes shall be distributed among the several applicants therefor, without discrimination between shippers, localities or competitive or non-competitive points, but preference may always be given in the supply of cars for shipment of live stock or perishable property.

2. The commission shall have power to make, and by order shall make, reasonable regulations for the furnishing and distribution of freight cars to shippers, for the switching of the same, for the loading and unloading thereof, for demurrage charges in respect thereto, and for the weighing of cars and freight offered for shipment or transported by any common carrier.

Section 38. *Liability for damage to property in transit.*—Every common carrier and every railroad corporation and street railroad corporation shall, upon demand, issue either a receipt or bill of lading for all property delivered to it for transportation. No contract, stipulation or clause in any receipt or bill of lading shall exempt or be held to exempt any common carrier, railroad corporation or street railroad corporation from any liability for loss, damage or injury caused by it to freight or property from the time of its delivery for transportation until the same shall have been received at its destination and a reasonable time shall have elapsed after notice to consignee of such arrival to permit of the removal of such freight or property. Every common carrier, railroad corporation and street railroad corporation shall be liable for all loss, damage or injury to property caused by delay in transit due to negligence while the same is being carried by it, but in any action to recover for damages sustained by delay in transit the burden of proof shall be upon the defendant to show that such delay was not due to negligence. Every common carrier and railroad corporation shall be liable for loss, damage and injury to property carried as baggage up to the full value and regardless of the character thereof, but the value in excess of one hundred and fifty dollars shall be stated upon delivery to the carrier, and a written receipt stating the value shall be issued by the carrier, who may make a reasonable charge for the assumption of such liability in excess of one hundred and fifty dollars and for the carriage of baggage exceeding one hundred and fifty pounds in weight upon a single ticket. Nothing in this section shall deprive any holder of such receipt or bill of lading of any remedy or right of action which he has under existing law.

Section 39. *Continuous carriage.*—No common carrier shall enter into or become a party to any combination, contract, agreement or understanding, written or oral, express or implied, to prevent by any arrangement or by change of arrangement of time schedule, by carriage in different cars or by any other means or device whatsoever the carriage of freight and property from being continuous from the place of shipment to the place of destination. No breakage of bulk, stoppage or interruption of carriage made by any common carrier shall prevent the carriage of freight and property from being treated as one continuous carriage from the place of shipment to the place of destination. Nor shall any such breakage of bulk, stoppage or interruption of carriage be made or permitted by any common carrier except it be done in good faith for a necessary purpose without intention to avoid or unnecessarily interrupt or delay, the continuous carriage of such freight or property to evade any of the provisions of law, of this act or of an order of the commission.

Section 40. *Liability for loss or damage caused by violation of this act.*—In case a common carrier shall do, cause to be done or permit to be done any act, matter or thing prohibited, forbidden or declared to be unlawful, or shall omit to do any act, matter or thing required to be done, either by any law of the state of New York, by this act or by an order of the commission, such common carrier shall be liable to the persons or corporations affected thereby for all loss, damage or injury caused thereby or resulting therefrom, and in case of recovery, if the court shall find that such act or omission was wilful, it may in its discretion fix a reasonable counsel or attorney's fee, which fee shall be taxed and collected as part of the costs in the case. An action to recover for such loss, damage or injury may be brought in any court of competent jurisdiction by any such person or corporation.

ARTICLE III.

PROVISIONS RELATING TO THE POWERS OF THE COMMISSIONS IN RESPECT TO COMMON CARRIERS, RAILROADS AND STREET RAILROADS.

Section 45. *General powers and duties of commissions in respect to common carriers, railroads and street railroads.*—1. Each commission and each commissioner shall have power and authority to administer oaths, in all parts of the state, to witnesses summoned to testify in any inquiry, investigation, hearing or proceeding; and also to administer oaths in all parts of the state whenever the exercise of such power is incidentally necessary or proper to enable the commission or a commissioner to perform a duty or to exercise a power.

2. Each commission shall have the general supervision of all common carriers, railroads, street railroads, railroad corporations and street railroad corporations within its jurisdiction as hereinbefore defined, and shall have power to and shall examine the same and keep informed as to their general condition, their capitalization, their franchises and the manner in which their lines, owned, leased, controlled or operated, are managed, conducted and operated, not only with respect to the adequacy, security and accommodation afforded by their service, but also with respect to their compliance with all provisions of law, orders of the commission and charter requirements.

3. Each commission and each commissioner shall have power to examine all books, contracts, records, documents and papers of any person or corporation subject to its supervision, and by subpœna duces tecum to compel production thereof. In lieu of requiring production of originals by subpœna duces tecum, the commission or any commissioner may require sworn copies of any such books, records, contracts, documents and papers or parts thereof to be filed with it.

4. Either commission shall conduct a hearing and take testimony as to the advisability of any proposed change of law relating to any common carrier, railroad corporation or street railroad corporation, if requested to do so by the legislature, by the senate or assembly committee on railroads, or by the governor, and may conduct such a hearing, when requested to do so, by any person or corporation, and shall report its conclusions to the officer, body, person or corporation at whose request the hearing was held. The commission may also recommend the enactment of such legislation, with respect to any matter within its jurisdiction, as it deems wise or necessary in the public interest, and may draft or cause to be drafted such bills or acts as it may deem necessary or proper to enact into law the legislation recommended by it.

Section 46. *Reports of common carriers, railroad corporations and street railroad corporations.*—Each commission shall prescribe the form of the annual reports required under this act to be made by common carriers, railroad and street railroad corporations, and may from time to time make such changes therein and additions thereto as it may deem proper: provided, however, that if any such changes or additions require any alteration in the method or form of keeping the accounts of such corporations, the commission shall give to them at least six months' notice before the expiration of any fiscal year of any such changes or additions, and on or before June thirtieth, in each year, shall furnish a blank form for such report. The contents of such report and the form thereof shall conform as near as may be to that required of common carriers under the provisions of the act of congress, entitled "An act to regulate commerce," approved February 4, 1887, and the act amendatory thereof approved June 29, 1906, and other amendments thereto. The commission may require such report to contain information in relation to rates or regulations concerning fares or freights, agreements or contracts affecting the same, so far as such rates or regulations pertain to transportation within the state. When the report of any such corporation is defective, or believed to be erroneous, the commission shall notify the corporation to amend the same within thirty days. The originals of the reports, subscribed and sworn to as prescribed by law, shall be prescribed in the office of the commission. The commission may also require such corporations to file monthly reports of earnings and expenses within a specified time. The commission may require of all such corporations specific answers to questions upon which the commission may need information. The annual report required to be filed by a common carrier, railroad or street railroad corporation shall be so filed on or before the thirtieth day of September in each year. The commission may extend the time for making and filing such report for a period not exceeding 60 days. If such corporation shall fail to make and file the annual report within the time above specified, or within the time as extended by the commission, or shall fail to make specific answer to any question, or shall fail to make the monthly reports when required by the commission as herein provided, within 30 days from the time when it is required to make and file any such report or answer, such corporation shall forfeit to the state the sum of one hundred dollars for each and every day it shall continue to be in default with respect to such report or answer. Such forfeiture shall be recovered in an action brought by the commission in the name of the people of the state of New York. The amount recovered in any such action shall be paid into the state treasury and credited to the general fund. Any railroad corporation operating a line partly within the second district and partly within the first district shall report to the commission for the second district; but the commission for the first district may, upon reasonable notice, require a special report from such railroad corporation. Any street railroad corporation operating a line partly within the first district and partly within the second district shall report to the commission of the first district; but the commission of the second district may, upon reasonable notice, require a special report from such street railroad corporation.

Section 47. *Investigation of accidents.*—Each commission shall investigate the cause of all accidents on any railroad or street railroad within its district which result in loss of life or injury to persons or property, and which in its judgment shall require investigation. Every common carrier, railroad corporation and street railroad corporation is hereby required to give immediate notice to the commission of every accident happening upon any line of railroad or street railroad owned, operated, controlled or leased by it, within the territory over which such commission has jurisdiction in such manner as the commission may direct. Such notice shall not be admitted as evidence or used for any purpose against such common carrier, railroad corporation or street railroad corporation giving such notice in any suit or action for damages growing out of any matter mentioned in said notice.

Section 48. *Investigations by commission.*—1. Each commission may, of its own motion, investigate or make inquiry, in a manner to be determined by it, as to any act or thing done or omitted to be done by any common carrier, railroad corporation or street railroad corporation, subject to its supervision, and the commission must make such inquiry in regard to any act or thing done or omitted to be done by any such common carrier, railroad corporation or street railroad corporation in violation of any provision of law or in violation of any order of the commission.

2. Complaints may be made to the proper commission by any person or corporation aggrieved by petition or complaint in writing setting forth any thing or act done or omitted to be done by any common carrier, railroad corporation or street railroad corporation in violation, or claimed to be in violation, of any provision of law or of the terms and conditions of its fran-

chise or charter or of any order of the commission. Upon the presentation of such a complaint the commission shall cause a copy thereof to be forwarded to the person or corporation complained of, accompanied by an order, directed to such person or corporation, requiring that the matters complained of be satisfied, or that the charges be answered in writing within a time to be specified by the commission. If the person or corporation complained of shall make reparation for any injury alleged and shall cease to commit, or to permit, the violation of law, franchise or order charged in the complaint, and shall notify the commission of that fact before the time allowed for answer, the commission need take no further action upon the charges. If, however, the charges contained in such petition be not thus satisfied, and it shall appear to the commission that there are reasonable grounds therefor, it shall investigate such charges in such manner and by such means as it shall deem proper, and take such action within its powers as the facts justify.

3. Whenever either commission shall investigate any matter complained of by any person or corporation aggrieved by any act or omission of a common carrier, railroad corporation or street railroad corporation under this section it shall be its duty to make and file an order either dismissing the petition or complaint or directing the common carrier, railroad corporation or street railroad corporation complained of to satisfy the cause of complaint in whole or to the extent which the commission may specify and require.

Section 49. *Rates and service to be fixed by the commission.*—Whenever either commission shall be of opinion, after a hearing, upon a complaint made as provided in this act, that the rates, fares or charges demanded, exacted, charged or collected by any common carrier, railroad corporation or street railroad corporation subject to its jurisdiction for the transportation of persons, freight or property within the state, or that the regulations or practices of such common carrier, railroad corporation or street railroad corporation affecting such rates are unjust, unreasonable, unjustly discriminatory or unduly preferential, or in anywise in violation of any provision of law, the commission shall determine the just and reasonable rates, fares and charges to be thereafter observed and in force as the maximum to be charged for the service to be performed, and shall fix the same by order to be served upon all common carriers, railroad corporations or street railroad corporations by whom such rates, fares and charges are thereafter to be observed. And whenever the commission shall be of opinion, after a hearing, had upon its own motion or upon complaint, that the regulations, practices, equipment, appliances, or service of any such common carrier, railroad corporation or street railroad corporation in respect to transportation of persons, freight or property within the state are unjust, unreasonable, unsafe, improper or inadequate, the commission shall determine the just, reasonable, safe, adequate and proper regulations, practices, equipment, appliances and service thereafter to be in force, to be observed and to be used in such transportation of persons, freight and property and so fix and prescribe the same by order to be served upon every common carrier, railroad corporation and street railroad corporation to be bound thereby; and thereafter it shall be the duty of every common carrier, railroad corporation and street railroad corporation to observe and obey each and every requirement of every such order so served upon it, and to do everything necessary or proper in order to secure absolute compliance with and observance of every such order by all its officers, agents and employees. The commission shall have power by order to require any two or more common carriers or railroad corporations whose lines, owned, operated, controlled or leased, from a continuous line of transportation or could be made to do so by the construction and maintenance of switch connection, to establish through routes and joint rates, fares and charges for the transportation of passengers, freight and property within the state as the commission may, by its order, designate; and in case such through routes and joint rates be not established by the common carriers or railroad corporations named in any such order, within the time therein specified the commission shall establish just and reasonable rates, fares and charges to be charged for such through transportation, and declare the portion thereof to which each common carrier or railroad corporation affected thereby shall be entitled and the manner in which the same shall be paid and secured.

Section 50. *Power of commissions to order repairs or changes.*—If, in the judgment of the commission having jurisdiction, repairs or improvements to or changes in any tracks, switches, terminals or terminal facilities, motive power, or any other property or device used by any common carrier, railroad corporation or street railroad corporation in or in connection with the transportation of passengers, freight or property ought reasonably to be made, or that any additions should reasonably be made thereto, in order to promote the security or convenience of the public or employees, or in order to secure adequate service or facilities for the transportation of passengers, freight or property, the commission shall, after a hearing either on its own motion or after complaint, make and serve an order directing such repairs, improvements, changes or additions to be made within a reasonable time and in a manner to be specified therein, and every common carrier, railroad corporation and street railroad corporation is hereby required and directed to make all repairs, improvements, changes and additions required of it by any order of the commission served upon it.

Section 51. *Power of commissions to order changes in time schedule; running of additional cars and trains.*—If, in the judgment of the commission having jurisdiction, any railroad corporation or street railroad corporation does not run trains enough or cars enough or possess or operate motive power enough, reasonably to accommodate the traffic, passenger and freight, transported by or offered for transportation to it, or does not run its trains or cars with sufficient frequency or at a reasonable or proper time having regard to safety, or does not run any train or trains, car or cars, upon a reasonable time schedule for the run, the commission shall, after a hearing either on its own motion or after complaint, have power to make an order directing any such railroad corporation or street railroad corporation to increase the number of its trains or of its cars or its motive power or to change the time for starting its trains or cars or to change the time schedule for the run of any train or car or make any other suitable order that the commission may determine reasonably necessary to accommodate and transport the traffic, passenger or freight, transported or offered for transportation.

Section 52. *Uniform system of accounts; access to accounts, etc.; forfeitures.*—Each commission may, whenever it deems advisable, establish a uniform system of accounts to be used by railroad and street railroad corporations or other common carriers which are subject to its supervision, and may prescribe the manner in which such accounts shall be kept. It may also in its discretion prescribe the forms of accounts, records and memoranda to be kept by such corporation, including the accounts, records and memoranda of the movement of traffic as well as the receipts and expenditures of moneys. The system of accounts established by the commission and the forms of account, records and memoranda prescribed by it as provided above shall conform as near as may be to those from time to time established and prescribed by the interstate commerce commission under the provisions of the act of congress entitled "An act to regulate commerce" approved Feb. 4, 1887, as amended by the act approved June 29, 1906, and amendments thereto. The commission shall at all times have access to all accounts, records and memoranda kept by railroad and street railroad corporations and may prescribe the accounts in which particular outlays and receipts shall be entered, and may designate any of its officers or employees who shall thereupon have authority under the order of the commission to inspect and examine any and all accounts, records and memoranda kept by such corporations. Where the commission has prescribed the forms of accounts, records and memoranda to be kept by such corporations it shall be unlawful for them to keep any other accounts, records or memoranda than those so prescribed, or those prescribed by or under authority of the United States. Any employee or agent of the commission who divulges any fact or information which may come to his knowledge during the course of any such inspection or examination except in so far as he may be directed by the commission, or by a court or judge thereof, or authorized by law, shall be guilty of a misdemeanor.

Section 53. *Franchises and privileges.*—Without first having obtained the permission and approval of the proper commission no railroad corporation, street railroad corporation or common carrier shall begin the construction of a railroad or street railroad, or any extension thereof, for which prior to the time when this act becomes a law a certificate of public convenience and necessity shall not have been granted by the board of railroad commissioners or where prior to said time said corporation or common carrier shall not have become entitled by virtue of its compliance with the provisions of the railroad law to begin such construction; nor, except as above provided in this section, shall any such corporation or common carrier exercise any franchise or right under any provision of the railroad law, or of any other law, not heretofore lawfully exercised, without first having obtained the permission and approval of the proper commission. The commission within whose district such construction is to be made, or within whose district such franchise or right is to be exercised, shall have power to grant the permission and approval herein specified whenever it shall after due hearing determine that such construction or such exercise of the franchise or privilege is necessary or convenient for the public service. And if such construction is to be made, or such franchise to be exercised in both districts, the approval of both commissions shall be secured.

Section 54. *Transfer of franchises or stocks.*—No franchise nor any right to or under any franchise, to own or operate a railroad or street railroad shall be assigned, transferred or leased, nor shall any contract or agreement with reference to or affecting any such franchise or right be valid or of any force or effect whatsoever, unless the assignment, transfer, lease, contract or agreement shall have been approved by the proper commission. The permission and approval of the commission, to the exercise of a franchise under section fifty-three, or to the assignment, transfer or lease of a franchise under this section shall not be construed to revive or validate any lapsed or invalid franchise, or to enlarge or add to the powers and privileges contained in the grant of any franchise, or to waive any forfeiture.

No railroad corporation, or street railroad corporation, domestic or foreign, shall hereafter purchase or acquire, take or hold, any part of the capital stock of any railroad corporation or street railroad corporation or other common carrier organized or existing under or by virtue of the laws of this state, unless authorized so to do by the commission empowered by this act to give such consent; and save where stock shall be transferred or held for the purpose of collateral security only with the consent of the commission empowered by this act to give such consent, no stock corporation of any description, domestic or foreign, other than a railroad corporation or street railroad corporation, shall purchase or acquire, take or hold, more than ten per centum of the total capital stock issued by any railroad corporation or street railroad corporation or other common carrier organized or existing under or by virtue of the laws of this state. Nothing herein contained shall be construed to prevent the holding of stock heretofore lawfully acquired. Every contract, assignment, transfer or agreement for transfer of any stock by or through any person or corporation to any corporation, in violation of any provision of this act, shall be void and of no effect, and no such transfer or assignment shall be made upon the books of any such railroad corporation or street railroad corporation, or shall be recognized as effective for any purpose. The power conferred by this section to approve or disapprove a transaction relating to franchises, rights or stock of any railroad corporation or street railroad corporation, or other common carrier, shall be exercised by the commission which is authorized by this act to approve the issue of stock by such railroad corporation or street railroad corporation.

Section 55. *Approval of issues of stock, bonds and other forms of indebtedness.*—A common carrier, railroad corporation or street railroad corporation organized or existing, or hereafter incorporated, under or by virtue of the laws of the state of New York, may issue stocks, bonds, notes or other evidence of indebtedness payable at periods of more than twelve months after the date thereof, when necessary for the acquisition of property, the construction, completion, extension or improvement of its facilities, or for the improvement or maintenance of its service or for the discharge or lawful refunding of its obligations, provided and not otherwise that there shall have been secured from the proper commission an order authorizing such issue, and the amount thereof and stating that, in the opinion of the commission, the use of the capital to be secured by the issue

of said stock, bonds, notes or other evidence of indebtedness is reasonably required for the said purposes of the corporation, but this provision shall not apply to any lawful issue of stock, to the lawful execution and delivery of any mortgage or to the lawful issue of bonds thereunder, which shall have been duly approved by the board of railroad commissioners before the time when this act becomes a law. For the purpose of enabling it to determine whether it should issue such an order, the commission shall make such inquiry or investigation, hold such hearings and examine such witnesses, books, papers, documents or contracts as it may deem of importance in enabling it to reach a determination. Such common carrier, railroad corporation or street railroad corporation may issue notes, for proper corporate purposes and not in violation of any provision of this or any other act, payable at periods of not more than twelve months without such consent, but no such notes shall, in whole or in part, directly or indirectly be refunded by any issue of stock or bonds or by any evidence of indebtedness running for more than twelve months without the consent of the proper commission. Provided, however, that the commission shall have no power to authorize the capitalization of any franchise to be a corporation or to authorize the capitalization of any franchise or the right to own, operate or enjoy any franchise whatsoever in excess of the amount (exclusive of any tax or annual charge) actually paid to the state or to a political subdivision thereof as the consideration for the grant of such franchise or right; nor shall the capital stock of a corporation formed by the merger or consolidation of two or more other corporations, exceed the sum of the capital stock of the corporations so consolidated, at the par value thereof, or such sum and any additional sum actually paid in cash; nor shall any contract for consolidation or lease be capitalized in the stock of any corporation whatever; nor shall any corporation hereafter issue any bonds against or as a lien upon any contract for consolidation or merger. Whenever it shall happen that any railroad corporation shall own or operate its lines in both districts it shall, under this section, apply to the commission of the second district. Whenever it shall happen that any street railroad corporation shall own or operate its lines in both districts, it shall, under this section, apply to the commission of the first district. Any other common carrier not operating exclusively in the first district shall apply to the commission of the second district.

Section 56. *Forfeiture; penalties.*—1. Every common carrier, railroad corporation and street railroad corporation and all officers, and agents of any common carrier, railroad corporation or street railroad corporation shall obey, observe and comply with every order made by the commission, under authority of this act, so long as the same shall be and remain in force. Any common carrier, railroad corporation or street railroad corporation which shall violate any provision of this act, or which fails, omits or neglects to obey, observe or comply with any order or any direction or requirement of the commission, shall forfeit to the people of the state of New York not to exceed the sum of five thousand dollars for each and every offense; every violation of any such order or direction or requirement, or of this act, shall be a separate and distinct offense, and, in case of a continuing violation, every day's continuance thereof shall be and be deemed to be a separate and distinct offense.

2. Every officer and agent of any such common carrier or corporation who shall violate, or who procures, aids or abets any violation by any such common carrier or corporation of, any provision of this act, or who shall fail to obey, observe and comply with any order of the commission or any provision of an order of the commission, or who procures, aids or abets any such common carrier or corporation in its failure to obey, observe and comply with any such order or provision, shall be guilty of a misdemeanor.

Section 57. *Summary proceedings.*—Whenever either commission shall be of opinion that a common carrier, railroad corporation or street railroad corporation subject to its supervision is failing or omitting or about to fail or omit to do anything required of it by law or by order of the commission, or is doing anything or about to do anything or permitting anything or about to permit anything to be done, contrary to or in violation of law or of any order of the commission, it shall direct counsel to the commission to commence an action or proceeding in the supreme court of the state of New York in the name of the commission for the purpose of having such violations or threatened violations stopped and prevented either by mandamus or injunction. Counsel to the commission shall thereupon begin such action or proceeding by a petition to the supreme court alleging the violation complained of and praying for appropriate relief by way of mandamus or injunction. It shall thereupon be the duty of the court to specify the time, not exceeding twenty days after service of a copy of the petition, within which the common carrier, railroad corporation or street railroad corporation complained of must answer the petition. In case of default in answer or after answer, the court shall immediately inquire into the facts and circumstances in such manner as the court shall direct without other or formal pleadings, and without respect to any technical requirement. Such other persons or corporations as the court shall deem necessary or proper to join as parties in order to make its order, judgment or writs effective, may be joined as parties upon application of counsel to the commission. The final judgment in any such action or proceeding shall either dismiss the action or proceeding or direct that a writ of mandamus or an injunction or both issue as prayed for in the petition or in such modified or other form as the court may determine will afford appropriate relief.

Section 58. *Penalties for other than common carriers.*—1. Any corporation, other than a common carrier, railroad corporation or street railroad corporation, which shall violate any provision of this act, or shall fail to obey, observe and comply with every order made by the commission under authority of this act, so long as the same shall be and remain in force, shall forfeit to the people of the state of New York a sum not exceeding one thousand dollars for each and every offense; every such violation shall be a separate and distinct offense, and the penalty or forfeiture thereof shall be recovered in an action as provided in section fifty-nine of this act.

2. Every person who, either individually or acting as an officer or agent of a corporation other than a common carrier, railroad corporation or street railroad corporation, shall violate any provision of this act or fail to obey, observe or comply with any order made by the commission under this act, so long as the same shall be or remain in force, or who shall procure, aid or abet any such corporation in its violation of this act or in its failure to obey, observe or comply with any such order, shall be guilty of a misdemeanor.

3. In construing and enforcing the provisions of this act relating to forfeitures and penalties the act of any director, officer or other person acting for or employed by any common carrier, railroad corporation, street railroad corporation or corporation, acting within the scope of his official duties or employment, shall be in every case and be deemed to be the act of such common carrier, railroad corporation, street railroad corporation or corporation.

Section 59. *Action to recover penalties or forfeitures.*—An action to recover a penalty or a forfeiture under this act may be brought in any court of competent jurisdiction in this state in the name of the people of the state of New York, and shall be commenced and prosecuted to final judgment by counsel to the commission. In any such action all penalties and forfeitures incurred up to the time of commencing the same may be sued for and recovered therein, and the commencement of an action to recover a penalty or forfeiture shall not be, or be held to be, a waiver of the right to recover any other penalty or forfeiture; if the defendant in such action shall prove that during any portion of the time for which it is sought to recover penalties or forfeitures for a violation of an order of the commission the defendant was actually and in good faith prosecuting a suit, action or proceeding in the courts to set aside such order, the court shall remit the penalties or forfeitures incurred during the pendency of such suit, action or proceeding. All moneys recovered in any such action, together with the costs thereof, shall be paid into the state treasury to the credit of the general fund.

Section 60. *Duties of commissions as to interstate traffic.*—Either commission may investigate freight rates on interstate traffic on railroads within the state, and when such rates are, in the opinion of either commission, excessive or discriminatory or are levied or laid in violation of the interstate commerce law, or in conflict with the rulings, orders or regulations of the interstate commerce commission, the commission may apply by petition to the interstate commerce commission for relief or may present to the interstate commerce commission all facts coming to its knowledge, as to violations of the rulings, orders, or regulations of that commission or as to violations of the interstate commerce law.

ARTICLE IV.

PROVISIONS RELATING TO GAS AND ELECTRICAL CORPORATIONS; REGULATION OF PRICE OF GAS AND ELECTRICITY.

Section 65. *Application of article.*—This article shall apply to the manufacture and furnishing of gas for light, heat or power and the furnishing of natural gas for light, heat or power, and the generation, furnishing and transmission of electricity for light, heat or power.

Section 66. *General powers of commissions in respect to gas and electricity.*—Each commission shall within its jurisdiction:

1. Have the general supervision of all persons and corporations having authority under any general or special law or under any charter or franchise to lay down, erect or maintain wires, pipes, conduits, ducts or other fixtures in, over or under the streets, highways and public places of any municipality, for the purpose of furnishing or distributing gas or of furnishing or transmitting electricity for light, heat or power, or maintaining underground conduits or ducts for electrical conductors.

2. Investigate and ascertain, from time to time, the quality of gas supplied by persons, corporations and municipalities; examine the methods employed by such persons, corporations and municipalities in manufacturing and supplying gas or electricity for light, heat or power and in transmitting the same, and have power to order such improvements as will best promote the public interest, preserve the public health and protect those using such gas or electricity and those employed in the manufacture and distribution thereof, or in the maintenance and operation of the works, wires, poles, lines, conduits, ducts and systems maintained in connection therewith.

3. Have power to fix the standard of illuminating power and purity of gas, not less than that prescribed by law, to be manufactured or sold by persons, corporations or municipalities for lighting, heating or power purposes, and to prescribe methods of regulation of the electric supply system as to the use for incandescent lighting and fix the initial efficiency of incandescent lamps furnished by the persons, corporations or municipalities generating and selling electric current for lighting, and by order to require the gas so manufactured or sold to equal the standard so fixed by it, and to establish the regulations as to pressure at which gas shall be delivered. For the purpose of determining whether the gas sold by such persons, corporations or municipalities for lighting, heating or power purposes conforms to the standard of illuminating power and purity and, of its own motion, examine and investigate the methods employed in manufacturing, delivering and supplying the gas so sold, and shall have access through its members or persons employed and authorized by it to make such examinations and investigations to all parts of the manufacturing plants owned, used or operated for the manufacture or distribution of gas by any such person, corporation or municipality. Any employee or agent of the commission who divulges any fact or information which may come to his knowledge during the course of any such inspection or examination, except in so far as he may be directed by the commission, or by a court or judge thereof, or authorized by law, shall be guilty of a misdemeanor.

4. Have power, in its discretion, to prescribe uniform methods of keeping accounts, records and books, to be observed by the persons, corporations and municipalities engaged in the manufacture, sale and distribution of gas and electricity for light, heat or power.

5. Examine all persons, corporations and municipalities under its supervision, keep informed as to the methods employed by them in the transaction of their business and see that their property is maintained and operated for the security and accommodation of the public and in compliance with the provisions of law and of their franchises and charters.

6. Require every person and corporation under its supervision to submit to it an annual report, verified by the oath of the president, treasurer, or general manager thereof, showing in detail (1) the amount of its authorized capital stock and the amount thereof issued and outstanding; (2) the amount

of its authorized bonded indebtedness and the amount of its bonds and other forms of evidence of indebtedness issued and outstanding; (3) its receipts and expenditures during the preceding year; (4) the amount paid as dividends upon its stock and as interest upon its bonds; (5) the name of, and the amount paid as salary to each officer and the amount paid as wages to its employees; (6) the location of its plant or plants and system, with a full description of its property and franchises, stating in detail how each franchise stated to be owned was acquired, and (7) such other facts pertaining to the operation and maintenance of the plant and system, and the affairs of such person or corporation as may be required by the commission. Such reports shall be in the form, cover the period and be submitted at the time prescribed by the commission. The commission may, from time to time, make changes and additions in such forms, giving to the persons, corporations and municipalities six months' notice before the time fixed by the commission as the expiration of the fiscal year of any changes or additions which would require any alteration in the method or form of keeping their accounts for the ensuing year. When any such report is defective or believed to be erroneous, the commission shall notify the person, corporation or municipality making such report to amend the same within thirty days. Any such person or corporation or municipality which shall neglect to make any such report within the time specified by the commission, or which shall fail to correct any such report within thirty days after notice, shall be liable to a penalty of $100 and an additional penalty of $100 for each day after the prescribed time for which it shall neglect to file or correct the same, to be sued for in the name of the people of the state of New York. The amount recovered in any such action shall be paid into the state treasury and be credited to the general fund. The commission may extend the time herein limited for cause shown.

7. Require each municipality engaged in operating any works or systems for the manufacture and supplying of gas or electricity to make an annual report to the commission, verified by the oath of the general manager or superintendent thereof, showing in detail, (1) the amount of its authorized bonded indebtedness and the amount of its bonds and other forms of evidence of indebtedness issued and outstanding for lighting purposes. (2) its receipts and expenditures during the preceding year, (3) the amount paid as interest upon its bonds and upon other forms of evidence of indebtedness, (4) the name of and the amount paid to each person receiving a yearly or monthly salary, and the amount paid as wages to employees, (5) the location of its plant and system with a full description of the property, and (6) such other facts pertaining to the operation and maintenance of the plant and system, as may be required by the commission. Such report shall be in the form, cover the period and be submitted at the time prescribed by the commission.

8. Have power, either through its members or inspectors or employees duly authorized by it, to enter in or upon and to inspect the property, buildings, plants, factories, power houses and offices of any of such corporations, persons or municipalities.

9. Have power to examine the books and affairs of any such corporation, persons or municipalities, and to compel the production before it of books and papers pertaining to the affairs being investigated by it.

10. Have power, either as a commission or through its members to subpœna witnesses, take testimony and administer oaths to witnesses in any proceeding or examination instituted before it, or conducted by it in reference to any matter within its jurisdiction under this article.

Section 67. *Inspection of gas and electric meters.*—1. Each commission shall appoint inspectors of gas and electric meters whose duty it shall be when required, to inspect, examine, prove and ascertain the accuracy of any and all gas meters used or intended to be used for measuring or ascertaining the quantity of illuminating or fuel gas or natural gas furnished by any gas corporation to or for the use of any person and any and all electric meters used or intended to be used for measuring and ascertaining the quantity of electric current furnished for light, heat and power by any electrical corporation to or for the use of any person or persons and when found to be or made to be correct, the inspector shall stamp or mark all such meters and each of them with some suitable device, which device shall be recorded in the office of the secretary of state.

2. No corporation or person shall furnish or put in use any gas meter which shall not have been inspected, proved and sealed, or any electric meter which shall not have been inspected, approved, stamped or marked by an inspector of the commission. Every gas and electrical corporation shall provide or keep in and upon its premises a suitable and proper apparatus to be approved and stamped or marked by the commission, for testing and proving the accuracy of gas and electric meters furnished for use by it, and by which apparatus every meter may and shall be tested, on the written request of the consumer to whom the same shall be furnished, and in his presence if he desires it.

If any consumer to whom a meter has been furnished, shall request the commission in writing to inspect such meter, the commission shall have the same inspected and tested; if the same on being so tested shall be found to be four per cent. if an electric meter, or two per cent. if a gas meter, defective or incorrect to the prejudice of the consumer, the inspector shall order the gas or electrical corporation forthwith to remove the same and to place instead thereof a correct meter, and the expense of such inspection and test shall be borne by the corporation; if the same on being so tested shall be found to be correct the expense of such inspection and test shall be borne by the consumer. A uniform reasonable charge shall be fixed by the commission for this service.

Section 68. *Approval of incorporation and franchises; certificate.*—No gas corporation or electrical corporation incorporated under the laws of this or any other state shall begin construction, or exercise any right or privilege under any franchise hereafter granted, or under any franchise heretofore granted but not heretofore actually exercised without first having obtained the permission and approval of the proper commission. Before such certificate shall be issued a certified copy of the charter of such corporation shall be filed in the office of the commission, together with a verified statement of the president and secretary of the corporation, showing that it has received the required consent of the proper municipal authorities. No municipality shall build, maintain and operate for other than municipal purposes any works or systems for the manufacture and supplying of gas or electricity for lighting purposes without a certificate of authority granted by the commission. If the certificate of authority is refused, no further proceedings shall be taken before the commission, but a new application may be made therefor after one year from the date of such refusal.

Section 69. *Approval of issues of stock, bonds and other forms of indebtedness.*—A gas corporation or electrical corporation organized or existing, or hereafter incorporated, under or by virtue of the laws of the state of New York, may issue stocks, bonds, notes or other evidence of indebtedness payable at periods of more than twelve months after the date thereof, when necessary for the acquisition of property, the construction, completion, extension or improvement of its plant or distributing system, or for the improvement or maintenance of its service or for the discharge or lawful refunding of its obligations, provided and not otherwise that there shall have been secured from the proper commission an order authorizing such issue, and the amount thereof, and stating that, in the opinion of the commission, the use of the capital to be secured by the issue of such stock, bonds, notes or other evidences of indebtedness is reasonably required for the said purposes of the corporation. For the purpose of enabling it to determine whether or not it should issue such an order, the commission shall make such inquiry or investigation, hold such hearings and examine such witnesses, books, papers, documents or contracts as it may deem of importance in enabling it to reach a determination. Such gas corporation or electrical corporation may issue notes, for proper corporate purposes and not in violation of any provision of this or any other act, payable at periods of not more than twelve months without such consent; but no such notes shall, in whole or in part, directly or indirectly be refunded by any issue of stock or bonds or by any evidence of indebtedness running for more than twelve months without the consent of the proper commission. Provided, however, that the commission shall have no power to authorize the capitalization of any franchise to be a corporation or to authorize the capitalization of any franchise or the right to own, operate or enjoy any franchise whatsoever in excess of the amount (exclusive of any tax or annual charge) actually paid to the state or to any political subdivision thereof as the consideration for the grant of such franchise or right. Nor shall the capital stock of a corporation formed by the merger or consolidation of two or more other corporations, exceed the sum of the capital stock of the corporations, so consolidated, at the par value thereof, or such sum and any additional sum actually paid in cash; nor shall any contract for consolidation or lease be capitalized in the stock of any corporation whatever; nor shall any corporation hereafter issue any bonds against or as a lien upon any contract for consolidation or merger.

Section 70. *Approval of transfer of franchise.*—No gas corporation or electrical corporation shall transfer or lease its franchise, works or system or any part of such franchise, works or system to any other person or corporation or contract for the operation of its works and system, without the written consent of the proper commission. The permission and approval of the commission, to the exercise of a franchise under section sixty-eight of this act, or to the assignment, transfer or lease of a franchise under this section shall not be construed to revive or validate any lapsed or invalid franchise or to enlarge or add to the powers and privileges contained in the grant of any franchise or to waive any forfeiture. No such corporation shall directly or indirectly acquire the stock or bonds of any other corporation incorporated for, or engaged in, the same or a similar business, or proposing to operate or operating under a franchise from the same or any other municipality, unless authorized so to do by the commission. Save where stock shall be transferred or held for the purpose of collateral security only with the consent of the commission empowered by this act to give such consent, no stock corporation of any description, domestic or foreign, other than a gas or electrical corporation, shall purchase or acquire, take or hold, more than ten per centum of the total capital stock issued by any gas corporation or electrical corporation organized or existing under or by virtue of the laws of this state. Nothing herein contained shall be construed to prevent the holding of stock heretofore lawfully acquired. Every contract, assignment, transfer or agreement for transfer of any stock by or through any person or corporation to any corporation, in violation of any provision of this act, shall be void and of no effect, and no such transfer or assignment shall be made upon the books of any such gas corporation, or electrical corporation, or shall be recognized as effective for any purpose.

Section 71. *Complaints as to quality and price of gas and electricity; investigation by commission; forms of complaints.*—Upon the complaint in writing of the mayor of a city, the trustees of a village or the town board of a town in which a person or corporation is authorized to manufacture, sell or supply gas or electricity for heat, light or power, or upon the complaint in writing of not less than 100 customers or purchasers of such gas or electricity in cities of the first or second class, or of not less than 50 in cities of the third class, or of not less than 25 elsewhere, either as to the illuminating power, purity, pressure or price of gas or the initial efficiency of the electric incandescent lamp supply, or the regulation of the voltage of the supply system used for incandescent lighting, or price of electricity sold and delivered in such municipality, the proper commission shall investigate as to the cause for such complaint. When such complaint is made, the commission may, by its agents, examiners and inspectors, inspect the works, system, plant and methods used by such person or corporation in manufacturing, transmitting and supplying of such gas or electricity, and may examine or cause to be examined the books and papers of such person or corporation pertaining to the manufacture, sale, transmitting and supplying of such gas or electricity. The form and contents of complaints made as provided in this section shall be prescribed by the commission. Such complaints shall be signed by the officers, or by the customers, purchasers or subscribers making them, who must add to their signatures their places of residence, by street and number, if any.

Section 72. *Notice and hearing; order fixing price of gas or electricity, or requiring improvement.*—Before proceeding under a complaint presented as provided in section seventy-one, the commission shall cause notice of such

complaint, and the purpose thereof, to be served upon the person or corporation affected thereby. Such person or corporation shall have an opportunity to be heard in respect to the matters complained of at a time and place to be specified in such notice. If an investigation be instituted upon motion of the commission the person or corporation affected by the investigation may be permitted to appear before the commission at a time and place specified in the notice and answer all charges which may be preferred by the commission. After a hearing and after such investigation as may have been made by the commission or its officers, agents, examiners or inspectors, the commission within lawful limits may, by order, fix the maximum price of gas or electricity to be charged by such corporation or person, or may order such improvement in the manufacture or supply of such gas, in the manufacture, transmission or supply of such electricity, or in the methods employed by such person or corporation, as will in its judgment improve the service. The price so fixed by the commission shall be the maximum price to be charged by such person or corporation for gas or electricity in such municipality until the commission shall upon complaint as provided in this section or upon an investigation conducted by it on its own motion, again fix the maximum price of such gas or electricity. In determining the price to be charged for gas or electricity the commission may consider all facts which in its judgment have any bearing upon a proper determination of the question although not set forth in the complaint and not within the allegations contained therein.

Section 73. *Forfeiture for noncompliance with order.*—Every gas corporation and electrical corporation and the officers, agents or employees thereof shall obey, observe and comply with every order made by the commission under authority of this act, so long as the same shall be and remain in force. Any such corporation, or any officer, agent or employee thereof, who knowingly fails or neglects to obey or comply with such order, or any provision of this act, shall forfeit to the state of New York not to exceed the sum of one thousand dollars for each offense. Every distinct violation of any such order or of this act, shall be a separate offense, and in case of a continuing violation each day shall be deemed a separate offense. An action to recover such forfeiture may be brought in any court of competent jurisdiction in this state in the name of the people of the state of New York, and shall be commenced and prosecuted to final judgment by counsel to the commission. In any such action all penalties and forfeitures incurred up to the time of commencing the same may be sued for and recovered therein, and the commencement of an action to recover a penalty or forfeiture shall not be, or be held to be, a waiver of the right to recover any other penalty or forfeiture; if the defendant in such action shall prove that during any portion of the time for which it is sought to recover penalties or forfeitures for a violation of an order of the commission the defendant was actually and in good faith prosecuting the suit, action or proceeding in the courts to set aside such order, the court shall remit the penalties or forfeitures incurred during the pendency of such suit, action or proceeding. All moneys recovered in any such action, together with the costs thereof, shall be paid into the state treasury to the credit of the general fund.

Section 74. *Summary proceedings.*—Whenever either commission shall be of opinion that a gas corporation, electrical corporation or municipality within its jurisdiction is failing or omitting or about to fail or omit to do anything required of it by law or by order of the commission or is doing anything or about to do anything or permitting anything or about to permit anything to be done, contrary to or in violation of law or of any order of the commission, it shall direct counsel to the commission to commence an action or proceeding in the supreme court of the state of New York in the name of the commission for the purpose of having such violations or threatened violations stopped and prevented either by mandamus or injunction. Counsel to the commission shall thereupon begin such action or proceeding by a petition to the supreme court alleging the violation complained of and praying for appropriate relief by way of mandamus or injunction. It shall thereupon be the duty of the court to specify the time not exceeding twenty days after service of a copy of the petition within which the gas corporation, electrical corporation or municipality complained of must answer the petition. In case of default in answer or after answer, the court shall immediately inquire into the facts and circumstances in such manner as the court shall direct without other or former pleadings, and without respect to any technical requirement. Such other persons or corporations, as it shall seem to the court necessary or proper to join as parties in order to make its order, judgment or writs effective, may be joined as parties upon application of counsel to the commission. The final judgment in any such action or proceeding shall either dismiss the action or proceeding or direct that a writ of mandamus or an injunction or both issue as prayed for in the petition or in such modified or other form as the court may determine will afford appropriate relief.

Section 75. *Defense in case of excessive charges for gas or electricity.*—If it be alleged and established in an action brought in any court for the collection of any charge for gas or electricity, that a price has been demanded in excess of that fixed by the commission or by statute in the municipality wherein the action arose, no recovery shall be had therein, but the fact that such excessive charges have been made shall be a complete defense to such action.

Section 76. *Jurisdiction.*—Whenever any corporation supplies gas or electricity to consumers in both districts, any application or report to a commission required by this act shall be made to the commission of the district within which it is mainly supplying, or proposing to supply, such service to consumers. But nothing herein contained shall be construed to deprive the commission of either district of the power of supervision and regulation within its district. And either commission shall have power to enter and inspect the plant of such corporation, wherever situated.

Section 77. *Powers of local officers.*—If in any city of the first or second class there now exists or shall hereafter be created a board, body or officer having jurisdiction of matters pertaining to gas or electric service, such board, body or officer shall have and may exercise such power, jurisdiction and authority in enforcing the laws of the state and the orders, rules and regulations of the commission as may be prescribed by statute or by the commission.

ARTICLE V.

COMMISSIONS AND OFFICES ABOLISHED; SAVING CLAUSE; REPEAL.

Section 80. *Board of railroad commissioners abolished; effect thereof.*—On and after the taking effect of this act the board of railroad commissioners shall be abolished. All the powers and duties of such board conferred and imposed by any statute of this state shall thereupon be exercised and performed by the public service commissions.

Section 81. *Commission of gas and electricity abolished; effect thereof.*—On and after the taking effect of this act the commission of gas and electricity shall be abolished. All the powers and duties of such commission conferred and imposed by any statute of this state shall be exercised and performed by the public service commissions.

Section 82. *Inspector of gas meters abolished; effect thereof.*—On and after the taking effect of this act the offices of inspector and deputy inspectors of gas meters shall be abolished. All the powers and duties of such inspector conferred and imposed by any statute of this state shall be exercised and performed by the public service commissions. But any meter inspected, proved and sealed, by the said inspector of gas meters, prior to the taking effect of this act, shall be deemed to have been inspected by the commission.

Section 83. *Board of rapid transit railroad commissioners abolished; effect thereof.*—On and after the taking effect of this act the board of rapid transit railroad commissioners shall be abolished. All the powers and duties of such board conferred and imposed by any statute of this state shall thereupon be exercised and performed by the public service commission of the first district.

Section 84. *Transfer of records.*—1. The board of railroad commissioners, the commission of gas and electricity, and the inspector of gas meters, shall transfer and deliver to the public service commission of the second district all books, maps, papers and records of whatever description, now in their possession; and upon taking effect of this act, the said commission is authorized to take possession of all such books, maps, papers and records.

2. The board of rapid transit railroad commissioners shall transfer and deliver to the public service commission of the first district all contracts, books, maps, plans, papers and records of whatever description, now in their possession; and upon taking effect of this act, the said commission is authorized to take possession of all such contracts, books, maps, plans, papers and records. The said commission may also, at its pleasure, retain in its employment any person or persons now employed by the said board of rapid transit railroad commissioners, and all said persons shall be eligible for transfer and appointment to positions under the public service commission of the first district.

Section 85. *Pending actions and proceedings.*—This act shall not affect pending actions or proceedings, civil or criminal, brought by or against the board of railroad commissioners or the commission of gas and electricity, or the board of rapid transit railroad commissioners, but the same may be prosecuted or defended in the name of the public service commission, provided the subject-matter thereof is within the statutory jurisdiction of such commission. Any investigation, examination or proceeding undertaken, commenced or instituted by the said boards or commission or either of them prior to the taking effect of this act may be conducted and continued to a final determination by the proper public service commission in the same manner under the same terms and conditions, and with the same effect as though such boards or commissions had not been abolished.

Section 86. *Construction.*—Wherever the terms board of railroad commissioners, or commission of gas and electricity or inspector of gas meters or board of rapid transit railroad commissioners occur in any law, contract or document or whenever in any law, contract or document reference is made to such boards, commission or inspector, such terms or reference shall be deemed to refer to and include the public service commission as established by this act, so far as such law, contract or document pertains to matters which are within the jurisdiction of the said public service commissions. Nothing in this act contained shall be deemed to apply to or operate upon interstate or foreign commerce.

Section 87 repeals all existing laws in conflict with this bill; Section 88 appropriates $300,000 for the commissions, one-half for each, and Section 89 provides that the act shall take effect July 1, 1907.

Foreign Railroad Notes.

In Hungary the narrow-gage railroads are of 15 different gages, from 18 to 39⅜ in. The government has now decreed that henceforth such railroads may be built of only two gages, 70 and 76 centimeters = 27½ and 30 in.

The first task set for the new central office of the Prussian State railroads is a thorough examination of the rules and regulations for the different branches of the service, with a view to such a revision as will secure greater clearness and uniformity.

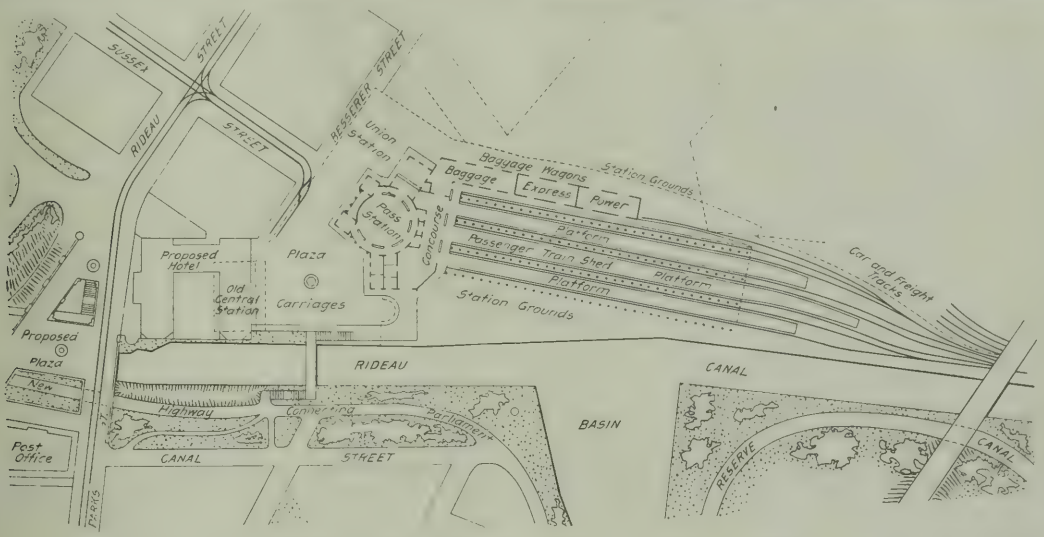
In the discussion of the railroad estimates by the Prussian Diet a champion of labor wished the government to agree to an advance in the salaries of locomotive engineers so that for the first year they may receive $360, and to rise in time to a maximum of $600 per year.

The coal production of the whole German Empire in 1906 was 249,000,000 short tons, 12 per cent. more than in 1905. About one-quarter of this was lignite. Of the whole, 92 per cent. was produced in Prussia. The imports were 20,200,000 and the exports 26,500,000 tons. Since 1901 the consumption of coal in Germany has increased 59,400,000 tons, or nearly one-third.

Proposed Union Station at Ottawa.

Plans for a central passenger station and hotel for Ottawa, Ont., have been submitted to the City Council and await the action of that body. The proposed station is to cost about $250,000, and the hotel, if built, between $1,250,000 and $1,500,000.

The general layout of the proposed station site and the main elevation of the station itself are shown in the accompanying drawings. The station is to face on a new plaza, containing about 32,000 sq. ft. of ground. There is to be a separate driveway at the other side for baggage and express wagons, so that they will not use the plaza. Passengers coming to or departing from the station can be distributed across the plaza to the north, east and west parts of the city.



Proposed Lay Out of New Union Station and Grounds at Ottawa.

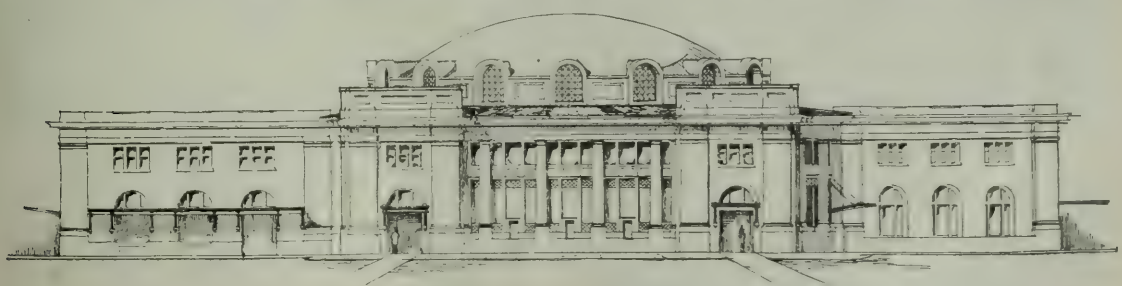
The station has been planned to provide for future needs for many years. It is to be used by the Grand Trunk, Canadian Pacific, Canadian Northern and New York Central (Ottawa & New York) roads. Each of the roads at present entering Ottawa can reach the new terminal by running around a Y and backing into the station. All trains will be backed into the trainsheds, thus keeping locomotive smoke as far away as possible. All switching, transferring of cars and changing of locomotives is to be done in the yards outside the station.

The station building proper consists of a main waiting room under a large central rotunda 85 ft. in diameter, open to the roof, lighted by clerestory windows, without skylights, and around the outside of this room will be wide passage ways to the ticket office, baggage rooms, waiting rooms, telephones, news stand, trainshed, concourse and exits and entrances, so that there will be no necessity of passing through the waiting room on the way to or from these different points. The ticket offices are to have a mezzanine floor above for clerks and for storing tickets. The waiting room and connecting corridors occupy about 5,600 sq. ft. The separate waiting rooms for women cover about 1,150 sq. ft., and the men's room about 700 sq. ft. The baggage rooms and custom rooms cover about 7,450 sq. ft., and the express and mail rooms 3,460 sq. ft. Besides this, there is to be a power and heating plant for the station, with separate track for coal and ashes. The entire area set aside for the proposed terminal covers about 266,000 sq. ft., or over six acres. The total length of the station will be 250 x 125 ft., exclusive of its concourse, which is 50 x 250 ft. The separate buildings for baggage, express, mail, and power, will cover 350 x 35 ft. All of this area is so arranged as to be increased in size as may be required.

The second story of the station building has separate stairway and elevator entrances, and will be used for railroad offices, covering about 14,000 sq. ft. The roofs are planned to carry snow and water away from the sidewalks and approaches. The construction of the station building will be fireproof throughout, with steel and iron framework, including large elliptical trusses supporting the rotunda roof. The exterior walls will be of solid masonry faced with light colored granite and stone, with projecting cornices, pediments, columns and pilasters. The entrance doorways will have glass marquises overhead, and the baggage room doors will be protected by umbrella awnings. The carriage concourse will be joined to the station by wide projecting canopies for the protection of passengers. The dome over the rotunda will be roofed with copper.

The passenger trainshed will cover about 8,200 sq. ft., and will be 530 x 186 ft., including seven tracks and four platforms. The columns for the overhead trusses are so placed that they do not block the platform. The design consists of a series of arched trusses, 17 ft. high at the lowest point above the tracks, the entire construction being of steel and cement. Directly over the tracks, openings will be left for the escape of smoke and gas from the locomotives. The sheds will be designed particularly for Canadian winter weather. A series of automatically controlled trap doors along the roof of the train shed can be opened and the snow dropped on cars underneath whenever desired.

The passenger platforms will be lighted overhead with wire-glass skylights at the apex of the roof, where they cannot be covered by snow, and where condensation can be provided for. These platforms will be of cement, 20 ft. wide in the clear, and raised nearly to the height of the car steps. The main platforms for express trains are over 700 ft. long, with umbrella awnings extending out beyond the trainshed proper. The platforms for local trains



Front Elevation of Proposed Union Station at Ottawa.

are 600 ft. long. The space between the platforms will be drained toward the center, so that any oil from the cars or engines, together with any rain or snow coming through the smoke openings, will be carried away from the platforms and to drains outside of the building.

Track Deformations and Their Prevention.*†

BY G. CUENOT,
Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway.

XII.

METHODS OF IMPROVING THE JOINT.

The obligation of obtaining a more rigid track, in view of realizing greater speeds, and also of reducing expenses of operation, is in contradiction to the well-known principle that a railroad track should be elastic, and should not present hard spots. It is necessary, in discussing this question, to define the word "elasticity," as employed in this case. Is an elastic track that which, under the effect of loads, returns each time to its original position? Or should elasticity be understood as a special quality, difficult to define, which produces smooth rolling; should the track be like a spring of great power, slowly registering the shocks and diminishing the effect so disastrous for vehicles and for travelers?

If the first sense is adopted, an elastic track is necessarily a bad track; it does not diminish the shocks, it multiplies them. For it is impossible that this elasticity should be at all points of like proportions; here the track, under the effect of the ballast, of the roadbed, and other causes, will be deformed more than at the neighboring point. Shocks and jolts, impossible to avoid, will result from it. Under existing conditions, with ties as they are laid, having small rigidity, it may be said that on each rail length there is first a drop, extending to the middle of the section; then a rise, from this point to the end of the rail. Both in the drop and in the rise there are high points and low points, which exaggerate the general bad effect. This is occasioned by the fact that the joint, in consequence of the drawing together of the ties at the splicing, which stiffens the rail, is the least elastic point of the track, and that in reality a hard point has been obtained when the contrary result was sought.

For, up to the present time, if we have used a suspended joint, it is because we have been afraid of having a hard point in its place; it has been surmised, wrongfully, that the supported joint was bad, and that it was necessary to keep it in the air in order to preserve that elasticity, which is only a deception. A track absolutely rigid as a marble table would be infinitely preferable for rolling to a track capable of deformation, like that which we actually have. This deformation—for the word "elasticity" is improper—is a necessity; it cannot be made otherwise, but it is not an advantage, any more than one could pretend that the elasticity of the bridge of Saints-Pères was sought for, and constitutes progress.

It has been forgotten that, on a track as actually constructed, hard points were not possible, because all the points of this track become deformed, and because, under the ties, the vertical displacement is greater than anywhere else. Mr. Coüard has shown that the flexure of rail between two consecutive ties was comprised between one-tenth and one-twentieth of a millimeter, and that the lowering of a tie under a load can reach four millimeters (0.16 in.); the mean is two millimeters (0.08 in.), that is to say the flexure of the rail is comprised between 1/200 and 1/400 of the lowering of the tie, and can be considered as infinitely small in comparison with the latter. Otherwise put, the tie bends infinitely more than any other point of the track; it is therefore wrong to think that it can constitute a hard point.

The necessity for laying rails in short lengths, in order to leave play between them for expansion, should not allow this fact to be lost sight of, that the extremity of a rail is like any other point, and that it should not be otherwise treated. Now the two extremities of the rails which follow each other have a marked tendency to vibrate differently; and from this tendency a fall is created, which goes on increasing with time.

Not only is the splicing displaced, but the rail is curved under the effect of the fall and of the shock which follows. Mr. Coüard has shown that the unequal level, between the middle of the rail and its extremities, can attain 0.8 in., divided thus:

Permanent bending between the middle and the extremity of the rail	0.56 in.
Variable flexure	0.12 "
Compression of the ballast and of the subsoil	0.12 "
Total	0.80 in.

This material inequality is due to the fall and to the shock, that is to say, to the suspended joint; it is the direct consequence of it. When laying rails an allowance of 0.02 in. at the extremities is admitted; if this allowance is in a contrary direction at the two extremities of adjacent rails, it is possible for the total drop to amount to 0.04 in. This circumstance, which is frequently presented, is the cause for the permanent bending, which rises even to 0.56 in. The hammering of the rail at its extremities aggravates the original situation up to the limit indicated. It is the same as far as the variable flexure is concerned; an end of rail of about 11.81 in., since the ties of the even joint are spaced about 23.62 in., should not bend under the loads to which it is submitted by more than one-tenth of a millimeter. The variable bending which it takes, and which is 0.12 in., is solely due to the shock, and, consequently, to the suspended joint. It is possible then to reduce in an appreciable manner the unequal level of 0.67 in. by holding the joint and preventing it from vibrating. We will then have only the flexure of the tie, the compression of the roadbed, which can be reduced to 0.06 in. That is to say, by sustaining the joint the unequal level which is actually produced can be reduced to one-twelfth of its real value. This will not only make better track, since the shock will be lessened, but it will prolong the life of the rail, occasioning a material economy in renewals.

The disorganization of the splicing, which is the first effect of the play allowed at the extremities of the rails, their curvature and the shock which follows, can be avoided by fixing the ends on a very rigid tie. It is conceivable that the two extremities, fastened on a single piece would act jointly with that piece, and would not have the tendency to work separately, as actually takes place. It is naturally necessary that the tie be rigid in order to avoid the stress on the fastenings, but, under that reservation, the method which we have outlined, and which is very old, only presents advantages.

Mr. Coüard, in his study on the vertical deformation of rails, makes the following comment:

"The principal attempts which have been made at reinforcing the splices of rails and the want of success of the oldest attempts, leaves little to be hoped for from the new, and I do not believe that it will be in this direction that the solution of the stability of the joint will be found.

"Experience proves that it is dangerous to suppress the allowance for expansion in railroad tracks.

"The unsymmetrical placing of ties in such a way that there is a greater number under the first half of the rail, appears to have given good results on the line from Saint-Etienne to Lyons, the busiest of the P. L. M. system.

"The reinforcement of the joint, by drawing together the ties of the even joint, has been well tried; several companies have also sought to bring the ties of the even joint still nearer together, in connection with the suspended joint."

This tendency to draw nearer and nearer together the ties of the even joint leads to the adoption of the supported joint; it is therefore not astonishing to find in the discussion at the Congress of 1895 at London the following declaration by Mr. John M. Toucey, of the New York Central:

"We have no more suspended joints since we tried them some years ago. We abandoned them because the inflection was too great. The joint is supported by three ties: one in the middle, the others at the extremities of the splices.

"With the rails of 100 lbs. per yard and this splice bearing on three ties, there is scarcely any sensible inflection at the joint. The rolling is almost as smooth in the middle of the rail as at the extremities. We believe, therefore, that our system of splicing is the best."

I concur in this rational conclusion. Mr. Coüard also recognizes that this is good practice, and he has shown that if the supported joint has been rated as bad, it is because the tie at the joint, induced successively by the rail in advance and by the following-rail, oscillated and easily became untamped when adjacent ties were 31½ in. away. He has established, in fact, that in the tunnels of Blaisy-Bas and of Saint-Irénée, with spacing reduced to 23.62 in., and with 87-lb. rails, the supported joints behaved well, although the pivoting of the ties still existed.

I conclude, then, that the only practical method for improving the joint is to support it on a tie and to place two others 11.81 in. from it. Moreover, untamping will be much less to be feared if a rigid type of tie is adopted, which always rests on its appointed bed. Experiment will alone permit of pronouncing upon this subject; but it can be said that untamping will then be less easy, because the tie, resting on nearly a plane surface, will distribute the pressure on the ballast uniformly, while actually, by reason of the flexure, the pressure is distributed unequally, and the ballast deformed unequally, which produces unwedging.

But this measure will only be useful after we succeed in correcting the unevenness which exists between the two extremities of the rail, and which proceeds, on the one hand, from defects in manufacture, and, on the other, from defects in laying. It is understood that if the joint still presents, after establishment of the track, any unevenness, in whatever direction, the latter will become rapidly worse, the tie of the joint becoming unwedged and finishing by churning, which is actually the case with the even joint. The unevenness will increase, and the state of things will become

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†Abridged translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.

just what it is now. The first measure to be taken consists, then, in suppressing the existing unevenness; it is possible to accomplish this in two ways, either by placing wedges under the lowest part of the rail (but this would be difficult, for it is a question of some tenths of millimeters), or by planing the two extremities of the rail with a portable tool, which seems easy, in order to place the rolling surface at the same level on both sides of the joint.

Consolidation of the fastenings is indispensable to complete the good support of the joint. If it is indispensable to improve the joint, which is certainly the weakest point in the track, it is no less necessary to pay attention to the holding power of the fastenings. It has been seen how important they were, as much from the point of view of assuring the joint action between the rail and the tie as of the resistance opposed to lateral movement.

As far as concerns this resistance, it is proper to utilize the whole lower surface of the head of the screw spike, and, on that account, to adopt the tie plates, which diminish the effect of the cutting which the rail exercises on the body of the screw spike. Certain railroad companies, fearing this cutting, have kept its shank away from the edge of the base of the rail; this is a bad solution, for, if it serves to avoid one difficulty, it brings about another equally serious. Lateral displacement of the rail, since it is not well supported and its overturning on curves, or sliding, is not properly guarded against. Experiments made on the P. L. M. on this subject show that with a metallic plate the cutting is very much diminished; it is true that we must take care of the abnormal wear which is necessarily produced between two metallic surfaces, the lower part of the base and the upper surface of the plate. But it is possible to interpose between the two surfaces a plate of felt or poplar.

On this account the reinforcement of the plates actually in use on the P. L. M. was occasioned; it has been seen, in the first part of this study, that, for want of a suitable reinforcement, the screw spike is not sufficiently sustained, and that under the influence of a relatively weak push exercised on the rail, it has a tendency to be overturned, not being stopped by the plate. The reinforcement, which we have made practical, has, on the contrary, arrested the movement of overturning and diminished the chances for inclination of the rail, and, consequently, of the spreading of the track. One can object, and it is probably the reason for maintenance of the actual type, that the reinforcement of the plate can induce loosening from the base of the rail, the head of the screw spike continuing to be supported on the reinforced part of the plate, while no longer being applied to the base. It does not seem impossible to remedy this disadvantage; it suffices, in fact, to slide an iron wedge under the head of the screw spike, in the same manner that wedges are placed between the splice and the lower part of the head of the rail. The importance of the result to be obtained justifies the measure which should be taken.

EMPLOYMENT OF THE TREENAIL.

As a means of consolidation of the fastenings, above all of those which are used in ties already old, the treenail has been employed with success. The wooden treenail, Collet system, was at first put in service, then the metallic treenail, of which one of the best types is the one invented by Mr. Thiollier. We pointed out, in the first part of this study, the results which the Collet treenail gave. I think it proper to recall them in revision.

The resistance to excessive turning, which is an essential quality of the fastening, is:

For pine without treenail	132 lbs.
For pine with treenail	176 "
For hardwood, oak, or beech, without treenail	220 "
For hardwood, oak or beech, with treenail	242 "

The resistance to tearing out, which is about 11,023 lbs., in creosoted pine with the treenail, in place of 7,716 lbs., seems to decrease with time; for it decreases at the end of two years to 8,818 lbs., to a limit sensibly equal to that which the wood possesses in its natural state. That holds according to the manner even in which the treenail is made; the latter is, in fact, cut out of wood in the direction of the grain, and thoroughly creosoted. Now it is known that a piece of wood thus established is in bad condition for receiving spikes or screws; they both hold badly. The wood does not permit of penetration by a screw thread; this has been proved by experiment with the treenail. Thus, when the insertion is first made, the force of extraction is exercised on the treenail; at the end of a few months the combination of screw spike and treenail submitted to extraction acts otherwise, it is the screw spike which is withdrawn, under a force of about 7,716 lbs. It holds from this that the wood of the treenail has not received the imprint of the screw thread; it is simply compressed more or less strongly, which in the beginning assures the union of the two pieces. But at the end of a short time the effect of this compression diminishes, the wood shrinks little by little, the contact diminishes, and the force which is necessary for extracting the system diminishes.

The resistance to tearing out in new oak ties is about 13,228 lbs.; it is about 15,432 lbs. when the latter are provided with treenails. But there is equally produced a diminution of resistance with time, as much in the first case as in the second, and the reason for it is the same.

As far as the resistance to overturning is concerned, the employment of the treenail does not appear to increase it materially; it depends above all, as has been seen, on the reinforcement of the plate.

The useful effect of the treenail is not, in fact, very great for opposing such a movement, because the upright wood of the treenail presents quite a weak resistance, scarcely the tenth of the resistance of the wood submitted to a force perpendicular with its fibers; because, under the influence of the force, the hole takes an oval shape, and because the wood crushes.

Another disadvantage in this method of consolidation of the fastenings arises from the fact that its employment requires the use of plates, in order to protect its upper surface. It is thus that the treenails of ties on tracks of the P. L. M. Co. are well preserved, because they are provided with a plate, but they shrink in the same ties without the plate, and a space between the treenail and the wood of the tie is produced, rendering the fastening bad and very shaky. This fact explains why, with certain companies where the plate is not in use, the wooden treenail could not be employed. It is possible, we believe, to remedy this disadvantage by placing on the head of the treenail a protecting coat composed of tar and sand, or of lime, sufficiently elastic to lend itself to all the movements of the tie.

It may therefore be said that, under actual conditions, the treenail prolongs the durability of a tie whose fastenings are damaged, but it does not give an increase of resistance, since the latter diminishes quite rapidly. It is not safe, therefore, to count on its employment for improving the fastenings in a permanent manner; at the beginning an improvement is obtained, but it does not seem to continue.

THIOLLIER TREENAIL.

Against excessive turning, which it is important to avoid, there is not any increase of resistance; the employment of the Thiollier metallic treenail seems, on the contrary, to produce this increase. This treenail is nothing but a steel helix of oval section, of which the number of spirals varies according to the pitch of the screw spike, and which is incorporated right at each screw spike of the tie in a socket previously cut in the tie by means of a cutting tap. The lining has the same pitch as the screw spike to be employed, and an interior diameter about the same as that of the core of the screw spike, in order to reduce the play between the two pieces to the minimum; the helix, prepared for its normal service, is always flush with the upper part of the tie, lines the place cut out for the plate, and, at its lower part, ought always to rest on at least 0.39 in. of wood not tapped.

According to the inventor, as soon as the squeezing force commences, by the contact of the cap of the screw spike with the rail or the chair, the lining increases in diameter, embraces the forms of the screw spike, which places the latter under protection against all spontaneous untightening, and assumes the function of a spring, all the different spirals obeying the force parallel to its axis transmitted by the screw spike.

The lining, by its diameter greater than that of the screw, engages the parts of the wood with a more extended surface than that engaged by the threads of the screw spike, and in re-employed ties, where the same site is preserved for the screw spike, the parts of the wood less altered or less blackened.

These advantages have caused certain railroad companies to employ the Thiollier lining. The results of extraction are essentially the same as those which are obtained with the Collet treenail, that is to say, the resistance is increased by about 30 per cent. But experience has not perhaps been sufficient to enable us to pronounce on the efficiency of the lining after a certain time of employment; and it is to be feared that there will be produced, as with the Collet treenail, a certain relaxation of the distended fibers. In each case the resistance to excessive turning is limited. It does not increase constantly, as a purely superficial examination would tend to prove. It is necessary to guard against squeezing it too tightly, for the spiral and the screw spike are made like a nut and its bolt. In acting on the bolt, the nut is made to ascend; the spiral ascends, the rings come to be pressed against each other and against the plate, tearing the fibers of the tie, and the apparent resistance to excessive turning is as much greater as the fastening is more dislocated. But it is easy not to reach this limit, and it is easily possible to remedy this disadvantage by providing the treenail with a spur applied against the bottom of the tie, and by diminishing the flexibility of the spirals in order that they may not be able to be pressed against each other.

Nevertheless, the Thiollier lining is an excellent palliative, for it increases the resistance to transverse overturning comparatively with the known systems, and is economical, since the lining can be placed without withdrawing the tie from the track, which produces an economy of about 1 franc (19.4 cents).

Apart from the effect of overturning, which is very rarely produced, while admitting at the same time that it can take place, there is occasion for considering the resistance which the rail, pro-

vided with its plate and its fastenings, presents to sliding. It has been possible to verify this resistance by means of the Collet déclimètre, and by a special arrangement which permits of direct action on the plates. The results of these experiments are given below:

Pine ties creosoted. With bare screw spikes	8,598 lbs.
With screw spikes and treenails	11,905 "
With screw spikes provided with Thiollier linings	15,212 "
New oak creosoted cross ties with bare screw spikes	17,637 "
New beech creosoted ties	18,298 "

The following comparison can be made, so far as the forces for tearing out are concerned, according to whether the ties are or are not provided with treenails or spirals:

Pine ties. With bare screw spikes	6,834 lbs.
With screw spikes and new treenails	10,824 "
With screw spikes and treenails after 3½ years' service	8,818 "
With screw spikes and spirals	9,148 "

It can be said, in recapitulation, that the Thiollier spiral presents 28 per cent. more resistance against sliding than the Collet treenail; the latter, on the contrary, offers 18 per cent. more resistance against tearing out than the spiral without interposition of the plate. In the case in point, it is therefore only a question of ties of soft wood, for with hard wood the resistance is more considerable, and the employment of the treenail or of the spiral is not pointed out.

It is evidently possible to consolidate the fastenings of ties in bad condition by employing either the Collet treenail or the Thiollier lining, but is the result obtained definite, and ought one to count on a constant and notable improvement? I do not think so, at least with the Collet system, because this treenail is cut from wood parallel with the grain; I reserve my approval so far as concerns the Thiollier spiral, because experiment has not been carried on for a sufficiently long time. Will there not be, on the other hand, a certain advantage, in point of view of resistance, in placing such systems in a composite tie, where the wood is compressed between two metallic parts? This is probable, because the wood is maintained in constant tension against the fastening, without it being possible to produce withdrawal. From the same cause the sinking of the rail in the tie diminishes, which reduces the inclination of the track by its spreading, as well as the movement of the joint.

The employment of the treenail and of the spiral, such as they are known, certainly does not constitute the only method of prolonging the life of ties in bad condition. A simple plug of wood, cut perpendicular to the fibers, can fill the same office, especially if care is taken to give it the form of a truncated cone, whose large base should be directed downwards. When tightening the screw spike the plug would be caused to rise, and its intimate contact with the tie would be assured.

But, whatever may be the type adopted, it is necessary to protect the head of the plug against atmospheric variations; for that a simple coat of tar with lime will suffice, in the case where the plate will not be adopted.

The employment of a bolt to replace the screw spike, with the bolt resting on the lower surface of the tie, is perhaps no longer an always satisfactory solution, because a reduction of resistance to overturning is to be feared. Against tearing out, on the contrary, the resistance is maximum.

(To be concluded.)

Plain Words from a Canadian Judge.

As a result of a wreck at Gourock, Ont., last September, on the Grand Trunk, in which three lives were lost, Joseph Thompson, a conductor, was sentenced to three years in the penitentiary. Sentence was passed by Justice Riddell. A part of his address is reproduced below, from the Toronto *News:*

"I must bear in mind the various objects, with which in view the law has affixed punishment to a crime. They are the reformation of the criminal and the prevention of similar offences by him and others. As to the first, I was shocked to see that instead of the leniency of the Crown being regarded with gratitude, it was made a ground of complaint. Instead of admitting the violation of the rules laid down with the approval of your governor-general-in-council for your guidance, a violation which was proved to have been committed by yourself more than once, you attempted to bolster up a defence by statements which nobody believed; and you apparently hoped that the jury might through prejudice against the railway company be false to their oaths and to their duty to their country.

"I must bear in mind the various objects with which in view part. Instead of repentance for your own crime you seek to cast all the blame upon others. For your own sake, then, I must cause some substantial punishment to be inflicted. More men are killed in Canada upon the railways every year through preventable causes, by reason of sheer negligence, than Canada lost in the Boer war. If this were the fault of the rules or regulations of the railway companies, then terrible were the guilt of those responsible for such rules. If you and your fellow trainmen had used even ordinary care, the three men now lying in the grave as the result of your act might now be happy and useful citizens. It has been said that the present condition is due in large measure to a widespread lack of discipline. If so this must be improved.

"You were a conductor of very long experience, a capable man in every sense of the word. You were on a choice route, which realized for you a rate of pay considerably higher than the average rate at which conductors on freight trains are paid (your remuneration was about $40 per week). Your hours were long—too long—though you had two clear days in the week to rest, the hours of the other five were nineteen to twenty per day, and sometimes more.

"You knew that you had the right, under the rules, to a rest of eight hours, once you had worked sixteen hours; and there can be no doubt that you continued on the route because of its remunerative character. You knew that if you desired you would be put upon a run involving fewer hours of continuous work, but that if you did so, your pay would be less. You stoutly asserted that you had plenty of sleep, that you by many years' practice had trained yourself to be content with a few hours per day, and no responsible officer of the company ever heard any complaint from you that you wanted your hours of work reduced. You were permitted to continue on the long route.

"To my mind, the persons who even permitted you to work nineteen to twenty hours per day, day after day, five days in the week, were guilty of a gross wrong; the persons who made rules and regulations under which this was possible, are themselves almost or quite as guilty morally, perhaps legally, as yourself of the death of these three poor victims. And I shall cause to be sent to the Crown authorities a copy of the proceedings of this trial, with the recommendation that all proper investigations be made and that the persons responsible, no matter what their position may be, be proceeded against, so far as the criminal law permits. It were wrong to punish an employee and allow the employer to go scot free, where both are at fault."

Justice Riddell then cited the explicit disobedience of order which caused the wreck. It was the old story of attempting to make another siding before the other train arrived. The prisoner confessed this disobedience, but tried to put the blame on the engineer. Of this the justice said:

"You were wide awake then; and your conduct there and then was simply without excuse. The engineer, upon whom you try to throw the blame, knew, or might have known, as well as you, the danger, but his negligence if he was negligent—and that has yet to be tried—does not in the least relieve you."

Thompson pleaded that he had fallen to sleep as a result of his long working. Justice Riddell disposed of this point by saying: "Your plea is that you fell asleep, but if the sentry sleep no excuse is accepted; the penalty is death. What is to be said of you? If men in charge of dangerous engines are taught that if negligence on their part result in death or injury, punishment must inexorably follow, we shall cease to hear of so many horrors which could, and therefore should, have been prevented. I have been told that I may exact a fine. I refuse even to consider the exaction of a fine or to do anything which could suggest that the stain of the blood that is on your hands can be washed out with money. It is hard to see any circumstances of mitigation, to discover anything which justifies me in reducing the punishment below the term mentioned in the act, but I am inclined to be merciful. I remember that you have not before been guilty (so far as appears) of any similar offence."

Traffic Through the "Soo" Canals and the Detroit River.

The American and Canadian canals at Sault Ste. Marie together carried, during the season of 1906, 51,751,080 net tons of freight as against 44,270,680 tons in 1905, an increase of 7,480,000 tons, or 17 per cent. It is interesting to remember that the increase in 1905 was 12,724,574 tons, or 40 per cent., over 1904.

The following table shows for each of the decades following 1855, the year in which the first canal was opened, the total increase in tonnage for each 10 years and, in the second column, the average percentage of yearly increase in traffic. By adding the tonnage carried in 1905 and 1906 the total amount of freight carried since the canals were opened is found to be over 450,000,000 net tons.

	Tons.	Per Ct.
1855-1864	1,203,358	44
1865-1874	4,829,247	12
1875-1884	14,868,639	17
1885-1894	80,343,218	17
1895-1904	253,002,697	12
1905	44,270,680	
1906	51,751,080	
	450,268,919	

The American canal opened last year on April 13 and closed December 17, making a season three days longer than in the preceding year. The traffic through the American canal was 87 per cent. of the total freight. American vessels carried 95 per cent. of the total freight traffic, the same proportion as in 1905.

Of the total of a little over 51,750,000 tons of freight carried 10,166,175 tons were westbound and 41,584,905 tons eastbound. Iron

ore furnished 35,357,042 tons, or 68 per cent. of the total freight tonnage. The next largest item was coal, of which 1,011,375 tons of hard and 7,728,255 of soft were carried. The iron ore tonnage increased 13 per cent. over 1905. The increase in 1905, however, was 60 per cent. The wheat carried increased 23 per cent., following an increase of 37 per cent. in 1905.

The rapid increase in size of lake steamers is clearly shown. Until 1904 there was no vessel passing through the canal over 500 ft. long, or which carried more than 9,000 net tons. In 1904 one vessel over 500 ft. long was put in service which had a capacity of over 10,000 tons; there were also three other vessels with a capacity of between 9,000 and 10,000 tons put in commission that year. In 1906, 44 new freight steamers were put in commission for the Lake Superior trade. Of these, 32 were 500 ft. or more long and carried between 9,000 and 14,000 net tons of freight in a single cargo. There are now in commission 57 steamers between 500 and 600 ft. long with a beam of from 52 to 60 ft., as against one in 1904. The largest vessels are 600 ft. long, 58 ft. beam and carry 13,000 to 14,000 tons. In 1904 there was no vessel which carried over 12,000 tons; in 1906 there were 12.

For the season's largest single cargo the steamer "J. P. Morgan," of the Pittsburg Steamship Company (United States Steel Corporation), holds the record of 13,272 tons. The steamer "E. H. Gary" of the same line held the 1905 record with a single cargo of 12,368 net tons. For the two years previous to 1906 the steamer "Augustus B. Wolvin," of the Acme Steamship Company, which also in 1904 carried the largest single cargo, held the record for the greatest amount of freight carried during the year, and for the greatest number of ton-miles. It was outstripped in both of these records last year by the "E. H. Gary," which carried 313,434 tons of freight during the season and ran 42,986 miles, which makes 249,353,656 ton-miles for the season and gives it the record for all three performances.

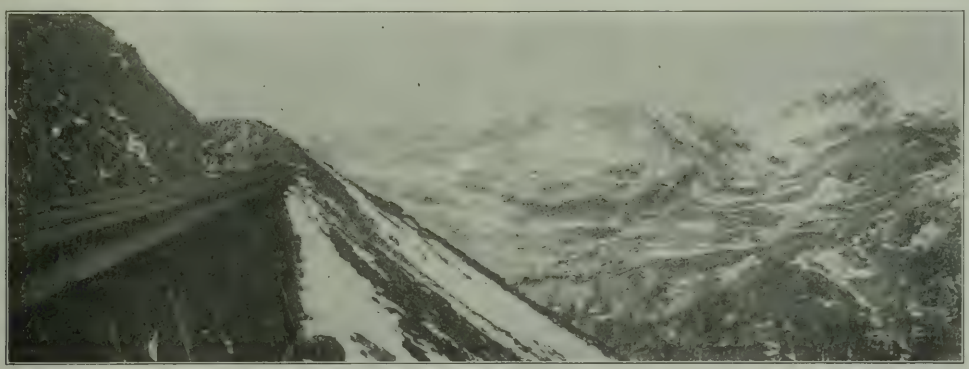
For the first time a record of the lake commerce passing Detroit, Mich., and Windsor, Ont., through the Detroit river, is included in the annual report of the "Soo" canals. The total of actual freight carried during 1906 was 63,808,571 net tons, an increase of 4,761,275 tons, or 8.5 per cent. over 1905. The concentration of the traffic on fewer and larger steamers is shown in the fact that in spite of this larger traffic there were 410 less vessel passages through the Detroit river. The figure for actual amount of freight carried is based on the proportion of actual freight to net registered tonnage which obtained during 1905 at Sault Ste. Marie, where in that year the actual freight was 25.92 per cent. greater than the registered tonnage. There were 60,589,441 tons of freight which passed through the St. Clair Flats canal during 1906. This canal is north of Detroit at the northern end of Lake St. Clair. It has been found from custom house records at Detroit that 2,581,488 net registered tons that used the Detroit river did not go through the St. Clair Flats canal, but turned around and went back down the river. This amount, therefore, should be subtracted from the Detroit river tonnage for an accurate estimate of the amount of freight carried through the Detroit river to the northern lakes.

The following table shows the commerce passing through the Detroit river for the last five years:

Year.	No. of Passages.	Net Registered Tons.	Actual Freight.	Value.
1902	33,000	39,328,689	44,260,506	$440,834,460
1903	33,113	37,453,796	46,817,245	471,917,830
1904	29,472	33,049,984	42,792,236	453,598,656
1905	35,599	45,042,822	55,508,360	522,888,751
1906	35,128	50,673,897	63,808,571	662,971,053

Mountain Scenery on the Moffat Road.

We have previously published a number of photographs taken along the line of the Denver, North-Western & Pacific. Of the two shown herewith, the view from Slide Rock bridge, east of the Continental Divide, is of interest as showing where the tree line stops.



View from Slide Rock Bridge; Denver, North-Western & Pacific.



Highest Railroad Station in the World; Corona, Colorado, 11,629 ft.

The Corona station, 11,669 ft. above tidewater, is, we believe, the highest steam railroad station in the world. There is always snow at Corona, and the management makes a special feature of snowball excursions, run from Denver in the summer months. The station is built of logs, caulked with wool and cement.

Proposed East River Bridge; New York Connecting Railroad.

The accompanying illustrations from the architects' drawings show the general appearance of the proposed bridge over the East river at Ward's and Randall's islands to be built by the New York Connecting Railroad, and which will join the belt line now building around Brooklyn from Bay Ridge on the harbor with the Harlem river branch of the New York, New Haven & Hartford. The bridge and the approaches are in reality a series of bridges of many different types, with a total length of over three miles with the main channel arch over Hell Gate as the crowning feature. This huge arch of 1,000 ft. clear span will be the largest structure of its kind in the world, being more than 200 ft. longer than the Niagara gorge arch and designed for much heavier loads.

The south approach in Queens county, Long Island, is a succession of reinforced concrete arches and plate girders over the numerous intersecting streets, the intermediate sections being an earth fill with heavy concrete retaining walls. Some 135 ft. girders are required at one street crossing. The steel viaduct approach to the main arch consists of a plate girder superstructure supported on steel rocking towers spaced about 75 ft. apart. At intervals of about 800 ft. are concrete stability piers filled with gravel, to which the floor stringers are anchored. Expansion joints are provided in the center of the distance between these piers, but no roller bearings or other movable supports are included in the design.

The main arch is flanked on each side by the abutment piers, which are carried up 200 ft. in the form of double towers. These will be of massive proportions and elaborately ornamented above the deck. They will rest on compact gravel and hard pan, the bottom of the foundations being above the high-water line, and will, therefore, be much less expensive to build than would foundations for any other type of bridge requiring piers in or close to the water. The part below the springing line of the arch will be granite-faced masonry, and above that finished concrete. The main body of the piers will be hollow and filled with earth and stone to provide sufficient weight to counteract the horizontal thrust of the arch.

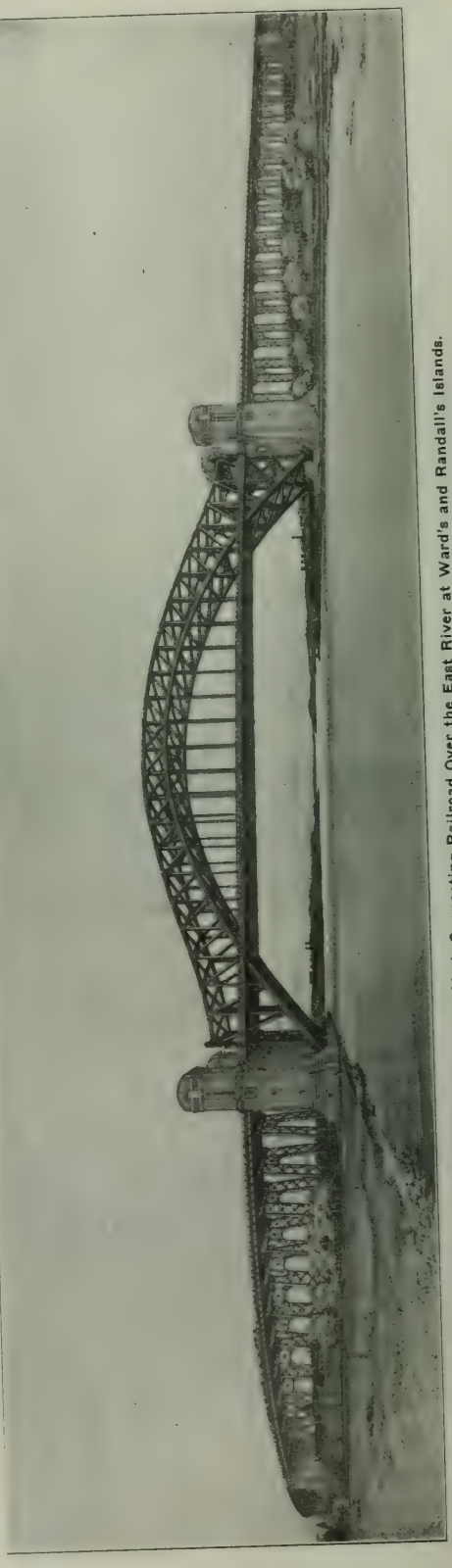
The arch will be 300 ft. high at the crown, with a clear waterway under the floor of 140 ft. The panels are of uniform length, 42 ft. 6 in. At the crown the depth of 40 ft. was imposed by the conditions of the design and similarly the height at the portal was that required for the end bracing and head room over the tracks. The peculiar but very symmetrical reverse curve of the upper chord resulted from the determination of the height of the intermediate panels to provide a uniform increase in the compressive stresses in the bottom chord from crown to abutment. Ample wind bracing is provided between the arch trusses, which are spaced 60 ft., center to center, as well as in the floor system.

The floor system consists of deep plate girder stringers under each rail and crossbeams at each post, interlaced with diagonal bracing. There will be four tracks, two for passenger and two for freight trains, with material platforms between. The rails will be laid on ties embedded in 15 in. of stone ballast, laid on a floor of 8-in. creosoted and caulked timbers. This construction will be used throughout on the metal superstructure of the main arch and approaches. The bridge has been designed for live loads on each of the four tracks, consisting of two 190-ton locomotives coupled and followed by a uniform load of 5,000 lbs. per lineal foot.

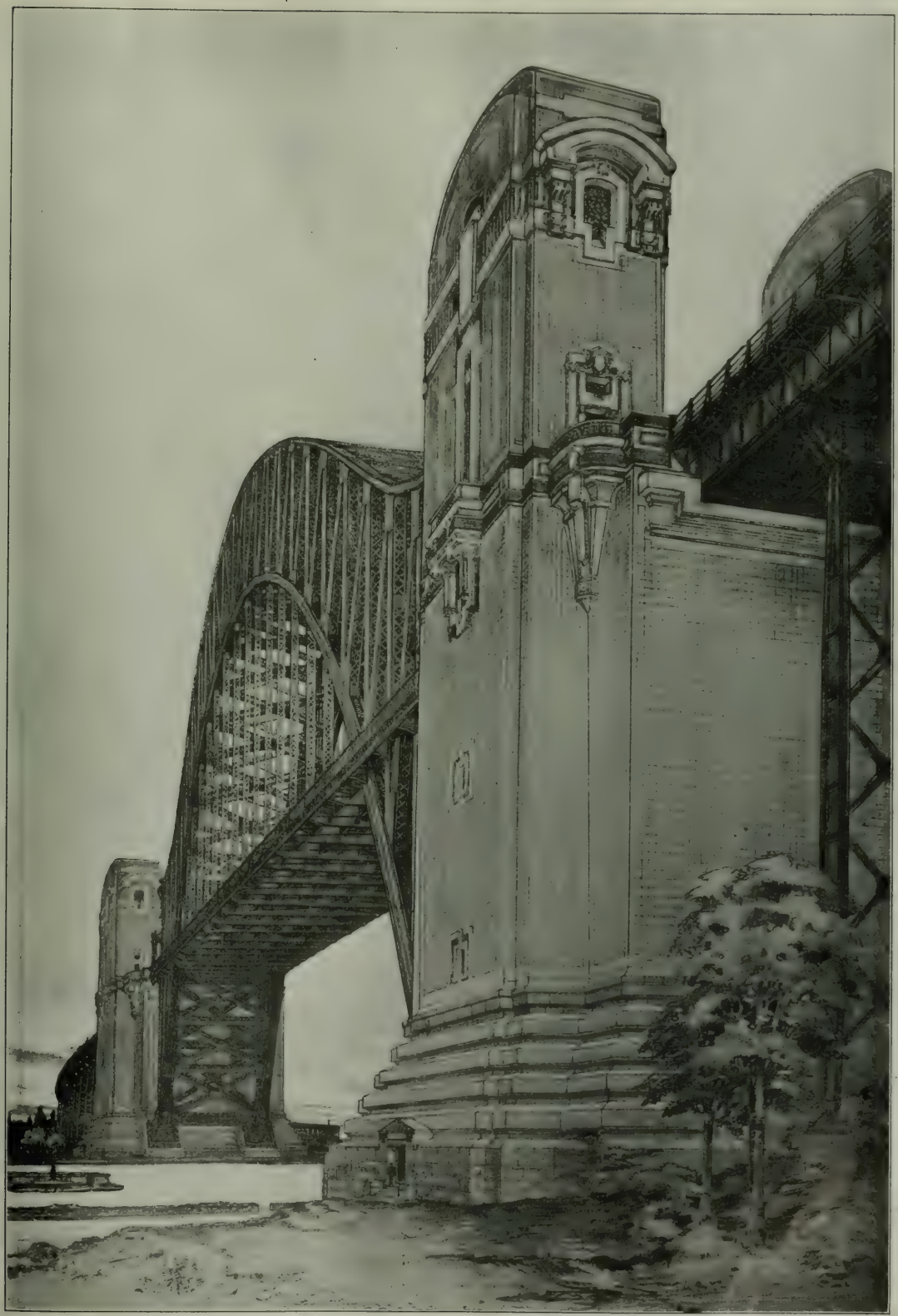
While the arch may be considered as two-hinged, the abutment bearings will be solid and made without pins. The whole design is such that the movement at the crown is only a few inches, and in a structure of this size it was considered useless to provide for very small movements at the abutments. There are two expansion joints in the floor system of ingenious design. They are so arranged that the opening is never more than ⅛ in. under any conditions. This was done to prevent the whole floor system moving under the action of a train starting or stopping on the bridge.

Beyond the main arch the viaduct is continued over Ward's island to Little Hell Gate, which is not navigable to deep-draught boats, and therefore required only an ordinary deck lattice truss bridge of five spans, varying in length from 105 to 245 ft. Beyond this the viaduct is continued over Randall's island to the Bronx kill, where a double lift bridge, having two spans of 160 ft., will be built. The line curves on a 3 deg. curve from a point 80 ft. north of the Hell Gate arch and then continues on a tangent to the main land at Port Morris, where connection is made with the New Haven. The maximum grade will be 0.72 per cent. compensated.

The method proposed for erecting the main arch is somewhat similar to that employed with the cantilever bridge now building over Blackwell's island further down the river. The abutments and towers will first be built up to the level of the floor and the skew backs erected on falsework at the base. A temporary steel tower about 175 ft. high will be erected on top of each pier and anchored in the rear by eye-bar chain cables with a strength of 1,700 tons. These cables will be carried back to a "dead man" about 425 ft. in the rear of the abutments. The main floor girders will be brought to the bridge site and buried in the ground in four rows or columns between the "dead man" and the abutment to take up the horizontal



Proposed Bridge of the New York Connecting Railroad Over the East River at Ward's and Randall's Islands.



Perspective View of Arch and Piers of Proposed Bridge Over the East River; New York Connecting Railroad.

thrust. In the beginning the shore panels will be erected by derricks on the piers, and as soon as these are up the eye-bar anchor chains will be anchored to the structure, being carried up about 90 ft. on the temporary tower and then down to the rear. A traveler running on the top chord will be used to erect the arch, hoisting the members from scows moored in the channel below. After the first few panels have been erected the anchor chain will be raised to the top of the tower and the remaining erection completed. Closing of the arch will be done by manipulating sand or hydraulic jacks mounted under the foot of the temporary towers. No additional metal will be required in any of the members in the arch to provide for excessive stresses during erection.

The plans for the entire structure, which were made by Gustav Lindenthal, Consulting Engineer, and Palmer & Hornbostel, Architects, have been submitted to the Municipal Art Commission for approval. The bridge in many respects is one of the most daring and remarkable engineering structures ever proposed. In spite of its great weight, 80,000 tons, it is claimed that it can be built and erected at less cost than any of the other bridges over the East river.

We are indebted to Mr. Lindenthal for the information here given.

Unnecessary Empty Car Movements Between Chicago Terminals.*

Disagreements and disputes between inspectors as to responsibility for defects existing in cars occasion more unnecessary empty movements than any other known cause, and my experience is that investigations are generally barren of results. Why this should be I am not in position to say; I only know that it is so, and so far as I can see there is no excuse for it. At the same time, I admit I am not qualified, by practical experience, to judge of the merits of a case involving mechanical points because I am not a car builder, but there is one thing I do feel pretty sure about, and that is that the mechanical departments are largely at fault for conditions tending to wastefulness and contributing to bad work in a terminal where there is neither room nor time to spare, and it is to that department, without bias of any kind, that I desire most particularly at this time to speak.

If it were not customary, and necessary as well, to interchange cars in bad order, it would be easy to find a remedy for the difficulty referred to by making an agreement that delivering lines must invariably see to it that all cars offered in interchange shall be put in good order beforehand, but such a restriction would hamper and retard the movement of traffic in a most vexatious way. Moreover, it would nullify, if not entirely destroy, one of the wisest provisions of the Master Car Builders' rules. A great many cars cannot be repaired under load, and, as transfers fall on receiving lines in Chicago, such cars are delivered to connections, shipments transferred and cars returned, and here is where the trouble begins.

It frequently happens that existing defects are made worse in switching, and when such a car is returned to the delivering line it is rejected by the inspector and, without any attempt being made to adjust matters the car is immediately sent back. Then begins the shuttle-cock process and before the case is settled it may make many movements between two railroads, because one does not want it and the other won't have it—all the while piling up trackage and per diem for the juggling roads to pay and depriving the owner of the use of his car besides.

The interchange of cars between the St. Paul and most of its connections in this terminal is through the belt lines. The charge for moving an empty car is a dollar one way and, in addition, a reclaim of 25 cents is allowed for the intermediate move, making the charge to the delivering line $1.25 to $2.50 for the round trip. I have a number of cars that have made unnecessary movements between the St. Paul company and its connections, and if you will follow me I will endeavor to show you what these unnecessary movements entail in the way of expense.

D., L. & W. car 23,060 made four round trips empty between the St. Paul and the New York, Chicago & St. Louis roads between February 17 and April 15, at an expense for trackage and per diem of $40 before its case was finally settled. In this case candor compels me to admit that the evidence is against our own people, but that is not going to deter me from an open confession of the facts. This car was delivered to us under load and in good order, it is claimed, and we returned it with two center sills and one inner sill broken, making a combination of defects. The N. Y., C. & St. L. refused to receive it and our Chief Inspector went to Stony Island and saw their Master Mechanic at that point about the car. The next day a letter was received from him saying he would accept the car on the following conditions, namely, that the car should carry home route cards and that the two center sills be planked in proper shape so that the car will be safe to handle in trains to Buffalo. Also, that defects on car must be fully covered by our M. C. B. defect card. Admitting, for the sake of argument, our defenseless position in sending an empty car to a connecting line in such a condition, let me ask first, why should a delivering line be called upon for a home route card for a car that was entitled to return via the Nickel Plate to the owner, one of its direct connections, and second, why did the Nickel Plate not repair the car, load it to Buffalo, or in that direction, and call upon us for defect cards covering our responsibility, according to Rule 8 of the Car Foreman's Code?

These questions are not asked with a view of letting the St. Paul down as easily as possible, or for the purpose of showing that the Nickel Plate is to blame. Here is a 60,000 capacity box car out of service for 60 days while two roads juggle it between them empty and pay $40 for the privilege.

Georgia Southern & Florida ventilated fruit car 2,363 was received from the Illinois Central via the Chicago Belt February 23, loaded for Milwaukee, and when made empty it was returned to our Galewood yard where it arrived March 1st and on March 2d it was returned to the Illinois Central via the Belt. This car also made four round trips via the Belt between the Illinois Central and our line and was last returned to us March 26, and is in our yard at this writing. Per diem and trackage accumulated on this car to the amount of $32.50. This makes a total of $72.50 for three roads to pay for the privilege of juggling two empty foreign cars between them, which I think you will admit is equivalent to throwing so much money away.

I am not able to furnish much information in regard to the last mentioned car. Our chief inspector went to see the general foreman of the Illinois Central and reported that he said the car was not rejected by his inspectors, although it was in bad order, but the Superintendent of Transportation of the Illinois Central wrote to me that it was rejected by his inspectors and he further stated that his company will not accept cars in bad order unless fully carded for defects. At the same time, Rule No. 8 of the Car Foreman's Association does not require that cars should be so carded. That rule reads as follows:

"It is understood that in the interchange of cars within the Chicago switching district all parties to this agreement will accept as their own the record of the receiving line, so far as the condition of the car is concerned, and that M. C. B. defect cards will be furnished for such defects when proper request is made, when based on M. C. B. rules and this agreement."

The Master Car Builders' Rules provide that cars offered in interchange must be accepted if in safe and serviceable condition, the receiving line to be the judge in cases not provided for in Rules 3 to 56 inclusive and in the declaration of principles the Master Car Builders' Rules must positively affirm that "These rules make car owners responsible for, and therefore chargeable with, all repairs to their cars necessitated by ordinary wear and tear in fair service, so that defect cards will not be required for any defects thus arising."

One thing is made clear to my mind at least by this exhibit, which is that there is a wide difference of opinion among employees of the Car Department regarding the intent and purport of the M. C. B. Rules of interchange and the subsidiary rules of the Car Foreman's Association, otherwise empty cars would not make such movements as have been cited. This may be due in great measure to the failure of those whose duty it is to properly instruct inspectors respecting their duties and in part to a mistaken idea that it is the duty of an inspector to get ahead of others by employing sharp practices if necessary. There is a cause for every effect and as we know what the effect is in this case, we ought to find the cause and a remedy for it. In this connection I would make the following suggestions:

When an empty car, foreign to your road and to the delivering line, is received in bad order, don't let your inspectors fire it back on the next transfer without calling the attention of the Chief Inspector to it, and don't send it back then until you have notified the Chief Inspector of the delivering line of your intention to do so and given him the reasons for that course. Then see to it that all cards of every kind are stripped from the car and that your cards are put on both sides, plainly indicating that the car is being returned on account of being in bad order and, in addition, bill it to Mr. Blank, Chief Inspector of Blank Railroad, and show on billing defects which you object to. Take every legitimate means at hand to protect your company from imposition, but remember that the mutual interests of the railroads centering in a common terminal are entitled to great consideration at your hands and that all lines should work as one for the common good, when they can do so without detriment to their own interests. Try to impress upon the minds of the inspectors this important fact, namely, that every time you move a car it costs money which somebody must pay and that unnecessary movements must be avoided.

Every road in Chicago has a way of protecting itself if it finds other lines are acting unfairly in the matter of giving it empty cars in bad order. It can return a car and charge the delivering line one-half the regular rate, $2.50, and in addition to that, the reclaim for three days per diem and, in addition to that it can insist that Belt Line charges shall be assessed against the line at fault. So you see it is possible to make it expensive for any line guilty of unfairness.

*Abstract of a paper by W. F. Beecham, Car Accountant of the Chicago, Milwaukee & St. Paul, before the Western Railway Club.

GENERAL NEWS SECTION

NOTES.

The New York State two-cent passenger bill has now passed both houses, and awaits action by the Governor.

All roads operating out of Chicago continue to report satisfactory traffic conditions. The car shortage is now less severe than it has been.

The Union Pacific on May 25 announced an increase of from one cent to three cents an hour for all carmen on the system, effective June 1.

The new third-rail line of the Philadelphia & Western was opened May 22 from the Union Station, 69th and Market streets, Philadelphia, to Strafford, 15 miles.

The Metropolitan Line, running freight boats between Boston and New York as a part of the Morse combination, has revised its rate schedule to conform to the standard in effect before the Joy Line entered the field.

Following the enactment of the two-cent passenger law in Pennsylvania, the Philadelphia & Reading announced May 23 that when the spring schedules go into effect next Sunday there will be a general increase in these rates, averaging from 10 to 35 per cent.

The Connecticut upper house has passed a bill forbidding a change of the signal system without approval of the railroad commissioners; another providing a way for requiring the stopping of passenger trains at stations when demanded by local authorities, and a third providing for removing all kinds of obstructions to view at grade crossings.

According to a western railroad officer, 10,000 telegraph operators could to-day find steady employment in the South and West. The present demand will be increased on January 1, 1908, when the law limiting the hours of railroad telegraphers to nine hours goes into effect. The officer quoted suggests that a great field is here open for young women.

As a result of the recent decision of the Interstate Commerce Commission in the Atchison, Kan., case, to the effect that the railroads could not make an allowance for elevation at Omaha and Kansas City and refuse it at Atchison, the Chicago Board of Trade has made a demand upon the railroads for an allowance of half a cent a bushel for the elevation of grain at Chicago.

It is said that the Pacific Express Co. has closed a long-time contract with the traction companies operating between Toledo and Dayton, whereby these companies will retire from handling express independently on June 1, the Pacific Express Co. taking over the business on that date. This is understood to be the first of the old line express companies to take over traction business.

The state railroad commission of Montana has given notice to the Interstate Commerce Commission of an agreement with the Great Northern, the Northern Pacific, and the Butte, Anaconda & Pacific, under which these railroads undertake to issue at as early a date as practicable, an interchangeable 3,000-mile ticket good for one year from date of sale, at the rate of 2½ cents a mile.

The two-cent passenger rate law in Arkansas is to be contested by the railroads on the grounds that the Governor never signed the bill, although what purports to be his signature is attached; also that if he did approve the measure he was in an unsound mental condition; also that the act is confiscatory, and that the Arkansas roads cannot operate under a two-cent law and pay expenses.

The Pennsylvania Railroad on May 22 filed a bill in equity against the County of Philadelphia asking the common pleas court to enjoin the defendant from demanding any penalties for any violations of the act of April 13, 1907, which provides that the two-cent passenger rate shall go into effect on October 1 and is compulsory upon every company operating a railroad in whole or in part in Pennsylvania.

Announcement is made by the Illinois Central that on June 1 it will establish a rate of 2½ cents a mile for each member of public parties of ten or more. The rates apply to all points south of the Ohio river. The Illinois Central is the first line to act on the recent ruling of the Interstate Commerce Commission that exclusive party rates would be abolished on May 31. Other lines have been against any reduction of fares in this class of business.

The Board of General Appraisers has overruled the protest of W. P. Plummer, of New York, in regard to an importation of steel rails, which were assessed as such at seven-twentieths of a cent per pound under paragraph 130, and which were claimed to be dutiable at $4 per ton as scrap fit only to be remanufactured. The importer's contention was based upon the fact that the rails are of an obsolete type, but the board thinks that they can still be employed as rails and that it was not proven that they are in fact in the nature of waste.

The judgment for $275,538 entered in the Supreme Court against the Manhattan Railway Co. and in favor of the city of New York on the report of Hamilton Odell as referee, has been affirmed by the Appellate Division of the Supreme Court. The judgment represents the amount due by the company under a law passed in 1867. By this law the West Side & Yonkers Patent Railway Co. was authorized to build an elevated railroad in Manhattan, but it was provided that the company should forever pay into the city's treasury 5 per cent. of the net income from passenger traffic on Manhattan Island. The road, now the Ninth Avenue Elevated, was opened in 1879, and the Manhattan Railway Co. succeeded to the rights and franchises of the West Side & Yonkers Co.

The dispute which has been waged by the western roads over lengthening the schedule of the through passenger trains was ended May 24, when an agreement was reached to put into effect on June 9 new schedules adding three hours to the present running time of the fastest trains from here to San Francisco, and four hours to the present schedules of eastbound trains from San Francisco. The actual running time from Omaha to San Francisco and Los Angeles of the Overland Limited trains on and after June 9 will be 76 hours and 28 minutes, an increase of about 5 hours. In addition to generally lengthening the schedules of passenger trains between here and the principal western cities on June 9, several hours will be added to the schedules of all freight trains except those hauling live stock, from the Missouri river and points beyond.

Commissioner Prouty on Future Railroad Legislation.

In a speech before the Manufacturers' Convention held in New York last week, Charles A. Prouty, of the Interstate Commerce Commission, spoke on the general subject of railroad legislation. He advocated the establishment of a railroad department of the national government, with a cabinet officer at its head. He said that his observation had shown him that whatever federal body regulates interstate railroads must be charged with the duty of correcting unlawful rates and practices, and must have the power to institute and prosecute suits on behalf of the public on its own initiative. He also argued that the regulating body must exercise the same control over the operation of railroads which it exercises over their rates. The principle of reciprocal demurrage does not appear to him just to the railroad or of much practical benefit in actual experience. The necessity of regulation of conditions under which freight cars are interchanged by the different railroads, so that a road with adequate equipment can be protected from levies on its cars by roads not properly supplied with equipment, is referred to as a reason why the federal body should have power over railroad operation. There is no room for doubt that the national government should exercise some direct control over the capital accounts of interstate railroads, should supervise the leases into which they enter, and determine the circumstances under which one may buy the stock of another and the extent to which a holding company may direct the operations of a road. Railroad securities ought to be a favorite investment for the savings of the small and great alike. Mr. Prouty continues:

"Carriers are required to establish rates which are just and without discrimination. I am utterly unable to see how this can be done without the right upon their part to confer and agree.

"I do not think that railroads should be allowed to pool their earnings or tonnage. The argument put forth for that privilege in the past no longer exists, since rebates are no longer paid."

Police! Train Afire.

"There's an express train afire tearing up past me on the Central. It has just come out of the tunnel—and will the police please hurry."

Police Headquarters got the word and passed it along so fast that Engine 36 and Truck 113 were drawn up at the 125th street station of the New York Central when the Buffalo and Cleveland Special, drawn by an electric locomotive, which had left the Grand Central 13 minutes before, got in. It was surely enough on fire—that is, the forward hood of the buffet car was. There was some smoke, and flamelets that were red enough to be seen. The train crew had spied the smudge and had hand grenades working when

the real firemen hit the job. The occupants of the ten passenger cars turned out and looked on. The train was delayed nine minutes.—New York *Sun*.

Schedules by Popular Vote.

A local organization at New Orleans having complained to the Southern Pacific management that owing to the fact that the first train in the morning for Houston did not leave until 6.40 a.m. and was a slow train, Houston had considerable advantages in the way of papers and train service to towns half way between the two cities, the Southern Pacific is taking a vote of the travelers on the early morning train out of New Orleans as to whether an earlier train shall be put on. The tickets numbered serially are issued to each adult passenger on the train. They read as follows:

"No. .....

"The New Orleans Progressive Union has asked this Company to start its local passenger train No. 5 from New Orleans at an earlier hour than it is at present scheduled. In the opinion of the Progressive Union, the fact that the first train leaving Houston, Tex., meets No. 5 at a point east of the midway point between Houston and New Orleans places the latter city at a disadvantage with Houston and other Texas cities. It is the desire of this Company to run its local passenger trains at such times as will best suit its patrons, and in order to ascertain their sentiment in this matter, you are respectfully requested to indicate hereon whether or not you would favor starting this train from New Orleans at 5:30 a. m., instead of 6:40 a. m., as has been requested.

"Employees of this Company are positively forbidden to attempt in any way to influence passengers in their expressions in this matter, and I will appreciate a report of any violations of these instructions.

"E. B. CUSHING, General Superintendent.

"F. E. BATTURS, G. P. A.

"I favor the change .....
"I am opposed to the change .....
"Signature .....
"Postoffice address .....
"Date .....
"Please indicate your vote by cross-mark on proper line."

"Record Discipline" on the Atchison.

Merit marks were placed to the credit of 36 employees of the Atchison, Topeka & Santa Fe in April, as reported in the *Employees' Magazine*. We quote a few of the items:

Charles L. Stewart, baggageman on Nos. 9 and 10, officially thanked for taking to ticket office, in Kansas City, passenger to whom ticket was sold to Chicago.

O. D. Wingo, barber-baggageman on trains 3 and 4, officially thanked for bringing to ticket office, in Chicago, a passenger to whom was sold a ticket to Los Angeles.

L. M. Johnson, engineer, Wichita, 10, for securing passengers for our line, persuading them to wait over and take the Santa Fe rather than use the line of a competitor.

S. G. Kinney, engineer, Middle division, 10, for observing defective rail on Sand Creek bridge and reporting it to section foreman, thereby avoiding a possible serious accident.

N. J. Cody, brakeman, Arizona division, 10, for watchfulness in discovering brake rigging down and taking immediate steps to stop his train before derailment could occur.

H. Chitwood, engineer, Southern division, 10, for prompt action in baling oil from a tank car containing company oil to tank of engine 202, enabling him to get over the road without delay.

George R. McIntosh, engineer, Midland division, 10, for firing engine from Arkansas City to Emporia, instead of delaying or giving up train account of having student fireman, who was unable to keep the engine hot.

E. H. Marshall, engineer, Missouri division, 5, for making practically schedule time with No. 2, after meeting with accident. A valve stem had broken; engineer disconnected engine and ran a distance of 70 miles with 11 cars, working engine on one side.

J. B. Neale, engineer, Los Angeles division, 10, for carefully inspecting long freight train on descending grade as he rounded curves, with result that he saw sparks of fire flying and, upon stopping train, found brake-beam dragging, which probably would have caused derailment.

Federal Commission Twice Sustained by the Supreme Court.

Two decisions have been handed down in the United States Supreme Court by Justice McKenna, Justice Brewer dissenting, sustaining orders of the Interstate Commerce Commission. One of the cases, the Central Yellow Pine Association v. the Illinois Central et al., involved an advance of 2 cents per 100 lbs. in rates on yellow pine lumber from East Louisiana, Alabama and Mississippi to Cairo and other Ohio river points, Evansville, Louisville and Cincinnati. The other case involved a similar advance in rates on lumber from Georgia to those Ohio river points. The Commission issued orders in both cases forbidding enforcement of the higher rates. The cases, which involved large amounts and questions of great importance, were strenuously contested, not only before the Commission, but in both the lower courts and the Supreme Court. The Supreme Court's decisions cannot fail to strengthen the hands of the Commission. The opinions of the Commission were rendered by Commissioner Clements.

Mr. Yoakum on Texas Railroads.

B. F. Yoakum is quoted as follows in the St. Louis *Globe-Democrat*:

While many of the acts of the Texas legislature dealing with operation of railroads will prove expensive, and some of the tax laws will greatly increase our burdens of taxation, yet upon the whole the legislation of the past session was not so inimical as many had feared and I believe that the legislature and the people of Texas ought to be congratulated on the fact that so much proposed unwise legislation was defeated. I am greatly pleased that the legislature did not deem it wise to reduce the passenger rates in Texas. I am sure that all the railroads interested in Texas, as well as the Texas roads, feel the same way and that they will not only give expression to their appreciation in words, but there will be substantial evidence by the expenditure of liberal sums of money in advertising with the view of bringing new people into the state.

The people want, and have a right to expect improved service. This is a comparatively new country, vastly short of railroad facilities, and there are many requirements of the railroads to properly take care of the growing business. To injure the railroad earning power at this time would seriously affect the interests of the people of the state. There are still large areas in Texas that must have transportation. Let us look at it from a broad and liberal business standpoint. Let us gridiron the state with good railroads to properly serve its people and take care of its present growing business. To accomplish this I am confident the railroads will do their part.

International Traffic Through Mexican Gateways.

An official report issued by the Mexican Government gives the following figures of traffic across the Rio Grande from July 1 to Dec. 31, 1906:

National of Mexico.

Laredo—	Cars.	Freight, tons.
To Mexico	9,724	261,713
From Mexico	906	9,056
Total traffic	10,630	270,769

Mexican International.

Ciudad Porfirio Diaz	Cars.	Freight, tons.
To Mexico	5,486	124,234
From Mexico	3,083	3,855
Total traffic	8,569	128,089

Mexican Central.

Ciudad Juares—	Cars.	Freight, tons.
To Mexico	3,843	63,591
From Mexico	3,282	45,858
Total traffic ...	7,125	109,449

Sonora Railway.

Nogales—	Cars.	Freight, tons.
To Mexico	1,537	20,433
From Mexico	1,478	15,756
Total traffic....	3,015	36,209

During these six months 20,590 cars entered Mexico from the United States, and 8,749 came north across the border, leaving 11,841 of the cars in Mexico. These 20,590 cars carried 469,991 tons of freight from the United States to Mexico, and the 8,749 cars which returned carried 74,525 tons from Mexico to the United States.

Strike of Machinists on the Erie.

Of the total of about 900 machinists employed by the Erie Railroad, all the union members, about 700, have quit work. According to the management's statement, issued on May 25, the only contention that the men have is that piecework be abolished. It is understood by the Erie officers that the machinists' union has decided to make a general fight against piecework and to begin hostilities on the Erie. The railroad men say that there is good reason for this from the union standpoint, as the men who work on piecework are earning larger wages than before and taking little interest in union matters. There are 17 shops affected by the strike, of which the largest are at Susquehanna and Meadville, Pa., and Hornell, N. Y.

Train Wreckers on the Erie and the Southern Pacific.

On Saturday night, May 25, an attempt was made to wreck Erie passenger train No. 6 at a point near Alden, N. Y., where the road runs on a deep fill across a long ravine. At a point in the middle of the curve a rail bolstered up by large stones was put across the eastbound track. The engineer saw the obstruction and applied the emergency brakes, in spite of which the locomotive struck the rail, but was not derailed, although the pilot was smashed.

On the morning of May 22, half an hour after midnight, train No. 20, the Coast Line Limited, on the Southern Pacific, was wrecked at West Glendale, Cal., 10 miles north of Los Angeles. One man was killed and 22 persons injured, three perhaps fatally. At a point on a trestle the fish plates and bolts of two connecting rails on the southbound track had been removed, and in the bolt holes strands of heavy wire were fastened at the end of each rail. From the appearance of the track after the wreck, it was evident that some person hidden on a hillside close to the trestle had pulled the wire as the train approached, and spread the rails outward toward the edge of the trestle. The train, three hours late, was traveling

at over 35 miles an hour. The engine wheels left the rails and the engine took to the ties for 100 yds. The tender, the dining car, two Pullmans, the buffet car, and the mail and baggage cars plunged over the edge of the trestle, falling 16 feet. The buffet car, the express car, and one of the Pullmans were turned upside down, and the others landed on their sides. All were badly crushed and splintered.

Hackensack Meadow Improvements.

The New Jersey Terminal Dock & Improvement Co. and the Hackensack Meadow Co. are to be reorganized and merged. Foreclosure proceedings have been begun against the Terminal Co., and similar proceedings are to be brought against the Hackensack Co., these steps being preliminary to the reorganization. The Terminal Co. was incorporated two years ago, and acquired over 90 per cent. of the stock of the Hackensack Meadow Co., and also the property of a construction company and 106 acres of land on the Hackensack Meadows. The two companies own 3,500 acres of land and have been filling in the meadows for terminal purposes.

Railroad Equipment Imported by Mexico.

The Mexican government has issued a statement of imports from the United States into Mexico of locomotives, freight railroad cars and rails during the eight months from July to February of the current fiscal year, as follows:

1906.	Locomotives			Rails		
		Value.			Value.	
	No.	Total.	Average.	Tons.	Total.	Per ton.
July	5	$37,328	$9,332	1,150	$36,467	$31.46
August	4	52,380	13,145	3,713	109,180	29.40
September	7	106,550	15,221	778	22,853	29.37
October	11	143,125	13,011	1,305	48,254	36.69
November	23	321,839	13,993	3,832	114,689	29.92
December	23	267,054	11,612	3,901	142,286	36.47
1907.						
January	1	19,000	19,000	5,166	165,468	32.03
February	5	40,720	8,145	2,904	100,658	34.66
Eight months	76	$988,696	$13,009	22,758	$739,855	$32.50

The value of locomotives imported during the corresponding eight months of the preceding fiscal year was $189,000. In corresponding months of last year $1,120,613 worth of rails were imported, but that was a period of extensive railroad building and transformation from narrow to broad gage for the same months of 1904-05 the value was $317,593, construction having been less. During these months of the current year, the value of passenger and freight cars bought by Mexico in the United States was $1,520,941, as compared with $680,244 in the same months of 1905-06, and $410,283 in 1904-05.

First Car Over West Shore Electrified Lines.

The first electric car to run over the newly electrified line of the West Shore from Utica to Syracuse by its own power arrived in Syracuse on the evening of May 21, taking about an hour and a half for the run of 49 miles, including the distance in the central part of each city over the tracks of the local trolley lines. The third-rail, direct-current system now in operation in the New York terminal territory is used except within the city limits. The electrified line of the West Shore will continue to be used for freight trains.

Surprise Tests on the Pennsylvania.

The first report of signal tests on the Pennsylvania, made public six months ago, showed that on 2,252 trains tested, 97 per cent. of the enginemen complied implicitly with the letter of the signal rules, while the 3 per cent., who ran by signals, came to a stop a short distance beyond. During March the Central, the Elmira and Canandaigua and the Delaware divisions, and in April the Philadelphia Terminal, the Tyrone and the Buffalo divisions, had perfect records in these tests. The report for April showed that in 79 tests on the Pittsburg division, only one engineman failed to come to a stop before passing the signal. One careless engineman also was found on the Maryland division and one on the New York division, the train in the latter case passing the stop signal at a speed of about two miles an hour. Besides these surprise signal tests, the speed at which trains take crossover switches is closely watched.

What Happens to Old Railroads in Ireland.

Twelve miles of railroad between Birr and Parsontown in Ireland, according to a cable despatch from Dublin to the Chicago *Inter Ocean*, have disappeared. The road was built in 1868 and worked for a time by the Great Southern company, after which mortgagors took possession, but did not work the line. The authorities tried to collect taxes, but no one would admit ownership. The inhabitants of the region, seeing that they were deprived of the use of the railroad as a transportation agency, decided to get what advantage they could out of the road. This they did by carrying off rails, buildings and all other equipment of the permanent way except a bridge, which still remains because the police objected to the use of a crane in removing the girders.

Central Office for Forest Service Tests.

The Forest Service recently established a central office at Washington for the management of timber tests and the compilation of data obtained at the various laboratories. McGarvey Cline, a graduate of Purdue University, has been put in charge. The timber tests of the Forest Service have hitherto been under the direction of Professor W. K. Hatt, of Purdue, who has found it necessary to relieve himself of these responsibilities.

Car of Coal Four Years on Road.

The fact that a car of coal ordered by a Chickasha dealer in October, 1903, did not reach its destination until January, 1907, was reported recently to the office at Guthrie, Okla., of Attorney-General Cromwell. The coal was ordered from the McAlester mines. Soon afterward, however, the Chickasha dealer sold his business, reporting the ordered car to his successor, and left the city. In January last, nearly four years later, the car arrived in Chickasha, billed to the original owner of the business in Chickasha, and his successor refused to receive it.—St. Louis *Globe-Democrat.*

New Ferry Boats for the Lackawanna.

The Norfolk & Washington Steamboat Company, of Norfolk, Va., is reported to have sold to the Delaware, Lackawanna & Western two ferry steamers recently built for operation between Washington, D. C., and Alexandria, Va. One of the steamers had been chartered by the Old Dominion line for service at the Jamestown Exposition, the other by the Chesapeake & Ohio for the same purpose. The latter boat will not be sent north till November.

Changes in the Department of Civil Engineering at Columbia University.

The testing laboratory at Columbia University will hereafter be a part of the Department of Civil Engineering. This laboratory, including the new 400,000-lb. Olsen machine, recently purchased, is now located on the first floor of the Engineering building. It is the purpose of the department to increase largely the equipment of the laboratory both in variety and capacity of machines by the purchase of a 500-ton machine for testing full-size compression and tension members 25 ft. long, a torsion machine of large capacity, an impact machine and the corresponding smaller appliances, tools, electric motors and other incidental equipment necessary for the complete working installation of the laboratory. This laboratory would have the widest range and greatest capacity for all classes of engineering investigation of the physical properties of every kind of structural material of any in the country, and would be second to none in the world.

New Rules for Transportation of Explosives.

The War Department has assigned Major Beverly W. Dunn, of the Ordnance Department, to take part in the preparation of new regulations for transportation of explosives by the American Railway Association. The committee of the association appointed for this purpose has made a preliminary report and expects to make a final report in October.

TRADE CATALOGUES.

Track Supplies; Railroad Material.—Catalogue No. 110, 1907 edition, of the Buda Foundry & Manufacturing Co., Chicago, has just been issued. It is much larger than any of its predecessors and is complete. The company's plant capacity has been considerably increased by the addition of new shops and machinery, which is noted in the catalogue. The products are carefully illustrated and described; they include scales; hand and push cars; velocipedes; rail-drilling machines; tool grinders; rail benders; track gages and levels; switch stands; ratchet, friction and ball-bearing jacks; car replacers; crossing gates; frogs, switches, crossings and special track work, and many additional miscellaneous appliances. Most of these products are also described in individual bulletins issued by the company, and many of them have been described in the *Railroad Gazette.* The new catalogue, which is a standard size (5 in. x 9 in.), has 330 pages, is bound in cloth and is excellently printed.

Opportunities Along the Northern Pacific.—The general emigration agent of the Northern Pacific Railroad has prepared a list of the business opportunities along the line of that road. The list is given by states, beginning at the eastern end of the line and taking them in order to the coast. The towns in each state are listed alpha-

betically. Essential information about existing conditions in each town is briefly given and the different openings there listed. At the front of the volume these openings are recapitulated alphabetically under the various sorts of businesses and professions. The book has 102 pages.

Gages.—The 1907 catalogue of the Ashcroft Manufacturing Co., New York, has 135 pages, is fully illustrated, and is bound in cloth. The products of the company include many types of gages for steam pressure, vacuum, water pressure, altitude, car heating, air brakes, etc. A large part of the catalogue is devoted to the Tabor indicator for taking indicator cards. These machines in various styles, as well as planimeters and other auxiliary apparatus, are made by the Ashcroft Co.

Elgin & Belvidere Electric.—Bulletin No. 17 of The Arnold Company, Chicago, describes the Elgin & Belvidere Electric, an interurban trolley line in Illinois, which The Arnold Company built. The road is 36½ miles long and was formally opened in February. It operates on three-phase alternating current. The engineering features, line construction, power generation and distribution, and equipment are described and illustrated fully.

Denver & Rio Grande.—"Camping in the Rocky Mountains," issued by the passenger department of this company, describes many regions in Colorado, Utah and Mexico where a vacation may be enjoyably spent. The pamphlet also gives useful suggestions for camp outfits for two to six persons, including the cost of supplies. Extracts from the game laws of Colorado and Utah are included.

Coal-Handling Machinery.—Catalogue No. 072 of the C. W. Hunt Co., West New Brighton, N. Y., describes electric freight-handling cranes, coal storage plants, coal-hoisting elevators, cable railroad conveyors, and a large line of accessories, including buckets, coal crackers, scales, coal valves, chutes, etc. The catalogue gives dimensions and capacities of different sizes of apparatus.

Steam Shovels.—Catalogue No. 67 of the Thew Automatic Shovel Co., Lorain, Ohio, describes and illustrates types of steam shovels ranging in capacity from ½ cu. yd. to 2½ cu. yds. Shovels for special purposes, such as ore handling, mining and cellar excavation, are also shown. The company also furnishes shovels driven by electric motors.

Axle Lighting.—Bulletin No. 5 of the Consolidated Railway Electric Lighting & Equipment Co., New York, describes, with photographs and drawings, the axle light equipment made for postal cars. The generator is belt driven and mounted on one end of a truck. In some cases two generators are desirable.

Geo. P. Nichols & Bro., engineers and machinists, Chicago, have prepared a little two-leaf folder to show a floor plan of their new shop at 315 South Canal street, with a list of the tools contained. It illustrates their facilities for general machine work.

Electric Fans.—Bulletin No. 146 of the B. F. Sturtevant Co., Hyde Park, Mass., illustrates and describes, with dimensions, types of ventilating fans ranging in diameter from 18 in. to 120 in. The motors are regularly wound for 110 and 220 volts.

Staybolts.—The Flannery Bolt Co., Pittsburg, is distributing a circular describing Tate flexible staybolts and their advantages.

Manufacturing and Business.

A semi-annual dividend of 1¼ per cent. has been declared on the capital stock of the William C. Baker Heating & Supply Co., New York.

A. R. Holliday, who recently resigned as Engineer of Maintenance of Way of the Vandalia at Indianapolis, is now Secretary of the National Concrete Co., Indianapolis.

The Bliss Electric Car Lighting Co., Milwaukee, Wis., expects to exhibit at the coming Atlantic City conventions complete 30-volt and 60-volt equipments for electric car lighting. They will be operated under conditions similar to those of actual service, and the methods of installing the equipment will be clearly demonstrated. The exhibit will occupy spaces 1,201 to 1,207, inclusive, on the south side of the steel pier. W. L. Bliss, John T. Dickinson and F. Urban, respectively President, Vice-President and General Manager of the company, will be in charge of the exhibit, assisted by district managers and others.

The United States Steel Corporation has ordered about $5,500,000 worth of electrical equipment from the Allis-Chalmers Company, Milwaukee. Most of the order is for the new plant at Gary, Ind., where 16 generating units, developing about 10,000 k.w., and motors ranging from 2,000 to 9,000 h.p. for driving the rolls in the rail mill and the machinery in the blooming and other mills will be installed. The generators are to be direct-connected to Allis-Chalmers gas engines, which will use blast furnace gas. Including orders for other plants of the steel company, 32 gas engine driven electric generators have been ordered from the Allis-Chalmers Company together with auxiliary apparatus required for these installations.

John E. Ward, Vice-President of the Gold Car Heating & Lighting Company, has decided to retire from the management of the Gold Companies for the purpose of engaging in the business of manufacturing and dealing in railroad, steamship and contractors' supplies. About July 1 he will start on an extended trip abroad, and on his return will open offices in New York City. Mr. Ward, who has been actively engaged for a number of years in the railroad supply business, was born at Poughkeepsie, N. Y., on June 3, 1875; received his early education in the public and high schools of that city, and in 1891 graduated from Manhattan College, New York City. He advanced rapidly from the duties of chief clerk, Shop Superintendent, Sales Agent and General Manager to the position of Vice-President of the Gold Companies. His experience and large circle of friends throughout the United States and Canada assure a still more successful career for Mr. Ward in his new undertaking.

Iron and Steel.

The Atlantic Coast Line has given an order for 1,400 tons of steel for bridges.

Negotiations are under way for 4,700 tons of bridge steel for two bascule bridges over the Chicago river.

The Chicago & North-Western and the Atchison, Topeka & Santa Fe are said to be in the market for between 40,000 and 50,000 tons of rails for 1908 delivery. The Chesapeake & Ohio is negotiating for 10,000 tons of rails, and the Harriman Lines for 25,000 tons of Bessemer rails.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Engineers Club of Philadelphia.

At a meeting of this club to be held June 1, a paper on "Ball and Roller Bearings in Practical Operation," by S. S. Eveland, illustrated by lantern slides, will be presented.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Buffalo & Susquehanna.—Charles W. Goodyear, First Vice-President, has been elected President, succeeding F. H. Goodyear, deceased. A. C. Goodyear succeeds C. W. Goodyear as First Vice-President.

Wabash.—Henry Miller, General Manager, has been elected also Vice-President. Mr. Miller was born in 1863 at Hannibal, Mo., and began railroad work in 1878 as boiler maker's apprentice on the Hannibal & St. Joseph, now part of the Burlington. After serving as switchman and then yard master, he was, in 1890, made Trainmaster of the St. Louis, Keokuk & Northwestern. Two years later he was appointed Assistant Superintendent of that road, and later was made also Assistant Superintendent of the Chicago, Burlington & Kansas City. In 1902 he was appointed Superintendent of both roads, and the next year General Superintendent of both roads and also of the Kansas City, St. Joseph & Council Bluffs; all of these roads are part of the C., B. & Q. In 1904 he was appointed General Superintendent of the Iowa district of the Chicago, Burlington & Quincy, and in 1905 he was appointed General Manager of the Wabash.



Henry Miller.

Chicago, Rock Island & Pacific.—E. L. Pollock, Purchasing Agent of the New York, New Haven & Hartford, has been elected Vice-President in charge of purchases of the Chicago, Rock Island & Pacific, the St. Louis & San Francisco, the Chicago & Eastern Illinois and the Evansville & Terre Haute.

Delaware & Hudson.—W. H. Williams has been appointed Assistant to the President, with office at New York.

C. S. Sims, General Manager, has been elected also a Director, succeeding Abel I. Culver, resigned.

Mexican Central.—J. A. Naugle, formerly Assistant General Manager of the Sonora Railway, has been appointed Assistant to Vice-President C. R. Hudson, of the Mexican Central.

See Rio Grande, Sierra Madre & Pacific.

New York, New Haven & Hartford.—J. M. Tomlinson, Auditor of Freight Receipts, has been appointed General Auditor. Alfred Mackville, chief traveling auditor, succeeds Mr. Tomlinson.

See Chicago, Rock Island & Pacific.

Rio Grande, Sierra Madre & Pacific.—H. R. Nickerson, who recently resigned as Vice-President of the Mexican Central, has been elected President of the Rio Grande, Sierra Madre & Pacific.

St. Louis & San Francisco.—See Chicago, Rock Island & Pacific.

Operating Officers.

Buffalo & Susquehanna.—G. D. Reynard, chief train despatcher of the Buffalo division, has been appointed Trainmaster at Galeton, Pa.

Detroit, Toledo & Ironton.—H. E. Warner has been appointed Trainmaster at Springfield, Ohio, succeeding George E. Stott.

Fonda, Johnstown & Gloversville.—J. N. Shannahan, General Superintendent, has resigned to become General Manager of the Washington, Baltimore & Annapolis Electric. W. H. Collins, Master Mechanic, succeeds Mr. Shannahan, with office at Gloversville, N. Y.

Mexican Central.—M. B. Murphy has been appointed Trainmaster of the Chihuahua division, succeeding W. B. Tucker, assigned to other duties.

Mexican International.—A. Clark, General Manager of the National Railroad of Mexico, has been appointed also General Manager of the Mexican International, succeeding W. S. Martin, resigned.

National of Mexico.—See Mexican International.

St. Louis & San Francisco.—J. W. Ashley, Superintendent of Car Service, has resigned to become Manager of the Missouri Valley Car Service Association at Kansas City. E. D. Levey, Assistant Superintendent of Car Service, has been appointed to the new office of Superintendent of Transportation, succeeding to the duties of Mr. Ashley, whose former office has been abolished.

Wheeling & Lake Erie.—J. G. Code, Assistant Superintendent, has been appointed Superintendent, with office at Canton, Ohio, succeeding C. V. Wood, resigned to go to the New York, New Haven & Hartford. A. P. Titus, Superintendent of Car Service, succeeds Mr. Code, with office at Canton. C. W. Miller, Trainmaster at East Toledo, Ohio, succeeds Mr. Titus, with office at Pittsburg. D. R. Webner, Trainmaster at Rook, Pa., succeeds Mr. Miller. C. O. Dambach, chief clerk to the General Superintendent, succeeds Mr. Webner.

Traffic Officers.

Chesapeake & Ohio.—A. L. Ellett has been appointed General Western Passenger Agent, with office at Cincinnati, succeeding J. D. Potts, promoted.

Chicago, Rock Island & Pacific.—J. G. Doolittle, traveling freight agent, has been appointed General Agent of the Chicago, Rock Island & Pacific and of the St. Louis & San Francisco at Salt Lake City.

Great Northern.—W. P. Kenney has been appointed Assistant Traffic Manager, with office at St. Paul.

Lake Shore & Michigan Southern.—See New York Central Lines.

New York Central Lines.—H. Bromley, General Ore and Coal Agent of the Lake Shore & Michigan Southern, has been appointed General Ore and Coal Agent of all New York Central Lines west of Buffalo, with office at Cleveland, Ohio.

St. Louis & San Francisco.—See Chicago, Rock Island & Pacific.

Union Pacific.—Gerritt Fort, Assistant General Passenger Agent at Omaha, Neb., has resigned to go to the New York Central & Hudson River.

Engineering and Rolling Stock Officers.

Erie.—Albert Swartz, who was recently appointed Division Engineer at Huntington, Ind., was born in 1878 at Columbus, Ohio. He graduated from High School at Toledo, Ohio, in 1894, and the next year began railroad work as a rodman on the Ann Arbor Railroad. The next year he went to the Cincinnati, Hamilton & Dayton as yard clerk at Toledo, and then was transitman on municipal work and electric railways until the end of 1898, when he went to the Tennessee Central to do similar work. In 1899 he left on account of sickness and soon after was made a draftsman in the Cleveland office of the Lake Shore & Michigan Southern. In the summer of 1901 he went to the Baltimore & Ohio as draftsman on construction work, and the next summer was made Assistant Division Engineer of Maintenance of Way at Baltimore. After a year he returned to the Chief Engineer's office as draftsman, and was later made chief draftsman. While in this position he designed the Washington terminal yards. In the winter of 1905 he was in charge of engineering design on improvements at Baltimore, and then went to the Erie as chief draftsman in the construction department at New York. The most important work he did in this position was on the Jersey City terminal improvements and masonry designed for new work. He was promoted to his present position early this month.

Tehuantepec National.—George Budge, roadmaster of the Matamoras division of the National of Mexico, has been appointed Superintendent of Maintenance of Way of the Tehuantepec National, with office at Rincon Antonio, Oaxaca.

Tonopah & Goldfield.—W. B. Chapin, Chief Engineer, has resigned.

LOCOMOTIVE BUILDING.

Bond Brothers, Bond, Md., have bought a locomotive.

The Kahului Railroad has ordered one locomotive from the Baldwin Locomotive Works.

The Illinois Terminal has ordered one locomotive from the Baldwin Locomotive Works.

The Cambria Steel Co. has ordered one locomotive from the Baldwin Locomotive Works.

The Cornwall & Lebanon has ordered one locomotive from the Baldwin Locomotive Works.

The Louisville & Atlantic has ordered one locomotive from the Baldwin Locomotive Works.

The Imboden Coal & Coke Co. has ordered one locomotive from the Baldwin Locomotive Works.

Schill, Selbohm & Co., Ltd., has ordered one locomotive from the Baldwin Locomotive Works.

The Wrightsville & Tennille has ordered one locomotive from the Baldwin Locomotive Works.

The Buffalo Union Furnace Co. has ordered one locomotive from the American Locomotive Works.

The National Railroad of Haiti has ordered two locomotives from the Baldwin Locomotive Works.

The Central Santa Lucia (Cuba) has ordered one locomotive from the Baldwin Locomotive Works.

Norton, McGraw & Co. (Brazil) has ordered one locomotive from the Baldwin Locomotive Works.

The Moron Sugar & Land Co., Cuba, has ordered four broad gage locomotives from the Baldwin Locomotive Works.

The Long-Bell Lumber Co., Kansas City, Mo., will order four additional locomotives from the Baldwin Locomotive Works.

The Danish Department of Public Works, Copenhagen, Denmark, it is reported, is in the market for three passenger locomotives.

The Due West Railway, under construction in South Carolina, is in the market for locomotives. R. S. Galloway, Due West, S. C., is President.

The Savannah & Southwestern, projected from Clyde, Ga., to St. Andrews Bay, Fla., 350 miles, will ask bids on locomotives in a few weeks. Harvey Granger, President, Savannah, Ga.

The Texas & Pacific, it is reported, has ordered forty 10-wheel locomotives from the American Locomotive Company for September and October delivery. These locomotives will weigh 200,000 lbs.

The Chicago & Milwaukee Electric, as reported in the *Railroad Gazette* of March 1, has ordered two locomotives from the Baldwin Locomotive Works and two locomotives from the American Locomotive Works.

The Charlestown & Western Carolina, as reported in our ad-

vance sheet of May 18, has ordered two 10-wheel freight locomotives, cylinders 20 in. x 26 in., and two consolidation locomotives, cylinders 21 in. x 28 in., from the Baldwin Locomotive Works.

The Bolivia Railway has ordered four simple, consolidation, 3-ft. 3-in. gage locomotives from the American Locomotive Company for November delivery.

General Dimensions.

Type of locomotive	Consolidation
Weight on drivers	129,000 lbs.
Total weight	143,000 "
Diameter of cylinders	19 in. x 24 in.
Diameter of drivers	44 "
Boiler, type	Straight top
" working steam pressure	180 lbs.
" heating surface, total	1,903 sq. ft.
Firebox, length	84 in.
Firebox, width	54 "
Grate area	31.5 sq. ft.
Tank capacity	6,000 gals.
Coal capacity	8 tons

Special Equipment.

Air-brakes	Westinghouse
Valves	Richardson
Valve gear	Walschaert
Sanding devices	Pneumatic
Springs	Pittsburg Steel & Spring Co.
Tires, driving wheel	Latrobe

The Chilean State Railways, as reported in the *Railroad Gazette* of May 17, have ordered five 5-ft. 6-in. gage, six-wheel switching side tank locomotives for September, 1907, delivery, and 20 5-ft. 6-in. simple mogul locomotives for September and October, 1907, delivery from the Baldwin Locomotive Works.

General Dimensions.

	Mogul.	Switching.
Type	Mogul.	Switching.
Weight on drivers, about	79,000 lbs.	73,000 lbs.
Total weight	98,500 lbs.	73,000 lbs.
Diameter of cylinders	17 in.	15 in.
Stroke of piston	24 "	22 "
Diameter of drivers	54¾ "	42 "
Boiler, type	Crown bar; straight top.	Radial stayed; straight top.
Working steam pressure	160 lbs.	
Heating surface, total	1,127 sq. ft.	545 sq. ft.
Tubes, number	186	106
" material	Iron.	
" outside diameter	2 in.	1¾ in.
" length	10 ft. 8⅝ in.	10 ft. 1 in.
Firebox, length	55¾ in.	52 1/16 in.
" width	43 in.	42 in.
" material	Steel.	
Grate area	16 sq. ft.	14 sq. ft.
Tank capacity	3,000 gals.	700 gals.
Coal capacity	6 tons.	About 1 ton.

The Intercolonial, as reported in the *Railroad Gazette* of May 17, has ordered 10 simple consolidation (2-8-0) locomotives from the Canadian Locomotive Company.

General Dimensions.

Type	Consolidation
Weight on drivers	148,300 lbs.
Total weight	164,880 "
Diameter of cylinders	21 in.
Stroke of pistons	28 "
Diameter of drivers	56 "
Boiler, type	Straight top
" working steam pressure	200 lbs.
" heating surface, total	2,095.7 sq. ft.
Tubes, number	236
" material	Charcoal iron
" outside diameter	2¼ in.
" length	14 ft.
Firebox, length	114 in.
" width	41 "
Grate area	32.5 sq. ft.
Tank capacity	6,000 gals.
Coal capacity	10 tons

Special Equipment.

Air-brakes	Westinghouse
Bell ringer	Intercolonial standard automatic
Boiler lagging	Asbestos sectional
Brake-beams, tender	Simplex
Brake-shoes	American Brake Shoe & Foundry Co.
Couplers	Washburn
Draft gear	Minder tandem
Headlights	Pyle electric
Injector	Hancock Inspirator Co.
Journal bearings	Ajax
Safety valve	Coale
Sanding devices	Wilson
Sight-feed lubricators	Detroit
Steam heat equipment	Safety Car Heating & Lighting Co.

CAR BUILDING.

The Chicago Great Western is in the market for 1,000 box cars.

The Moron Sugar & Land Company, Cuba, has ordered several cars.

The Pere Marquette is reported to be in the market for 750 gondola cars.

The Southern Pacific has ordered three observation cars from the Pullman Company.

The New York Central Lines are asking bids on 19 combination mail and baggage cars.

The Public Service Corporation of New Jersey has ordered 200 electric cars from the Cincinnati Car Co.

The Danish Department of Public Works, Copenhagen, Denmark, is reported in the market for 12 passenger cars.

The Charlestown & Western Carolina, it is reported, has ordered two 60-ft. passenger cars from Harlan & Hollingsworth.

Fox Brothers & Co. are reported to be figuring on ten cars of 60,000 lbs. capacity with the Ralston Steel Car Company.

The Due West Railway, under construction in South Carolina, is in the market for cars. R. S. Galloway, Due West, S. C., is President.

The Manistee & Grand Rapids is in the market for 50 gondola cars of 80,000 lbs. capacity, 25 flat cars of 60,000 lbs. capacity, and 25 second-hand flat cars.

The Krause & Managan Lumber Co., Lake Charles, La., is reported to have placed orders for four narrow gage logging cars with the Orange Iron Works.

The Union Pacific has ordered three observation smoking cars from the Pullman Co., instead of three dining cars, as reported in our advance sheet of May 15.

The Mexico, Santa Fe & Perry Traction, projected from Mexico, Mo., to Perry, 27 miles, will be in the market for rolling stock in about 30 days. S. L. Robison, President, Mexico, Mo.

The Savannah & Southwestern, projected from Clyde, Ga., to St. Andrews Bay, Fla., 350 miles, will ask bids on rolling stock in a few weeks. Harvey Granger, President, Savannah, Ga.

The Seaboard Air Line is said to have decided to postpone, on account of the condition of the money market, the ordering of 1,500 cars for which they were in the market, as reported in the *Railroad Gazette* of April 19.

The Wagner, Lake Shore & Armour Traction, recently incorporated to build an electric line from Wagner, S. Dak., to Mitchell, 65 miles, will be in the market for rolling stock in about 90 days. A. H. Pease, Wagner, S. Dak., may be addressed.

The Atlanta, Birmingham & Atlantic, as reported in the *Railroad Gazette* of May 24, has ordered for delivery by December 1, 500 40-ft. box cars of 60,000 lbs. capacity, and 300 40-ft. flat cars of 60,000 lbs. capacity from the American Car & Foundry Company; and 900 40-ft. coal cars of 80,000 lbs. capacity and 30 cabooses from the South Atlantic Car & Manufacturing Company.

The Baton Rouge Electric & Gas Company, Baton Rouge, La., as reported in the *Railroad Gazette* of May 10, has ordered nine semi-convertible cars from the St. Louis Car Co. These cars will be 31 ft. long over all and 8 ft. 8 in. wide, inside measurement. The special equipment includes:

Brake-shoes	Diamond "K."
Light	Kransharr
Seats	St. Louis Car Co.
Trucks	St. Louis Car Co.

The Richmond, Fredericksburg & Potomac, as reported in the *Railroad Gazette* of May 24, has ordered 200 box cars of 80,000 lbs. capacity from the Western Steel Car & Foundry Company for August, 1907, delivery, and 100 low side gondola cars of 100,000 lbs. capacity from the Pressed Steel Car Company for October, 1907, delivery. The box cars will weigh 37,500 lbs. and the gondolas 38,000 lbs. The special equipment for both includes:

Bolsters	Bettendorf
Brake-beams	Waycott
Brake-shoes	American Brake-Shoe & Foundry Co.
Brakes	Westinghouse
Brasses	Damascus Bronze Co.
Couplers	Janney
Door fastenings, for box cars	Wagner
Doors, for box cars	Wagner
Draft rigging	Farlow tandem
Dust guards	Harrison
Paint, for box cars	Hildreth special freight car
Paint, for gondola cars	Hildreth steel preservative
Roofs, box cars only	Hutchins inside metal
Springs	Pittsburg Spring & Steel Co.
Trucks	Bettendorf side frames

RAILROAD STRUCTURES.

Aurora, Ill.—The Chicago, Burlington & Quincy, it is said, will make improvements here to include a new passenger station, elevate its tracks, build a new freight yard, new locomotive shop and freight house at a cost of about $2,000,000.

Blasdell, N. Y.—The car barns of the Buffalo & Lake Erie Traction Company at this place were burned recently together with 25 cars. The loss is estimated at $100,000.

Bucyrus, Ohio.—The Ohio Central is making additions to its shop here. The building when finished is to be 90 ft. wide and 800 ft. long.

Defiance, Ohio.—The City Council has under consideration the question of granting concessions to the Baltimore & Ohio to enable it to make improvements at a cost of $300,000.

Galveston, Tex.—The Gulf & Interstate, it is said, is planning to make improvements at Point Bolivar, which is across the bay from Galveston. The work will include a pier 900 ft. wide and 1,000 ft. long, with a central slip 300 ft. wide and 500 ft. long.

Logan, Ohio.—Contract is reported let by the Hocking Valley for repair shops here to cost $90,000.

REDDING, CAL.—Bids are wanted July 10, by the Board of Supervisors, for a steel bridge to have a 60-ft. also a 310-ft. span on concrete piers, with 18-ft. roadway, over the Sacramento river. Robert L. Reading, County Surveyor.

SALT LAKE CITY, UTAH.—The Salt Lake City Union Depot Co. has been incorporated in Utah, with $200,000 capital. E. T. Jeffrey is President. This means that the revision of plans for construction of the Gould terminal station here has been finished and that work will be pushed to an early completion.

SAN ANTONIO, TEX.—The International & Great Northern has plans ready and will soon ask bids for building a new passenger station here to cost between $150,000 and $200,000.

TOLEDO, OHIO.—The Lake Shore & Michigan Southern, it is said, has plans ready for a new brick office building and freight house, also a freight shed 600 ft. long.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ANTOINE VALLEY.—Application has been made in Arkansas by a company under this name, with $150,000 capital, to build a line from Graysonia, Ark., to Arkadelphia, 27 miles. W. Grayson, N. W. McLeod, J. S. Cargile, G. M. Grayson and I. M. Seller, of Arkadelphia, are interested.

ARIZONA ROADS.—Ray and Gila copper companies, local reports state, are asking bids for building a line from Kelvin, Ariz., to Ray, seven miles.

ATCHISON, TOPEKA & SANTA FE (COAST LINES).—A contract has been let by this company to Grant Bros. to build a short cut-off west to Rio Puerco, N. Mex., the western terminus of the Eastern Railway of Oklahoma or Belen cut-off. On completion of the new line, the section from Sandia Station to Rio Puerco is to be abandoned.

BALTIMORE & OHIO.—An officer writes that this company proposes to build an extension of the Quemahoning branch from Boswell, Pa., to the mines of the Somerset Coal Company, about four miles. The Quemahoning branch connects with the Somerset & Cambria branch at Quemahoning Junction, which connects with the main line of the B. & O. at Rockwood, Pa.

BOSTON & PROVIDENCE INTERURBAN.—Mayor Fitzgerald, of Boston, Mass., favors granting a charter to this company to build an electric line from Boston to Providence, R. I., about 50 miles. William A. Gaston, of Boston, is interested in the project.

BUFFALO, GENESEE & ROCHESTER (ELECTRIC).—Incorporated in New York with $7,500,000 capital and office at Depew, in Erie County. The company proposes to build a line from Depew northeast to Rochester, 60 miles, with a branch south to Leroy, in Genesee County, five miles. The promoters include: Henry H. Kingston, J. J. Collier, J. A. Harris, Jr., S. Welch and T. H. Dixon, of Philadelphia; W. B. Cutler, J. H. Baker and H. P. Bissell, of Buffalo. The proposed line, it is reported, will be operated as an extension of the Buffalo & Depew, which is owned by the promoters of the new project.

CANADIAN PACIFIC.—Contract reported let to G. A. Begg & Co., of St. Catharines, Ont., for reducing grades and straightening curves on the line from Woodbridge, Ont., to Bolton, 10 miles.

CHICAGO SOUTHERN.—According to reports from Chicago, the syndicate recently formed for taking over the John R. Walsh system and extending it into Chicago, Ill., 38 miles, has the necessary funds amounting to $2,500,000 subscribed. The first instalment is to be paid this month. Work is to be started at once and finished about the first of August. The syndicate managers are J. R. Walsh, J. N. Faithorn and Orrville S. Babcock.

COLORADO ROADS (ELECTRIC).—Contract has been given to Joseph A. Osner, of Denver, for building an electric line from Englewood, Colo., south via Littleton to Roxborough Park, about 15 miles. The project is being financed by H. W. Hartman, T. B. Doane and other Denver capitalists.

ERIE.—This company is considering the question of resuming work on the Erie & Jersey, on which work was suspended about April 1. The line is to be built from Howells, N. Y., to Guymard, 42 miles, and includes a double-track tunnel 5,300 ft. long through the Shawangunk mountains. (March 29, p. 467.)

ERIE & JERSEY.—See Erie.

INDIANAPOLIS, CRAWFORDSVILLE & WESTERN TRACTION.—This company, incorporated in Indiana in 1903 to build an electric line from Indianapolis, Ind., west to Danville, Ill., has about finished the first section from Indianapolis to Crawfordsville, 45 miles. The western extension to Danville, Ill., will be soon started. The bridges are to be either of concrete or steel, and the rails of 70 and 85-lb. section. Entrance into Indianapolis is to be made over the West Michigan street loop to Indiana avenue, thence to the terminal station of the Indianapolis Traction Terminal Company. A. E. Reynolds, President, Crawfordsville; E. Hawkins, Secretary; O. P. Ensley, Treasurer, Indianapolis.

KANSAS TRACTION.—Organized in Kansas to build an electric line from Coffeyville north to Topeka, thence east via Lawrence to Kansas City, 225 miles. F. B. Shirley, of Coffeyville, is President.

LEETONIA RAILWAY.—An officer writes that this company, which operates 17 miles of road in Tioga County, Pa., has given contracts to Peter Pascuzzi, of Kane, Pa., for building three miles of road from Lick Run to Painter Run. C. A. Derr, Chief Engineer, Williamsport, Pa.

LONG ISLAND.—Preliminary surveys, it is said, are being made by this company for an extension of its Wading River branch from Wading River, N. Y., south to a connection with the main line at Manor, about six miles.

LYNCHBURG BELT LINE & CONNECTING RAILWAY.—See Norfolk & Western.

MEXICAN ROADS.—The International Land & Mining Company, of Arizona, it is said, has bought 1,200,000 acres of land in Mexico near the Texas border from General Naranjo, of Monterey, and will build a line 90 miles long to coal fields.

Application was recently made to the Mexican Government by J. P. Taylor, of Mexico City, for a concession to build a line from Comacho on the Mexican Central, in the northern part of the state of Zacatecas, to Bonanza. It is said that capital has been secured to carry out the work and surveys are nearly finished.

The Colima Lumber Company, it is said, will build a line from a point on the Mexican Central, near Colima, Mex., to timber lands at the base of Mount Colima. The line has been located and work is to be started soon.

MISSOURI, KANSAS & TEXAS.—Local reports state that this company is planning to build a road from its line at Iola, Kan., south to Humboldt, about 10 miles. The work will include a bridge over the Neosho river. The Atchison, Topeka & Santa Fe operates a line through these places.

NATIONAL LINES OF MEXICO.—The Mexican government has under consideration the building of extensions and branch lines. Part of these plans which have been agreed upon will probably be made public soon after the details for the merging of the Mexican Central into the government system are completed. The proposed work is to include a line up the valley of the Rio Grande for probably 400 miles. The Monterey-Matamoras line of the National now runs down the valley of the Rio Grande from Camargo to Matamoras, about 80 miles. It is planned to build the proposed extension from Camargo through the valley northwest to about opposite Del Rio, Texas. It is about 100 miles from Camargo to Laredo, Texas, and another 100 miles from Laredo to Eagle Pass, Texas. The proposed line is to connect with the main line of the National at Nuevo Laredo, opposite Laredo, and with the International at Ciudad Porfirio Diaz, opposite Eagle Pass. At Las Vacas, 50 miles above Ciudad Porfirio Diaz, it is to connect with the branch the Kansas City, Mexico & Orient is building south from San Angelo, Texas. It is intended to ultimately extend the line to El Paso, Texas, about 500 miles from Las Vacas.

NEW YORK CENTRAL & HUDSON RIVER.—The O'Rourke Engineering & Construction Company has withdrawn from the work of excavating the site for the New York Central's new terminal in New York. The company, it was reported, has under consideration the temporary abandonment of the main plans for a new terminal, but it is thought that the railroad will go ahead with the work.

NEW YORK TUNNELS.—The New York Tunnel Co., contractors for the Battery tunnels of the Rapid Transit Subway extension to Brooklyn under the East river, was placed in the hands of a receiver on May 23. The receiver will carry on the work, which is nearly finished.

NORFOLK & WESTERN.—An officer writes that about 60 per cent. of the work on the Lynchburg Belt Line & Connecting Railway, hitherto known as the low-grade line, under construction from a point on the Durham line, from 12th street station at Lynchburg, west to Forest, 7.60 miles, also from the same point on the main line east to Concord, 14.52 miles, has been finished. The line is being built to reduce the grades around Lynchburg, Va., and will shorten the distance over the existing line about three miles.

PENNSYLVANIA.—This company, it is said, will abandon the terminus of the Pennsylvania & Northwestern division at Bellwood, Pa., and establish a new terminus at Tipton, four miles northeast of Bellwood. The company is planning to build a new line between Glasgow and Tipton to secure easier grades.

PINE BLUFF NORTH & SOUTH.—It is reported that this company

plans to build from Memphis, Tenn., south to Shreveport, La. The first section to be built will be from Pine Bluff, Ark., to Lonoke or Devalls Bluff, where connection is to be made with the Rock Island. On the completion of this section work will be started from Pine Bluff north to Memphis, and to Shreveport, on the south end. E. B. Bloom is a director.

Shawnee Central.—Incorporated in Oklahoma with $10,000,000 capital, and office at Shawnee. The company proposes to build a line from Muskogee, Okla., southwest via Shawnee to Childress, Texas, 300 miles; also from Shawnee northeast to Tulsa, 80 miles, through the Creek, Seminole and Chickasaw Indian nations. Dr. W. S. Woods, President of the National Bank of Commerce of Kansas City, Mo., is an incorporator.

Southern Development Company.—Bids are wanted about June 1 by J. M. Parker, General Manager, Monroe, La., for grading 63 miles for a steam railroad between Monroe, La., and Crossett and Hamburg, Ark.

Toledo, Wabash & St. Louis.—Surveys made for a line from Toledo, Ohio, southwest to Defiance, 50 miles, and contract let for some of the grading. Preliminary surveys are being made from Defiance southwest to Fort Wayne, Ind. L. H. Chenoweth, formerly in charge of construction on the Wheeling & Lake Erie, is in charge of the construction.

Tonopah & Goldfield.—This company, operating a line from Mina, Nev., on the Southern Pacific, southeast to Tonopah, thence south to Goldfield, 100 miles, last year started work on an extension under the name of the Bullfrog-Goldfield Railroad, south to Bullfrog and Rhyolite. This extension is now in operation as far as



Tonopah & Goldfield.

Springdale, and it is expected next month to have the line finished to Bullfrog, 83 miles from Goldfield, and to Rhyolite. An extension is projected from the main line at Tonopah, northwest to a connection with the Nevada Northern at Ely, 160 miles, also one from the southern end near Bullfrog, south to Greenwater, Cal.

Wagner, Lake Shore & Armour Traction.—An officer writes that contracts are to be let in about 60 days for building this proposed electric line from Wagner, S. Dak., north via Lake Shore, Armour and Hillslide to Mitchell, 65 miles. There are to be between four and six bridges on the line. A. H. Pease, Wagner, S. Dak., may be addressed. (May 10, p. 664.)

Wheeling & Lake Erie.—This company, it is said, has finished a three-mile extension at Oneida, Ohio, to the industrial plants of that district. It joins Oneida and Malvern, connecting at the latter place with the Cleveland & Pittsburg division of the Pennsylvania Lines West.

RAILROAD CORPORATION NEWS.

Chicago Great Western.—The $2,000,000 4 per cent. debenture stock, which is to be listed on the New York Stock Exchange, is issued as of June 1. The proceeds are to be used in part to refund the company for construction work done in 1906, 25 miles of double-tracking between Galena and Stockton, and double-track work on the Eastern division.

Chicago, Rock Island & Pacific.—This company has sold to Speyer & Co., New York, $10,000,000 first and refunding mortgage, 4 per cent. bonds of 1934, making $66,851,000 outstanding of the $163,000,000 authorized. The proceeds of the sale are to be used for refunding the $7,500,000 three-year, 4½ per cent. notes maturing on July 1, 1907, and for betterments. The bankers are offering the bonds at 87 and accrued interest.

Delaware & Hudson.—This company has sold to Kuhn, Loeb & Co. and the First National Bank of New York, $10,000,000 equipment first lien, 4½ per cent., 15-year bonds, dated July 1, 1907, for a price said to be 94¼. The bankers are offering these to the public at 95. The bonds are a first charge on equipment valued at $11,000,000, and have a sinking fund of $650,000 a year. The bonds conform to the new insurance laws, so that insurance companies can buy them.

Flint River & Gulf.—See Gulf Line Railway.

Gulf Line Railway.—This company is to be incorporated as a consolidation of the Flint River & Gulf, which runs from Ashburn, Ga., to Bridgeboro, 32 miles, and the Hawkinsville & Florida Southern, running from Hawkinsville, Ga., to Worth, 44 miles. The last named line is leased to the Flint River & Gulf. The present operating company has a trackage agreement with the Georgia Southern & Florida by which it operates trains over the three miles of road between Worth and Ashburn. It is understood that the new company expects to eventually have a line from Augusta, Ga., to the Gulf of Mexico, with trackage rights into Atlanta, Ga.

Hawkinsville & Florida Southern.—See Gulf Line Railway.

Mexican Railway.—A dividend of $1^{15}/_{16}$ per cent. was paid on May 17 on the £1,011,960 ($4,908,000) second preferred stock. The only previous dividend paid on this stock was one of 3¾ per cent. in November, 1906.

Mexican Southern.—An annual dividend of 3 per cent. on the £1,000,000 ($4,850,000) capital stock was paid on May 9. The dividend rate has been 2½ per cent. for the last three years.

Missouri, Kansas & Texas.—This company is suing the United States in the Court of Claims for about $61,000,000, the value of 3,064,390 acres of land in Indian Territory. A previous suit, instituted by the state of Kansas in behalf of the railroad company, was dismissed by the United States Supreme Court on the ground that the railroad company, and not the state, should be the complainant. The land in question consists of the odd numbered sections for 20 miles on each side of the railroad's 240 miles of right of way through Indian Territory. It was granted in 1866 to the state of Kansas for the use of the Kansas & Neosho Valley Railroad, a predecessor of the M., K. & T. The same land was granted to five Indian tribes, and the grant to the railroad was to become effective when the Indians' title to the land should lapse, by treaty or otherwise, provided also that the land became a part of the public lands of the United States. The railroad company now contends that in 1897, by an Act of Congress, the land was allotted to individual Indians, before that time the tribes having worked the land in common. The railroad alleges that this process destroyed the Indians' original title, and that when the lands were, in 1897, surveyed and divided into sections and townships like public lands in other places, they therefore became public lands. Consequently, it contends that the terms of the grant of the land to the railroad were then fulfilled. The railroad company notified the Government's agents of these matters at that time, but, in spite of this, the Indians were allowed to take possession. The amount sued for is nearly as much as the par value of the out standing common stock of the M., K. & T.

New York, New Haven & Hartford.—This company has announced an increase in its capital stock from $100,000,000 to $130,000,000. Last January the directors voted to issue $30,000,000 additional stock when market conditions favored it. The new stock may have been issued either for exchange with all the Boston & Maine stock, whose market value is about the same as the market value of this new New Haven stock, or for purposes connected with the proposed consolidation of the Consolidated Railway and the New England Navigation Company with the New York, New Haven & Hartford.

Rock Island Company.—See St. Louis, Brownsville & Mexico.

St. Louis, Brownsville & Mexico.—It is said that Harriman interests have acquired control of this company, which owns 344 miles of road running from Brownsville, Tex., on the Mexican boundary, northerly to Algoa, from which point surveys have been made east to Galveston and north to Houston. A branch from Robstown, Tex., northwest to San Antonio, 125 miles, is proposed. The road has been controlled by B. F. Yoakum, Chairman of the Board of the Rock Island Company, and associates. If control were acquired by the Harriman interests, the road could be operated in connection with the Texas lines of the Southern Pacific.

Southern Pacific.—See St. Louis, Brownsville & Mexico.

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EDITORIAL ANNOUNCEMENTS.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:

Baldwin Locomotive Built to Metric Scale 761
The Cost of Locomotives 761
Gasolene Motor Cars. 761
Producer-Gas Power for Railroad Shops. 762
Boiler Explosions. 762

ILLUSTRATED:

A Solution of the Oil-Burning Locomotive Problem. 764
Norfolk & Western Improvements. 767
De Glehn Compound for Paris-Orleans Ry. 774
The Baldwin Superheater 780
Changing the Gage of the Louisville & Nashville. 782
Pacific Locomotive for the Atlanta & West Point. 784
Proposed Long Rifled Pipe Line for California Oil. 786
Compression in Locomotive Cylinders and Means for Its Relief 787
The Proposed Klamath Falls Line of the Southern Pacific. 790
A Proposed New 100-lb. Rail Section.... 794
Moment of Inertia and Curvature..... 795
Tests of Very Mild Steel Tube Sheets..... 797
The Barnes Skimmer and Blow-off Valve. 799
The Cost of Locomotives, 1890-1907..... 802
Recent Developments in Air-Brake Control Apparatus. 804

CONTRIBUTIONS:

Holding Force of Railroad Spikes..... 764

MISCELLANEOUS.

Gasolene Motor Cars for Railroad Service 778
Rail Corrugation on English Electric Lines 786
Superheated Steam on Locomotives..... 792
Program of the American Railway Master Mechanics' Association at Atlantic City 796
New Zealand Railroads..... 797
Liability for Injuries to Live Stock..... 798
The Hedjaz Railroad. 800
Value of Good English to the Engineer.. 800
Track Deformations and Their Prevention 801
The Use and Abuse of Fire Brick for Locomotive Fireboxes..... 808
Foreign Railroad Notes: 808
Retirement of M. Noblemaire..... 783

GENERAL NEWS SECTION:

Notes 809
Trade Catalogues 814
Obituary 815
Elections and Appointments 816
Locomotive Building 817
Car Building 818
Railroad Structures 818
Railroad Construction 819
Railroad Corporation News 820

VOL. XLII., No. 23. FRIDAY, JUNE 7, 1907.

The De Glehn compound locomotive illustrated on another page, built throughout to the metric scale, is a notable example of locomotive building in this country, and goes far to prove that the metric system is not as black as it has been painted, even for American mechanics. Of course, such a piece of work involved a good deal of special preparation in the way of gages and templates, but this evidently was not of such a character as to be prohibitive. As for the engine itself, it is of characteristically French design, and as such will probably not appeal to American engineers as a model to be copied. The coupling of connecting rods to two pairs of wheels, and the necessary displacement of the high-pressure cylinders, adds an air of complication which is always objectionable in this country, besides obstructing the means of access to the machinery that is located between the frames. These may sound like puerile objections to those who are using the engine, but they exist and are potent here. As usual in the French design, the machine has an air of elegance of finish and lightness of detail that is very pleasing to the eye and gives an idea of a high grade of efficiency.

Through the courtesy of one of the large locomotive works in this country, we have been able to publish in another column some exact figures regarding the cost of modern locomotives in comparison with those of 1890. These figures are worth close attention, for they are of a nature not usually available for publication. The most striking point about the figures is that a modern locomotive costs less per pound than an up-to-date engine of 1890. This is in spite of an increase in the cost of materials, and in spite of the growth in efficiency and complexity of the modern machine. When the increase in efficiency is taken into consideration, the first cost per unit of power is found to be reduced from 17 to 27 per cent., and the cost of operation per unit of power reduced from 20 to 30 per cent. In addition to this reduction in cost, the railroads of to-day have the advantage of a more highly developed equipment than was obtainable in 1890. A large number of locomotives carry electric headlights, the brake appliances have been largely improved and added to, and in many ways the purchaser is given increased convenience and safety, while the price has been reduced. Of course, in comparing prices of new engines with the prices given in our article, it must be borne in mind that there is no standard specification for locomotives, and that the prices we give are merely the averages of a considerable number of actual selling prices for each class of locomotive considered. In any individual case, it is possible to introduce changes of design or of details, which will make the price vary 10 to 15 per cent. either way from the average. The average prices, however, where based on a sufficient number of engines, form a fair criterion of the tendency of the prices in the period under consideration.

Gasolene motor cars have been entirely successful on the Union Pacific if we may judge from the paper read at the April meeting of the New York Railroad Club by W. R. McKeen, Jr., Superintendent of Motive Power of that road, which is reprinted elsewhere in this issue. Mr. McKeen is privileged to be enthusiastic about the experiment because he is the father of the idea and the inventor of the machinery used under the cars; but in the light of other published data he makes out somewhat too good a case for his hobby. About two years ago a committee of motive power officers of the Rock Island lines investigated the subject of self-propelled motor cars and in their report gave some estimated figures of cost of fuel and wages for five different types of cars, four of them steam cars. These figures reduced to the same comparative basis as those given by Mr. McKeen are as follows:

Type of car.	Daily Cost of fuel.	Daily Cost of wages.	Total cost, wages and fuel.*
Gasolene	$7.50	$7.00	$14.50
Steam, simple; oil fuel.....	4.90	9.25	14.15
Steam, compound; superhtr; oil	3.66	9.25	12.91
Steam, simple; coal fuel.....	2.69	9.25	11.94
Steam,compound; suprhtr; coal	2.01	9.25	11.26

*Per 100 miles run daily.

Mr. McKeen gives the total operating expense for a 100-h.p. car running 100 miles a day as varying under different conditions between $10 and $20, the average probably being about $18. This includes fuel, wages, running and shop repairs, lubricating oil, cleaning, etc. Just what proportion is charged to repairs is not stated but it is safe to conclude two things; first, that the motorman, who is a high-priced expert mechanic, spends a good deal of time, although perhaps not much money, in adjusting and otherwise tinkering with the machinery; second, that the real cost of heavy and light repairs has not yet been learned, for the cars have been in service hardly more than two years. Every automobile owner knows that heavy repairs begin some time and keep up for an indefinite time. At any rate the difference between $11.26, the lowest

cost of the steam motor cars, and $18, is more than enough to offset any difference in the cost of repairs, oil and cleaning. This is not intended as a criticism of the gasolene car as such, but to show the possibilities of the steam motor car when developed to as great a degree and as carefully designed and cared for as the Union Pacific cars.

PRODUCER-GAS POWER FOR RAILROAD SHOPS.

In view of the growing prominence that the question of possible general displacement of steam engine power plants by producer-gas power plants is assuming, an examination of the matter from the standpoint of the railroad shop power station would seem to be opportune. It may be stated at the outset that the time has not yet arrived when railroad shops need give this question serious consideration. The gas plant's chief claims to attention in this regard are its greater economy as compared with even the most efficient steam plants under average conditions of fuel cost, and the relative simplicity of the plant equipment. But the first of these has far less weight in the railroad shop phase of the question than the merely theoretical or even commercial aspects of the subject might seem to warrant. For in the first place the cost of power plant operation is a small part, at most, of the total shop expense, and in the large well-designed and properly-managed plants of to-day its percentage is almost insignificant. Then, when the cheapness of the fuel which most roads can get and use for this purpose is taken into account, it will be seen that even a considerable percentage of economy in this item which might be figured for a gas plant would really be a small factor in the total expense. Not that this fact is any justification for neglecting every opportunity to increase the economy of operation of the power station; but the question involves other factors than bare economy, and the practical objections to the producer-gas power equipment from the average railroad shop standpoint far outweigh whatever of advantage it might offer in the one item of fuel.

The most enthusiastic advocate of the gas engine would hardly claim for it the reliability in operation of the steam engine, even under the most favorable conditions of running and care; and, as a matter of fact, it is at present far from being the dependable machine that the latter is. The steam engine plant can be made to do duty even when seriously crippled, and a shut-down of the shops avoided; but producer-gas engine plants go wrong in seemingly unaccountable ways at most inopportune times, and few railroad managers would care to risk any uncertainty about the continuity of their shop service merely for a few hundred dollars periodic saving on the fuel for the power station. A year's saving might be swallowed up quickly in a single shut-down. Apropos of this question of relative reliability of these two kinds of power, we have heard it stated, with what truth we cannot say, that all of the gas engine makers run their plants with steam.

Of course, special conditions may exist at shops in certain localities where it might be a wise and profitable venture to install the producer-gas equipment; we know of at least one railroad shop that at the present time is engaged in making this substitution for its steam equipment. The particulars concerning the change have not yet been made public, so that nothing in detail can be said about it at present. It is our understanding, however, that the proposition accepted by the railroad company is based on a guaranteed yearly saving, with the agreement that in the event of failure to realize this saving, former conditions will be restored without expense to the railroad company. The road in question is in the Middle West, has 823 miles of line, about 100 locomotives and 4,500 cars. The change is being made at its principal shops.

It will be understood, of course, that what has been said in the foregoing against producer-gas power plants has regard only to the particular application discussed and is not to be construed as applying to the question of the desirability of this type of power in general, particularly in those localities where coal is dear. With the attainment of properly designed producer-gas engines and of a type of producer that will gasify bituminous coal satisfactorily, and with the cost of such plants brought down to a point where they can successfully compete in initial price with steam plants, we foresee a constantly widening field for this type of power. But, to return to the railroad shop, it is a cardinal principle in railroading that economies must not be attempted where the result would be an impairment of the efficiency of the transportation machine as a whole; therefore, producer-gas power must reach a more advanced stage of development before it can be seriously considered for railroad shop power.

BOILER EXPLOSIONS.

There is but one broad general cause for all boiler explosions, and that is the simple one that the boiler was not of sufficient strength to withstand the pressure to which it was at the time subjected. This is axiomatic, and may be made to cover the multitude of contributing causes to one or more of which the explosion is usually directly attributed. In the days of not-knowing, there is always a tendency to attribute natural phenomena which we are unable to explain, to some mysterious agency, and the theories that have been propounded to account for what happened are many and strange, while few are based upon real knowledge. It matters little what may be the cause of the weakness of a boiler, whether it comes from deterioration or design, the result is that when it is not strong enough to withstand the pressure it bursts.

In the case of stationary boilers, the causes of weakness still run the whole imaginable gamut, and to the man who has been in close touch with the cheaper grades of work and unskilled attendance the wonder is not that there are so many explosions but that so many boilers hold together as long as they do. Owners and operators seem to think that a boiler is a boiler, and because it is one it can be subjected to all manner of abuse and still remain intact. But when a mud-drum head is repaired by using a flat cast plate one inch thick and three or more feet in diameter, and then subjected to a rising pressure, the wonder is that it did not let go before the 40 lbs. pressure which did burst it was reached. Of course, it could not hold, and the reaction of the steam made a fine skyrocket of the parts that remained intact. Where the water is bad and boiler cleaning difficult, the unskilled and ignorant boiler attendant is more than apt to neglect the necessary cleaning, and the thrifty owner begrudges the services of an inspector until it often happens that the boiler is really working on the strength of the scale. In one case where these conditions prevailed, the scale had formed so hard and so thick on the water-leg of a locomotive-form boiler that the metal had been nearly eaten through by the action of moisture and coal, so that when cleaning was finally done, a pin could be pushed through the sheets. How near the attendants of that boiler room were to eternity and for how long a time will never be known, but it is safe to say that the margin of escape was a narrow one. Such may be the effects of carelessness and neglect.

Maltreatment due to thoughtlessness and ignorance cannot but be regarded as a very potent cause, and this may often be due to a disregard of all principles of mechanical decency, in the setting of the boiler, whereby stresses are set up that may manifest themselves in leaks, but too frequently develop incipient cracks that hold on until some critical moment when a disastrous explosion follows. For example: A small vertical boiler was set up with the feed-pump delivery in the bottom of the water leg. The water was taken direct from a driven well and had an average temperature of about 50 deg. F. When in full action it was not an uncommon thing to see the lower part of this boiler sweating like a pitcher of ice water, while the gage indicated a pressure of 90 lbs. When it was pumped up previous to shutting down, the men complained that the water, as drawn from the blow-off cock, was too cold to wash in. Fortunately this treatment developed a big blister on the inside sheet of the water-leg, which was cut away and a heater put in the feed pipe, so that there was no disaster. But while this abuse lasted it would have been interesting and somewhat startling if the actual internal stresses set up in that boiler could have been ascertained.

These three cases are merely cited as awful examples of bad design, gross neglect and abuse; the journal of every boiler inspector of experience is filled with a multitude of just such cases.

Leaving the stationary field and turning to the locomotive, we find that quite a different condition exists, though it has not always been an ideal one. For the most part, locomotive boilers have always been in charge of men skilled in the work they have had to do, and the accusation of bad design and gross neglect cannot often be made against them, while faulty design is becoming more and more of a rarity.

The locomotive has undergone a decided revolution in its development during the past quarter of a century, and in no part has this been more strongly marked than in the boiler. When we look back at the unscientific way in which locomotive boilers were built and mounted at that time, the strange part is that explosions were not of more frequent occurrence than they were, and the only apparent explanation lies in the low pressure and thinness of the sheets, by which indefinite bendings could take place without fracture. Just consider what those conditions were. A boiler was stif-

fened and braced throughout its whole interior by tubes and staybolts and braces until its rigidity was brought up to the highest notch. It was then securely bolted or riveted to the saddle at the front and braced by two bars reaching from the smokebox down to the front buffer. It was then carefully set upon expansion plates resting on the frames at the firebox, so that it could move freely to and fro as it expanded and contracted under the varying influences of the heat to which it was subjected; but a careful examination of hundreds of locomotives would fail to reveal any evidence of any motion having taking place. Why? Principally and simply because the back end was braced down against the back end of the frame, so that, by no possibility, could there be any longitudinal movement between the firebox and the frame.

Then what happened? The pump, and later the injector, threw its stream of cold water into the front end of the shell and it settled down to the bottom, cooling that part, in comparison with the top with which the steam was in contact, and so nicely bending the boiler into an arc, with the top on the convex side, and sometimes even lifting it clear of the frames, so that the whole weight at the rear was carried by the back braces, which had a bearing against the back head of from 50 to 80 sq. in. To what useless stresses was a boiler subjected that found itself in that condition? Well, we did find that the sheets were apt to bulge and yield, and after many years of this sort of work we slowly arrived at the conclusion that these back braces had best be omitted. In the meantime, what with light frames and bad cross-bracing, and the impossibility of proper expansion, the boiler was called upon for all manner of services, from transmitting the pulling effort of the cylinders to the tender and taking up buffing shocks, to carrying the pressure and generating the steam.

And how about the boiler itself? It seems strange that the simple lap seam should have persisted for so many years, when the story of its inefficiency and misconduct was told at every inspection. With a lap seam, the shell of the boiler could not be made truly cylindrical, nor could the internal pressure bring it into that condition without a distortion of the metal at or near the lap. This distortion usually occurred at the edge of the lap on the inside, where it was concealed from view by the tubes and scale and was of such magnitude that the metal was strained beyond the limits of its elasticity and so at first took on a permanent set, then cracked and gave the water entrance to the interior. Then corrosion started at once and grew until it manifested itself as grooving. Since bending will always occur at the smallest part, this section that was made smallest by cracking and corrosion was obliged to sustain all the strains due to the adjustment of the shell to the internal pressure, until at last the plate became too weak to sustain the load and it gave way. Then we had another explosion, due to grooving, and we wondered what could have caused that grooving, and laid the fault at the door of galvanic action, or acid in the water, or defective plates, or carelessness in handling the plates during construction, and did not for years look to what we were doing in the use of the lap seam.

But this is of the past; the lap seam has gone, never to return for locomotive work, and if state legislatures really want to interfere in such things they can well enact a statute making it a criminal offense to use it on any kind of stationary work.

With the disappearance of the lap seam, one of the most prolific causes of locomotive boiler explosions was done away with, and the seat of these disasters was transferred, as it were, from the shell to the firebox.

When the firebox was set down between the frames, and the length was limited to the allowable clearances between the eccentric straps at the front and the rear axle at the back on the American or 4-4-0 locomotive, there was comparatively little difference in the expansion of the inner and outer side sheets, so that while staybolt failures were not unknown they did not assume the proportions that they did later, when the fireboxes had been lengthened and widened as in modern designs. Although the to-and-fro movement of the sheets bends the bolts and breakages are frequent, sometimes almost appallingly so, the points on the firebox most likely to suffer from such breakage are so accessible to inspection that disaster has been very successfully averted. It is a rare occurrence that a locomotive boiler explodes because of an accumulation of broken staybolts, though this does sometimes happen. If, then, we have removed boiler explosions from the shell because of the use of the sextuple riveted welt seam, and can protect the firebox from failure because of broken staybolts, it would seem that there is little else to cause trouble. Yet we know that locomotive boilers continue to explode, at the rate of about three a month, taking the country as a whole. This is certainly a large enough figure, but it constitutes a small percentage of all boiler explosions that occur. For example From Sept. 1 to Dec. 31, 1906, 152 boiler explosions were reported, of which 14, or less than 10 per cent. of the whole, were on locomotives.

It may be assumed that we have now learned fairly well how to design a locomotive boiler and place it upon the frames in such a way that it will not be subjected to abnormal strains, so that, when such a boiler does explode we may usually look for the immediate cause elsewhere than in the design. Broadly stated, there may be two causes for undue deterioration of the modern boiler: one in neglect and the other in abuse at the hands of the driver. Neglect may take the form of failure to wash out at intervals of sufficient frequency to prevent the accumulation of mud and scale in the interior, or it may occur through the omission of inspections by which the condition of the staybolts can be watched. Press of work upon the road and the consequent demand for engines is responsible for much of the neglect of washing; or sometimes the delay is due to the fact that the engine is marked up for the shop, and it is not considered worth while to wash out for only a few days' run. But when a boiler is opened and it is found that it contains three or more wheelbarrowfuls of sediment, the evidence is pretty good that someone has been taking chances. The chemical properties of the scale itself may be so inert that no direct attack is made upon the metal, but its non-conducting qualities shield the plates from the absorption of heat by the water and overheating and the resultant injury takes place.

In regard to overheating, it is not probable that a general elevation of the temperature would be injurious to the sheets. That it should be, hardly stands to reason, for the sheets are heated in all flanging processes without injury, provided they are properly cared for. It is local heating that does the mischief, by setting up internal stresses that hold the metal in tension until something yields. It is not often that overheating upon a boiler in service is anything more than local; but when it is, the statement is corroborated. An instance of this is to be found in the case of a night switching engine that was standing for some time, and on which the crew went to sleep. They were awakened by the burning of the cab, and found not only that, but the wooden lagging in flames, with the firebox and back head red hot. Steam had risen while they were asleep and the boiler had emptied itself through the safety valve, and then the fire came up and caused the overheating. Of course, it was supposed that the boiler was ruined, and it was taken to the roundhouse. But a most thorough inspection failed to reveal any defect other than a few leaky tubes. So these were rolled out, the lagging and cab replaced and the engine sent back to work. That the boiler was uninjured is evidenced by the fact that it remained in service for twelve years thereafter without requiring new sheets! So it is safe to say that local overheating is the danger, and an accumulation of scale is a good way to cause it.

The fact that the men in charge and those employed in the locomotive power department are skilled has led to the belief that the locomotive boilers in their care are well looked after. This presumption is strengthened by the small number of locomotive boiler explosions that occur. It has always been held superfluous for the state to interfere in the matter, as it has been considered that the railroad officials were doing and would do all that any statute could possibly enact. Two years ago, however, the New York legislature passed a law requiring an inspection of every locomotive boiler in the state at least once every three months, and a report upon its condition filed with the railroad commission. This was amended in March of this year by adding some further requirements. This statute has been generally regarded as useless, because unnecessary, but if the statement from the twenty-fourth annual report of the commission is true, the condition of affairs before this periodic inspection was enforced was deplorable. According to this report:

> "Prior to the passage of the boiler inspection law many roads made no inspections at all, while others employed 'handy men' or other incompetent inspectors, which meant that boilers were often operated under dangerous conditions. Several roads operating in this state have no mechanical officers, consequently the boilers in the past received little or no care. These roads now realize the danger of operating old and ofttimes cast-off locomotives from other roads, and are inspecting the boilers regularly. The larger roads made inspections for or less thorough and with varying degrees of regularity, dependent on the demand for power. In busy seasons inspections and repairs were often of a most superficial character, and the safety of the boiler was a matter of doubt."

This is certainly a pretty stiff arraignment and one that should be followed by some modifications. To those who are in touch with this matter it is a known fact that the reports of boiler conditions

have been most regularly and efficiently rendered, and it would not be difficult to name roads within the limits of the state where there is a complete record of the condition of every boiler, and of every staybolt, for years, taken at monthly or bi-monthly intervals. Had there been any widespread neglect of these boilers, explosions would have rivaled in frequency the popping of firecrackers on our national birthday. The comparative immunity from locomotive boiler explosions has been due to good management, not to good luck.

It is an unfortunate fact, however, that there are cases of neglect and sometimes of faulty repairs. When soft patches are used on the inside of a firebox, it is simply an invitation to disaster. To be sure, disaster does not always accept the invitation, but the encouragement thus offered to a bad practice is more dangerous than a prompt failure of every soft patch would be, by stimulating the expectations that the boiler will hold. Once in a while a bad matter is made worse by the use of a copper patch in a steel firebox because this metal is more easily shaped than a steel sheet would be. Then, when such sheets do let go, instead of laying the calamity on poor Providence and calling it an accident, it should be recognized as a crime and the man responsible promptly sent to the penitentiary to think over the advisability of using soft patches or other dangerous means for repairing steam boilers.

Collapsed tubes are probably the most common form of boiler failure, and while they do not properly come under the category of explosions as the term is generally understood, they are dangerous and should be avoided as far as care and inspection will permit. On European roads, where brass tubes are used, much trouble is experienced from the scoring of the inside surface by the small particles of coke or coal. In this country the same difficulty is experienced, but to a much less extent.

The railroad companies may, therefore, be held accountable for preventable deterioration that occurs as the result of neglect of inefficient repairs. But it is regrettable that the carelessness of the engineman is responsible for so large a proportion of terrific explosions. Usually this carelessness manifests itself in low water, an overheated and collapsed crownsheet, and then a wrecked engine and men killed. As has been stated, low water in itself, with the resultant uniform heating of the crownsheet, need not necessarily cause an explosion or injure the plate; but when this heating is carried to so high a temperature that the metal is weakened and cannot sustain the steam pressure above it, it will yield and tear away from the stays, and the explosion is at hand. When this happens, the sheet always tells its own story of the treatment that it has received, and there can be no question whether it was overheated or not, as this is clearly proven by its color.

Given a rupture large enough to cause an explosion, no man can foretell the course of the tear or what will happen. Naturally, the rent follows the line of least resistance, but what this is likely to be no one can say. After the explosion, an examination of the metal is apt to show that it has been overstrained, so that physical tests of the metal of an exploded boiler cannot be relied upon to indicate its true condition previously.

The results that are witnessed when a boiler explodes can well be compared to what would happen were a powder magazine to be ignited. The heat of the contained water is sufficient to cause a percentage of its own volume to flash into steam, and this, with the expansive properties of that already existing, is sufficient to follow up any weakness and act as a constantly decreasing accelerating impulse to project the parts away from the point of rupture. Usually, in fact it might almost be said invariably, the boiler tells a very graphic story of what has happened to it and why it happened. The point at which the rupture started is usually so clearly indicated as to leave it in no manner of doubt, and from this the course of the rent can be followed and the general path of the boiler through the air can be determined. With the commencement of the fracture located within an inch or two, an examination of the metal at that point will usually fix the exact cause, whether it be an overheated sheet, a broken staybolt, a corroded or cracked sheet or a case of bad repairs.

Often when the cause is an overheated sheet, it is inferred that the engineer was putting water in the boiler at the time; but this is not necessarily so. If the specific heat of steel and water be compared it will be seen that the heat of the latter is so low that the amount of water that could be flashed into steam at boiler pressure by coming in contact with the steel would be so small as to be insignificant; hence it can be disregarded. In fact, attempts to explode boilers by such treatment have not been successful. To be sure, this does not tend to improve the quality of the sheet, but it is doubtful if it ever caused an explosion. Usually a hot sheet yields by tearing away from the stays or bagging until it bursts, and not as the result of a sudden increase of pressure.

Among the favorite theories of the past for the explanation of boiler explosions was that of the spheroidal formation of water and steam. According to this, the steam accumulates beneath the water as it does beneath the drop on a hot stove, and by holding the liquid in suspension, increases in pressure until it can be held no longer. Then it was supposed to burst up through the superincumbent mass with terrific force, and the explosion would ensue. It may suffice to say that there is no evidence that this has ever occurred. Water that is perfectly calm and quiet, uniformly heated, may, by the exercise of care, be raised to a temperature above that corresponding to the pressure to which it is subjected, without ebullition, but the slightest jar or inequality in the application of heat will stop this increase and ebullition will take place instantly. That such a condition should ever obtain in a locomotive boiler at rest is unbelievable; when it is in motion, it is clearly out of the question. And even when this is accomplished, the increase in temperature is too small to be considered as a factor capable of causing an explosion.

The water hammer has also been held responsible for boiler explosions, and this may have been the case with some ruptured steam pipes in stationary practice, but where the water hammer can occur or what can produce it on a locomotive is difficult to say; so that it may be passed by as a mere guess that can hardly be qualified as even ingenious. Sifted down, then, it truly does appear that boiler explosions are due to weakness of the boiler, and it appears that this weakness may be caused by inherent defects in design or in the metal; by neglect on the part of those charged with the care, cleaning and inspection of the boiler, and by carelessness on the part of the driver. Whatever may be the cause, the exploded wreck will usually tell a straight story of what has happened, that will admit of no dispute to him who has the eyes and training to read the book as it is written.

CONTRIBUTIONS

Holding Force of Railroad Spikes.

Maurer, N. J., May 25, 1907.

To the Editor of the Railroad Gazette:

Referring to the article in your issue of April 26th entitled "Holding Force of Railroad Spikes in Wooden Ties." You will find that the results obtained by the Forestry Department are directly contrary to those obtained by the Engineering Experiment Station at Urbana, Ill., the latter having found that creosoting increases rather than diminishes the amount of pull required to start a spike of any kind.

J. C. WILLIAMS,
Supt. Wood Preserving Plant of The Barber Asphalt Paving Co.

A Solution of the Oil-Burning Locomotive Problem.

BY HARRINGTON EMERSON.

A liquid fuel should, by its very nature, be much more efficiently burned in the firebox of a locomotive than coal, both from the standpoint of economy of fuel and also in the control and distribution of the heat liberated from the fuel over the different surfaces of the firebox. Actual practice on roads using both kinds of fuel shows that it costs nearly twice as much to maintain oil-burning fireboxes as it does those using coal. The rapid deterioration when oil is used is due to four causes: unequal distribution of the heat; wide variation in firebox temperature, carelessness in handling, and overtaxing the firebox.

The first cause is due to faulty construction of the usual fire brick arch, in that it does not distribute the flame over the firebox but rather concentrates it on the crown-sheet and parts of the side sheets. This fault is also aggravated by the blast effect of the burner. This unequal distribution of the heat causes certain parts of the firebox surface to do much heavier duty than these which are less exposed to this blast effect. Very frequently the heat is so intense at the points of concentration as to drive the water from the sheets, and the staybolts, rivets, etc., being left unprotected by the water, are burned away. Excessive strains are also set up in the different parts of the firebox by the unequal temperature, causing seams to open up and staybolts to break. This is one cause of excessive boiler repairs.

The second cause—the wide variation in temperature at different times—is due to the fact that, in common practice, no provision is made for maintaining a comparatively high temperature in the firebox at all times. The location of the draft openings and the comparatively small radiating surface of the arch make it possible at times to draw large volumes of cold air into the firebox

when the engine slips, or in drifting down hill, or when, for any reason, the fire is cut down. In a coal-burning locomotive this indraft of cold air is not possible as, with the grates well covered with burning fuel, no air can enter the firebox without first having passed through the bed of fuel.

The third condition may and does exist in handling both kinds, but the coal fireman, in order to keep up steam, must at all times keep the grates well covered, thus protecting the firebox against an inrush of cold air, while the oil fireman may, by careless handling of the firing valve and failure to follow the engineman in his use of the reverse lever and throttle, vary the temperature in the firebox 2,000 deg. in a moment of time, thus causing terrific expansion and contraction of sheets, staybolts and rivets.

The fourth cause, that of overtaxing the capacity of the firebox, is due to the higher heat or fuel value of oil as compared with coal, the capacity of a boiler or firebox frequently being doubled by substituting oil for coal. The hauling capacity of an oil-burning locomotive is often only limited by its weight on drivers and the ability of the drivers to hold to the rail. This has led to the overloading of oil-burning locomotives and is one of the most common causes of firebox failure and the high cost of maintenance.

The chief differences between oil and coal burning are:

(1) Per pound, oil contains 50 per cent. more heat units than coal.

(2) Per heat unit, oil requires less air than coal.

(3) In oil burning, the air does not have to pass through a bed of ashes, cinders and coal, therefore the same vacuum in the smokebox will draw 50 per cent. more air through the flues.

(4) Oil is mechanically fired, therefore there are no limitations as to length of firebox. The economical steaming limit of a locomotive is that of the economical vacuum in the smokebox. In burning oil, for the same vacuum more pounds of fuel are burned and for each pound more heat is liberated. It follows that the design of an oil burner as to burner, firebox and tubes should be radically different from that of a coal burner.

The amount of heat passing through the sheets of the firebox and through the tube walls depends on the difference in temperature on the two sides of the sheets or tube walls. In a coal burner, by pyrometric measurement the temperature 3 in. from the side sheet was found to be 1,300 deg. F., but in an oil burner it was found to be 2,700 deg. F. It is evident therefore that the strains on the firebox are greater for oil, and that water spaces sufficient for coal will be too narrow when oil is used. The remedy is to enlarge the firebox greatly, thus reducing the heat transmitted per square inch. If the firebox is not enlarged, then the water spaces should be of a special form and construction adapted to lessen firebox strains. If it is expedient to enlarge the firebox in order to lessen differences of temperature at the two sides of the firebox sheets, it is also expedient gradually to diminish the area of the tubes from firebox tube sheet to smokebox tube sheet.

As far as the tubes are concerned, it is a mistake to suppose that increased heating surface is of direct proportional advantage when differences of temperature are great. The speed with which heat is transferred is so enormous that the area of heating surface is of insignificant importance compared to temperature differences. The velocity of the gases passing through the flues when a locomotive is developing maximum power averages 2,000 ft. a second, therefore they pass from end to end of even the longest tubes in the one-hundredth part of a second. At the firebox end of the tube the velocity is much higher than this average.

The temperature drop in an oil burner is nearly 2,000 deg. F. from firebox to smokebox, and one-half of this, or 1,000 deg., occurs in the first 5 ft. of flue. Therefore, in the four-hundredth part of a second there is a temperature drop of 1,000 deg. That is "going some!"

It is much more important to have thin tubes and to maintain a high velocity of the gases than to retain heating surface. If all the gases from firebox to front end passed through a single tube, theoretically it would be quite as efficient as many tubes; actually, it would not, owing (1) to the non-transparency of the tube iron to heat, (2) to the increasing frictional resistance of the tube walls to high gas speed, (3) to the defects in water circulation on the outside of the tube.

Because in an oil burner there are no cinders to clog up the tubes, because the tubes can be kept cleaner, because a larger firebox surface is needed to absorb the larger volume of heat evolved, the oil-burning locomotive can be equipped with tubes both shorter and of smaller diameter than with coal, thus making the tube heating surface much more effective. The chief modification of the oil-burning locomotive should be:

(1) Larger water spaces around the firebox.

(2) Different construction of firebox, preferably with submerged seams and non-rigid suspension.

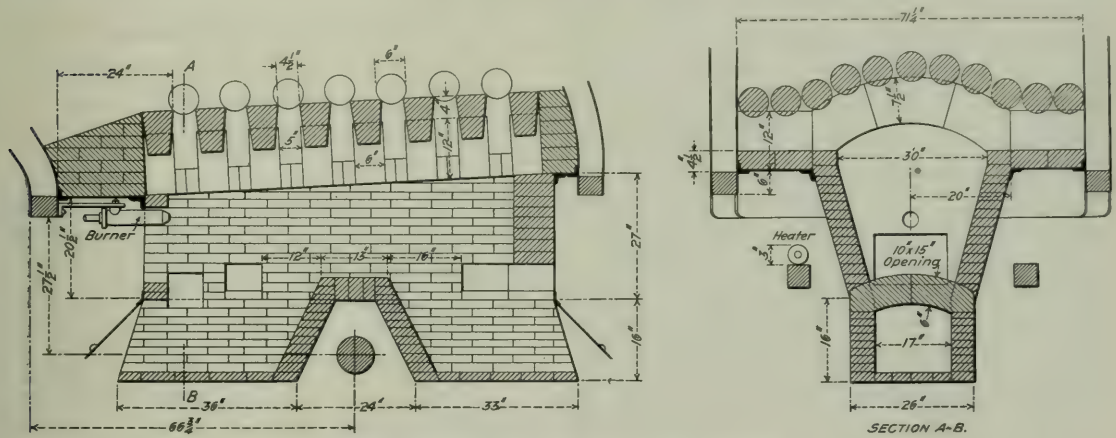
(3) A much larger firebox or combustion chamber.

(4) Shorter and thinner tubes but more of them, preferably diminishing in area from firebox to smokebox.

These changes rest on the assumption that oil can be more perfectly burned than coal; that is, it can be burned with less production of carbon and smoke, much less surplus of air to insure perfect combustion, and therefore much less expenditure of power to produce the required draft. Also, owing to the fearful strains in the firebox due to the high heats, the more the heat of combustion can be emitted and absorbed as radiating heat and the less by actual contact of the sheets with the burning gas, the better it will be.

A theoretically and practically satisfactory solution of this part of the problem has been secured by the use of the Neely furnace as applied to oil-burning locomotive fireboxes. It was designed by Mr. Thomas W. Neely, in charge of oil-burning economies in connection with the Santa Fe betterment work described in the *Railroad Gazette* Nov. 30 and Dec. 7, 1906. It is illustrated in the accompanying drawings. Instead of injecting the burning gases directly into the firebox where, during the act of combustion, there are not only tremendous variations in temperature but also an exceedingly active chemical corroding action, the burner is separated from the firebox by a perforated horizontal or arched wall of fire brick. The burner is placed in the front end of what the inventor calls the "developing chamber." The construction of the burner is such as to use a minimum amount of steam for atomizing the oil, and both the position and action of the burner induce past it a flow of air which is thoroughly mixed with the atomized oil and steam.

As is well known, the presence of a small quantity of steam materially aids perfect combustion, it being supposed by some that



The Neely Furnace Applied to Pacific Type Locomotive.

The burner, it will be noted, is at the front of the developing chamber. Air is drawn in around the burner and also through the doors in the pan, which are controlled from the cab. The balls are of specially prepared firebrick. Much of the initial combustion takes place below the arch and balls. Even if the whole arch collapses, as has occurred, there is no engine failure, as in this condition it is still as good as standard construction. The burner being at the front, the gases are shot backward and thus heat the door sheet. By varying the spaces between the arches and using different sizes of balls the flames can be distributed as desired.

the carbon will not readily combine with oxygen except in the presence of hydrogen; there may also be some obscure catalytic action, analogous to that of platinum sponge, which glows in the presence of escaping hydrogen. Be this as it may, the atomized oil, steam and air in Mr. Neely's furnace are initially burned in a separate chamber wholly surrounded by fire brick and immediately under the firebox. This chamber becomes intensely hot, and its design and heat operate (1) to heat the incoming air, (2) to mix thoroughly and heat all the gases before they pass into the firebox, and (3) to radiate a non-chemical heat to the firebox walls.

The flames being subdivided and baffled by the porous arch are forced to all parts of the firebox equally, thus doing away with any blast effect on any particular part of the box. Any unburned gases, in passing through the porous arch, which is kept at a white heat, are brought up to the combustion temperature maintained at such temperature until combustion is completed, thus preventing the deposit of carbon. The porous arch also causes the oil vapors and the air to be forced into intimate association, which results in quicker and more perfect combustion and makes it unnecessary to use any considerable excess of air in burning the oil as is the case with the ordinary arch. Whenever the fire is cut down, all air admitted to the firebox must pass through the highly heated arch, and being forced into intimate contact with the large heat-radiating surfaces of the arch and passing through comparatively small openings, the air is brought up to the temperature of the arch before being admitted to the firebox. Firebox temperatures vary but slowly.

It is a matter of common daily practice on the heaviest Santa Fe type locomotives to maintain the full steam pressure (225 lbs.) against two No. 11 injectors without a trace of color of smoke at the stack. There is but little difference in the evaporative efficiency of the boiler under different rates of duty owing to the uniformly good combustion. To show the results thus far secured with this equipment it will only be necessary to cite a few examples as found on the Gulf Lines and Coast Lines of the Santa Fe System, where the equipment is being used. On the Gulf Lines, engine No. 664, a consolidation with 21 in. x 28 in. cylinders and 180 lbs. steam pressure, was taken from the hospital track, where it was awaiting a new firebox, the Neely equipment was installed in the old firebox and the engine put into regular freight service. The records show that for the eight months following, the running repairs on this engine were a little more than half what they were during the eight months previous and the mileage was almost doubled.

Eighteen Santa Fe type locomotives now in service with this equipment on the Coast Lines are costing less than 1¼ cents per mile for brick work, boiler work, burner, piping, etc.—that is, all repairs not chargeable to machinery. These engines are averaging 3,800 miles and upward per month on one of the hardest divisions on the system, owing to heavy grades and poor water. The tonnage on this division was raised 50 tons per engine March 1, 1907. Engine No. 948, now in the fourteenth month out of the shop, is costing less than $10 per month for boiler work, and its shopping within the next three months will be rendered necessary only by the condition of its machinery. The boiler work on all these engines is averaging less than $12 a month. Almost no work at all is done on seams, radial stays and staybolts, and there is but little appreciable deterioration of the firebox. It is impossible at this time to say just what the life of the fireboxes on these engines will be. It is safe to say, however, that it will be at least double that of those fitted with the ordinary oil-burning equipment.

The results on the Coast Lines with the 18 engines above mentioned were attained at a time of heaviest traffic and when, by the promotion of firemen, many engines were manned by men who were unskilled in the duties required of them on their respective sides of the engine cab.

The principal features of the burner used are the high efficiency in atomizing and the suction effect by which a part of the heated gases from the furnace are drawn into the head of the burner and discharged with the oil and steam. The oil is thus almost completely atomized and vaporized when it leaves the burner. The amount of steam required for atomizing is about one-third of that required by burners commonly employed in locomotive practice. The suction effect mentioned sets up a counter-flow of the gases in the firebox or furnace along the sides and toward the burner, thus causing an even temperature in all parts of the developing chamber.

As an example of what is being accomplished in stationary practice, it may be stated that in one of the power-houses of the system a 125-h.p. boiler has been for hours at a time developing 206 boiler horse-power at a rate of evaporation of over 12 lbs. of water per pound of oil, the steam pressure being 120 lbs. The water evaporated by this boiler showed repeatedly above 6,000 lbs. per hour. A burner on one of the boilers in this power house was recently removed after having been in continuous service for over two years without any repairs whatever.

For locomotives, on the basis of like total amounts of water evaporated, the cost of maintaining the Neely oil burners is less than that of the coal burners, although the oil furnace is used in a boiler primarily designed for coal, and its adaptation to oil therefore more or less of a makeshift. After two years of experimental work on the Texas Lines, Mr. Neely was authorized to equip the 18 new Santa Fe type (2-10-2) engines, weighing 235,000 lbs. on drivers, already referred to. The boiler and furnace repair costs of these engines have been most carefully kept, a special force being detailed for that purpose. The figures are as follows:

	Cost per mile, cents.	Per cent. of whole.
Furnace	0.69	55.6
Firebox and flues	0.23	18.7
Burner	0.13	10.5
Pan and damper	0.10	8.0
Front end	0.08	6.7
Boiler	0.01	0.4
Total	1.24	99.9

These 18 engines have not been in service long enough to permit comparisons with engines differently equipped; but on the Texas Lines it has been possible to compare the cost of maintaining the same engine first with standard equipment and then with the Neely equipment.

Cost for All Repairs per Engine-Mile.

Engine No.	664, standard equipment, August, 1905	$0.113
"	664, Neely equipment, August, 1906	0.036
"	666, standard equipment, 4 months, average	0.102
"	666, Neely equipment, 4 months average	0.042
"	111, standard equipment, 8 months, 1905	0.081
"	111, Neely equipment, 8 months, 1906	0.024

This last comparison is vitiated, however, by the fact that a new firebox was put in at the time of installing the Neely equipment. In the other cases the fireboxes with the Neely equipment were the older.

As shedding additional light on the whole question of oil versus coal, as well as usual oil-burning methods versus improved oil-burning methods, figures are available covering:

(1) The same type of engine in similar service burning coal and burning oil.

(2) The same type of engine burning oil in the usual manner and burning oil in the improved manner.

(3) The same engine burning oil in the usual manner and in the improved manner.

	Burners—Coal	Burners—Oil.
No. of engines	41	40
Time	12 mos.—1906.	12 mos.—1906.
Class	900	900
Service	Freight.	Freight.
Weight on drivers	234,580 lbs.	234,580 lbs.
Division	New Mexico.	Arizona.
Average mileage per engine	26,391	24,233
" miles per month	2,199	2,019
" gross tons per mile	874.5	968.4
Repair costs per mile, excluding wrecks:		
Roundhouse: Labor	$0.0568	$0.063
Material	0.0182	0.027
Total	$0.075	$0.09
Back shop: Labor	$0.057	$0.083
Material	0.039	0.043
Total	$0.096	$0.126
Grand total, repairs per mile	$0.171	$0.216
Wages per mile:		
Enginemen and firemen	$0.114	$0.089
Hostlers and attendants	0.044	0.017
Miscellaneous supplies	0.005	0.003
Grand total cost per mile*	$0.334	$0.325
Grand total, per 1,000 gross ton-miles	$0.382	$0.331
Total lbs. of fuel per engine-mile†	263.3	226.6
Dollars of repair cost per ton of fuel	$1.33	$1.96
Gross ton-miles per ton of fuel	6.72	8.55

*Not including fuel or wreck repairs.
†60 tons of oil equal 100 tons coal.

This tabulation indicates that repairs are heavier for oil-burning locomotives both as to material and labor, but that the oil-burners, when out of the shop, are easier to operate in all respects, as they burn less fuel, take heavier loads and cost less for supplies, for hostlers and for engine crews. As machinery wear is less severe on the Arizona division, the grades not being as heavy nor the curves as sharp, the extra expenses occur in the oil-burning part of the locomotive from dampers to stack. Therefore, as to this class of repairs a comparison has been made between similar engines equipped with Neely furnaces and equipped with standard furnaces.

	Furnaces—Neely.		Furnaces—Standard.	
No. of engines	12		5	
Time	April, 1907.		April, 1907.	
Class	1,600		1,600	
Service	Freight.		Freight.	
Weight on drivers	234,580 lbs.		234,580 lbs.	
Division	Arizona.		Arizona.	
Fuel	Oil.		Oil.	
Total miles	46,577		15,241	
Average miles in month	3,881.4		3,233.5	
Average miles of 900 class for year 1906	.....		2,471.5	
Repair costs per mile, in cents:	Cents.		Cents.	
Furnace repairs	0.90	60.1 pr ct.	1.1	53.9 pr ct.
Burner and piping	.18	12.1 "	.06	3.0 "
Firebox and flues	.29	19.1 "	.83	40.8 "
Boiler	.03	1.8 "	.....	.....
Pan and damper	.08	5.7 "	.02	1.0 "
Front end	.02	1.2 "	.03	1.3 "
Total	1.50	100.0 pr ct.	2.04	100.0 pr ct.

The high costs for piping and damper work are temporary and due to the initial necessity of altering the standard arrange-

ment to conform to change of equipment. The above record for a single month is sustained by the records of longer periods.

Total repairs, as above, for standard engines of 1,600 class, from December, 1905, to December, 1906, per mile	$0.025
Total repairs Neely equipment, December, 1906, to May, 1907, per mile	0.015

Sixty per cent. of all engine failures in this class in this heavy service are due to firebox and flue troubles. The greater mileage of the Neely-equipped engines is due to fewer failures in firebox and flues.

The Neely furnace, because of its more perfect combustion, is supposed to be more economical in oil. Owing to the extraordinary difficulty of securing reliable oil records over a long period of time, no attempt has yet been made to demonstrate this.

It appears that the great value of the Neely equipment lies in the fact that the firebox and flues stand up better, do not leak, therefore do not cause engine failures or require shop repairs and thus cause delays. As a consequence the same engines made about 20 per cent. more mileage a month when equipped with the Neely furnace. Engine 948 when running with standard equipment averaged 2,030 miles per month. Since equipped with the Neely furnace, although 14 months out of shop and ready for heavy repairs, it has averaged for five months 3,389 miles per month, or 67 per cent. more.

If the Neely furnace could be supplemented by a longer firebox, wider water spaces and shorter tubes, such a properly designed and operated oil-burning locomotive would undoubtedly prove far more economical to maintain and more convenient to operate than any coal burner.

Norfolk & Western Improvements.

BY GEORGE L. FOWLER.
Associate Editor of the *Railroad Gazette.*

IV.

YARD OPERATION.

It is on that division of the Norfolk & Western extending for the 105 miles between Bluefield and Williamson, as previously stated that about 62 per cent. of the traffic moving over the road originates. This division is known as the Pocahontas division and traverses the heart of the semi-bituminous coal region of West Virginia. It is here that the celebrated Pocahontas coal is mined, a coal that ranks with the best of the Welch for calorific values and steam producing qualities. To the west of the Pocahontas field lie the veins of the Thacker coal, a field ranking high as a steam maker, but containing a little more volatile matter than the Pocahontas and lying on a higher level geologically, so that the approach to anthracite is a little more remote, as the natural coking process has not been carried on for quite so long a time. With a location through these two fields, whose product ranks so high and is so favorably known the tonnage is naturally high. Consequently the coal and coke tonnage for the last fiscal year, ending June 30, 1906, was 13,474,246 tons, which includes 1,012,418 tons of coke and gas and steam coal from the Clinch Valley field which lies to the southwest of Bluefield on the Norton line. These figures are the result of the rapid growth of the output since the opening of the original mine at Pocahontas in 1883. In the first year after the opening of the mines there was but one operation with a total output of 80,633 gross tons. This has increased to the present proportions at the rate shown graphically on page 354 in the issue of March 15.

The cars in which this traffic is handled consist of hopper bottom, gondola, rack coke, box and stock cars. The hopper bottom cars are of widely varying capacities. These are 20, 25, 30, 40 and 50 tons. The cars of 20 and 25 tons capacity are being rapidly retired from service and when they are found to require more than $50 in repairs they are consigned to scrap. The 40 and 50-ton cars are used almost exclusively in the tidewater and eastern industrial trade, while the gondolas, that are of 30, 40 and 50 ton capacities are used mostly for the western trade where the receivers of coal and coke have been slow in acquiring unloading stations adapted to the economical use of the hopper bottom or self-clearing cars, such as are employed in the east with large savings in cost of handling materials. The rack coke cars have a carrying capacity far above that of their holding on account of the lightness of the material of the load. The rated capacities are 20 and 50 tons, but the actual load carried ranges from 20 to 30 tons. The company also have a number of large steel hopper rack cars (some of which have a wooden rack) with a side dump.

From the geological map of the territory served by the Norfolk & Western it will be seen that the Pocahontas field lies at the eastern extremity of the Pocahontas division, while the Thacker abuts against it and lies at the western end of the same. It is evident then that the Thacker coal, in order to reach the eastern markets, must pass through the Pocahontas territory, so that, as a matter of fact, the greater portion of it is mined for a western delivery, and again, while the larger percentage of the Pocahontas coal goes east, there is also a large tonnage shipped to the west.

With these facts in mind regarding the importance and value of the Pocahontas coal in the markets, especially on the coast, it is readily understandable why the Norfolk & Western was called upon to build a very large receiving and distributing yard at Bluefield.

There is almost no coal mined east of this point. The famous Pocahontas fault occurs a few miles west of Bluefield and this defines the limit of coal production as clearly as any artificial demarkation could do. The yard then, is outside the coal producing belt, and all freight of this character, originating on the line, comes into it from the same direction, namely, the west, passes through it and on out at the east.

During the last fiscal year, the tidewater shipments of coal and coke amounted to more than 3,450,000 tons, to which must be added about 5,000,000 tons more than went east, making the total coal and coke tonnage that passed through the Bluefield yard in the neighborhood of 9,000,000 tons.

It is, therefore, necessary to have ample facilities for the handling of this traffic, hence the Bluefield yard.

BLUEFIELD YARD.

In order to understand the method of handling the traffic a word must be said in regard to the system of selling and shipping Pocahontas coal. Of course, it is all carried in carload lots and the capacity of these cars ranges from 25 tons, in the case of the old cars that are now becoming obsolete, to the latest type of steel construction, which has a capacity of 50 tons. The coal is mined and placed upon the cars and shipped to Bluefield direct from the tipple of the operation producing it. As these tipples are located all along the line and its numerous branches to the number of 160 or more, it is, of course, impracticable to maintain an agent either for the producer or the railroad at each of them. The system is, therefore, so arranged that neither is necessary. The coal is sold through agents each of whom handle the output of several operations. A few years ago all of the coal of the Pocahontas field was sold by a single agency. The coal put in the cars at the tipple is, therefore, sent to its selling agent at Bluefield. No waybills are made out and no record kept, the car is simply loaded, a tag attached and sent away. This tag, which is reproduced, gives the operation at which the load originates, the initials and number of the car and the name of the shipping agent at Bluefield, to whom it is consigned. The cars are gathered from the operation sidings by shifting engines and crews. They also pick up, at the same time, all other cars that are empty or filled with general merchandise. These last cars are waybilled and consigned, in the regular way, from the station where an agent is maintained. For operations located on the main line, the cars are collected by the regular trains and are mixed in with box and other merchandise cars. A train may, therefore, come into the Bluefield yard with every car tagged to a shipping agent, or it may have one or more accompanied by waybills.

The conductor of these trains makes out a switch list on the form shown in which he lists only such cars as have waybills and regular consignments and ignores those loaded with coal. The result is that it frequently happens that not a single car is listed on the card handed in by the conductor, or at most one or two stray merchandise cars that happen to have been picked up. The consequence is that there are no records of the numbers, loads or destination of the coal cars when they reach Bluefield.

The train is run in on the eastbound receiving track and stopped just short of the scale house. The first move is to send a boy down the side of the train who collects all of the tags and marks on each one the tare weight of the car from which it is taken, keeping them in the order in which they are collected. He then takes them to the office of the weighmaster at the scale house. The data contained thereon is then transferred to a book. This comprises the name of the shipping agent, the initials and number of the car, its tare weight and the operation at which the load originated. These last are all recorded by number, one being given to each in the field. These numbers are printed in red on the face of the tag referred to above, so that a glance suffices to tell the source of the load.

As a general thing the agents are notified in advance from the operation as to the initials, number and capacity of each car that has been loaded and consigned to them during the day. With this information at hand, the agent is prepared to make up a shipping list, which is sent to the weighmaster, and from which the waybills for each car is made out. This information is usually sent in the form shown, before the train containing the cars reaches Bluefield.

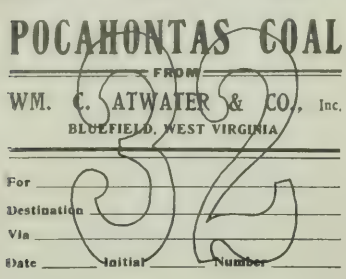
This enables the weighmaster's clerk to fill in the destination and consignee of each car. Should this shipping list or order not have been received at the time of the arrival of the train, the agent is informed by telephone of the arrival of the cars and asked for the shipping directions, which are at once forthcoming. This makes it possible to complete the switch list card and hand it to the con-

ductor of the switching crew. This work is all done while the car inspectors are going over the train, which requires from 15 to 20 minutes.

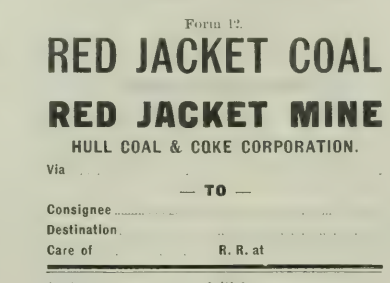
The yard is of the gravity type and the cars are let down over the scales which automatically registers the gross weights. The cars are then run into the proper tracks of the advance classification yard as detailed in the description of the Bluefield yard, in accordance with the information contained on the switch list. The gross weight having been obtained from the scales, the figures are read off in the order of the car locations in the train. This, of course, corresponds with that of the tags that have already been handed in and entered in the register book. These gross weights

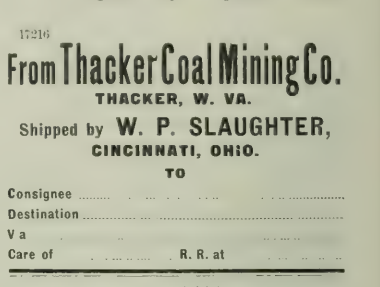
so as to save time and writing on which the name of consignor and consignee, class of lading and destination are printed in, leaving nothing to be inserted by hand but the car number, date and weights, as shown by the accompanying reproduction of the blank. The other billing is done in accordance with the ordinary methods.

So much for the eastbound traffic. For the westbound work conditions are quite different. There are some loaded cars passing through the yard in the regular through western traffic, but the great bulk of the tonnage in this direction consists of empties; and, for this, special arrangements have to be made in order to meet the requirements of the several operations for cars. The loaded cars are sent through the yard in the regular way as specified in the



Mine Tag for Coal to Bluefield; Norfolk & Western.



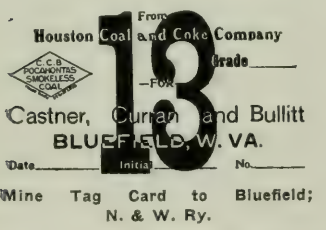


Mining Tags, Thacker Field; Norfolk & Western.

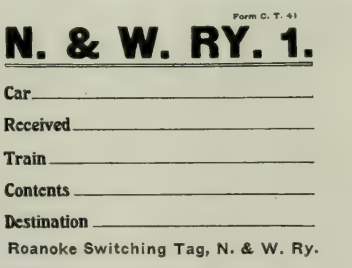
are accordingly entered in the same order from which the tare weights are subtracted, giving the net load. With this all the information is at hand for making out the waybills, which is accordingly done and a copy sent to the agents. This is the first and only information that the agent has of the weight of coal in the cars. The railroad company weighs the coal and gives the record to the shipping agent. In this way it has a check on the weights entered on the waybill, and the operator and agent is freed from the expense and trouble of weighing.

As soon as the cars have been dropped down upon the classification tracks they are made up into trains and pulled out. The time is usually too short to make up the individual waybills for

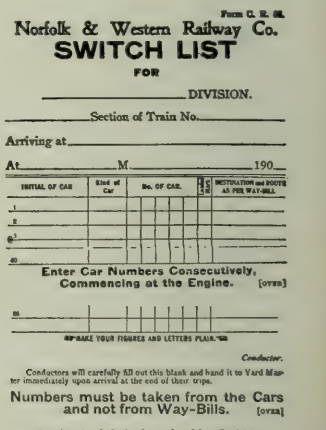
description of the yard, and the records are kept in the same way as for the eastbound loads. The empties, however, have to be made up for distribution to the several operations in order to meet the requirements of this great originating traffic. There is a standing agreement between the several operators and the railroad company that the operations in the Pocahontas field shall be classified according to the number of coke ovens erected and the available car supply prorated on that basis. In the Thacker field to the west where the coal is not coked, cars are divided on the capacity basis. There are, too, a few operations in the Pocahontas field where there are no coke ovens, and these are rated in the distribution of cars similar to the mines in the Thacker field. The coke oven basis



Mine Tag Card to Bluefield; N. & W. Ry.



Roanoke Switching Tag, N. & W. Ry.



Switch List Card; N. & W.

RECORD OF TRAINS ARRIVING AND LEAVING.

Train Section Arrived 190 , M. Name of Conductor

Train Section Left 190 , M. Name of Conductor

INITIAL	CAR NUMBER	Kind	Contents	Way Bill Date	Way Bill No.	WHERE FROM	DESTINATION	CONSIGNEE	REMARKS
1									
2									
3									
4									

Train Record Book (Old Form) Portsmouth Yard; Norfolk & Western.

each car, and the destination list only is, therefore, given to the conductor, and the waybills are forwarded by passenger train as soon as they can be made out. An exception to this is made in the case of cars destined for the Winston-Salem branch. There is a somewhat heavy business in southern shipments and the movement of solid trains is rapid. For these consignments a combined interline card and revenue waybill is made out. The original is written on thin, white paper and sent to the auditor, and a carbon copy made on a stiff card similar to that used on the switch list both in quality and size. This carbon copy is given to the conductor and serves as the revenue waybill.

Owing to the fact that there are but few shippers in comparison with the number of cars forwarded, special waybills are printed

originated in the early days of the industry and has held until the present.

Under these methods the car distributor at Bluefield allots the number of cars that are available from day to day. Trains are made up and despatched as rapidly as the cars come in and are sent out for car distribution along the line. The consignment of the cars to the mines is made on the basis of car tonnage capacity. During the night trains are made up for despatching in the early hours of the morning for the supply of those operations located on spurs that leave the main line near Bluefield, such as those to Pocahontas or Bramwell and Goodwill. These are regularly assigned trains and the crew makes the round trip distributing the empties and collecting the loads that are then hauled into Bluefield

for billing and consignment. Bluefield is the regular classification and shipping yard for all eastbound traffic as is Williamson for the westbound.

The actual number of empties that will be available for daily distribution cannot be known in advance for any length of time, but reports are received at the office of the superintendent of transportation at Roanoke, who informs the distribution agent at Bluefield of the probable number of cars that will be available for each 24 hours, based upon the location of the cars and the ordinary handling of the traffic. This information includes, not only the approximate number of cars that will reach the district from the east, but also from Portsmouth and the west, together with detailed information as to the makeup of each train when it leaves Radford, 62 miles east, so that the switch list for the classification of the cars can be made up by the time the train reaches the yard

statement of excess and shortage of the prorata delivery is kept so that the matter can be fairly adjusted from day to day in the distribution of the cars. The data thus collected and compiled serves as the basis for a daily report on the general situation that is made at 7 a. m. to the office of the superintendent of transportation at Roanoke. The physical operation of the yard has been handled in detail elsewhere.

WILLIAMSON YARD.

At Williamson, the next large yard west of Bluefield, the conditions are somewhat different, and there is of necessity a variation in the practice of keeping the car records. In the first place, the Williamson yard is made subordinate to that of Bluefield in the matter of eastbound shipments. All orders for car distribution are received from Bluefield and all eastbound loads, originating in the Williamson district, are sent to Bluefield under the operation tag

Form A D 58 E.

NORFOLK & WESTERN RAILWAY CO.

Interline Card and Revenue Way-Bill for Coal or Coke.

Car No.

Contents (Kind of Coal or Coke)

W. B. No. Date

Billed from Mine No.

Billed to

Via R. R. to

" " "

" " "

" " "

Consignor

Consignee

Final Destination

SCALE WEIGHT	RATE AND DIVISIONS
At	
Date	
Gross	
Tare	
Net	
Minimum	

FREIGHT	ADVANCES	PREPAID	COLLECT	Prepaid Beyond

RECEIVING AGENT WILL NOTE THAT THIS IS THE ONLY WAY-BILL THAT WILL BE ISSUED FOR THIS CAR:

TRANSPORTATION INFORMATION.

Transferred to Car No.

At Date

Weight of Car and Contents Net Tons

Marked Capacity of Car Lbs.

Conductors moving this Car must fill in record of same below.

	CAR	Date 190	TIME
TRAIN No.	Left		M
	Ar'd at		M

Conductor.

If load is transferred, or car is left short of destination, or delayed, state reasons therefor under head of remarks.

REMARKS:

Interline Card and Revenue Way-bill (Bluefield); Norfolk & Western.

Car No

To

Via

Contents

Norfolk & Western Railway Co.

CARD WAY-BILL.

FORM A D 58

W. B. No. Date 190

From

Consignor

Consignee

Destination

Via

Prepaid, $	Collect, $
Estimated Weight	Actual Weight
	Gross
Where Weighed	
	Tare
190	Net

Transferred to Car No.

At 190

The regular Way-Bills for this Car have been forwarded by Passenger Train to Agent

At Station

Conductors will fill out each space on back of this Card and the last one handling it at final destination will turn same over to Agent at that point for Etc.

Transportation Information.

Weight of Car and Contents { Net Tons.

Conductors moving this Car must fill in record of same below.

	CAR	DATE 190	TIME
TRAIN NO.	Left		M
	Ar'd at		M

Conductor.

	CAR	DATE 190	TIME
TRAIN NO.	Left		M
	Ar'd at		M

Conductor.

If left short of destination, or delayed, state why

Card Waybill Portsmouth Yard; Norfolk & Western.

Form A D 58 N

Norfolk & Western Railroad Co.

Accounting Department.

LOCAL CARD WAY-BILL

FROM

BLUEFIELD

TO

Lambert Point

Way Bill No.	Car Owner N. & W	Car Number
Lading COAL	Rate	Freight
Expenses	Prepaid	To Collect

Consignor, } Castner Curran & Bullitt.
Consignee, }

Way-Bill Weight	Scale Weight

190 Agent.

Transportation Information.

Weight of Car and Contents } Net Tons.

Special Card Waybill (Bluefield Yard); Norfolk & Western Ry.

C. R. M.

Norfolk and Western Railway Company.

COAL FIELD, FREIGHT TRAIN CAR REPORT

DIVISION. WARD.

DATE 190

ENGINEER	ENGINE	FROM	TO	CONDUCTOR

Tonnage Out of Initial Point Tons.

Tonnage at End of Run Tons

Conductor

	INITIALS	LOAD	DIVISIONS	LOAD OR EMPTY	MOVEMENT FROM	MOVEMENT TO	TIME LEFT	TIME ARR'D
1								
2								
3								
54								
55								

B.—Box. F.—Flat. C.—Coke.
S. D.—Single-Deck Stock. M.—Ballast Gondola. D.—Side Dump.
D. D.—Double-Deck Stock. G.—Gondola.

Train Car Report (Williamson Yard), Norfolk & Western.

The cars may fall short or exceed these figures according as the traffic is expedited or delayed. This includes all of the cars to be distributed throughout the whole of the coal region, whether that distribution be made from Bluefield, Williamson or Portsmouth, so that the whole matter is in the hands of one man.

This car distributing agent also keeps a daily record of the number of empty cars delivered to and the number of loads taken away from each operation. In this way the condition of the sidings at those points can be ascertained at any time. With the variation in the number of cars available as compared with the probable number as reported from Roanoke, it also happens that the distribution cannot be made in strict accordance with the classification of the operations that has been alluded to. For this reason a daily

for weighing and definite consignment. Williamson, too, is somewhat differently situated from Bluefield. The latter place is located to the eastward of the coal fields and there is almost no coal traffic originating to the eastward of it, while Williamson stands in the heart of the Thacker field, and must not only distribute cars in, but receives coal from both directions. Further than this, consignments of loaded cars pass through it, not only from the Thacker district, but also from the Tug river and Pocahontas districts that are located farther to the east.

Coal is also shipped under somewhat different conditions from the Thacker field than from the Pocahontas. Attention has been called to the fact that, in the Pocahontas field, the cars are loaded at the operations and tagged in a way that practically consigns

them to the representative shipping agents at Bluefield and these then give the shipping directions to the yard. In the Thacker district the same system is followed as far, as the making out of the waybills is concerned, but the coal is, for the most part, tagged for destination at the tipple and billed at Williamson, as very few of the operations maintain shipping agents at that place.

For this purpose a somewhat different form of car tag is used. It gives the consignee and destination, usually the routing, the grade of coal, date and car initial and number. Some call for the weights, but as this cannot be added at the tipple, and is not usually put on at the weigh office, it does not appear thereon. The tags also do not usually bear the operation number, though each one is numbered and is recorded as such in the weigh office. In fact, there is no uniformity in size, color or make-up of these tags, each one having evidently been designed by the user to meet his own peculiar ideas, the one requirement being that blank spaces

home office of the operations, and this may be located at Columbus, Bluefield or Roanoke. On the other hand, all westbound traffic that originates to the east of Williamson is weighed and billed at that point as at Bluefield. And this is done very rapidly.

As for the records they are very simple, complete and clear. When a train arrives a messenger from the weighing office goes down the line and removes the tags from the cars, checking off the numbers, adding the tare weight and keeping them in order. In addition to these the conductor turns in a train car report made up on the blank 10½ or 10, which furnish the car record office all the information needed as to the movement of each car up to the time of its arrival at Williamson. Blank 10½ is used only in the coal fields. From this the car tags, the waybills, and the switch list, similar to that used at Bluefield, are made up, and this is done and ready for delivery to the yard conductor by the time the train has been inspected.

NORFOLK AND WESTERN RAILWAY COMPANY.

WEIGHMASTER'S RECORD OF COAL AND COKE WEIGHED AT _____ SCALES.

Date of Month	CAR		Grade	From Mine No.	Series	Manifest No.	CONSIGNEE	DESTINATION	Initial No.	Light Weight of Car	Gross Weight of Lading	NET WEIGHT	N. E. W. Net Weight	REMARKS
	Initial	Number												
1														
2														
3														
4														
5														
6														

Weighmaster's Record (Williamson and Bluefield); Norfolk & Western.

shall be provided whereon to convey the information required in order to make an intelligent billing.

With this preliminary sketch of the conditions obtaining at Williamson we are now in a position to turn to the records and methods of handling the cars in detail.

The Williamson yard is provided with a hump, as stated in the description of the physical conditions, and the bulk of the loaded traffic passing through the yard is westbound; for, as previously stated, the greater portion of the traffic, both for the east and west originates between Bluefield and Williamson. In the classification of the westbound traffic trains are made up for Columbus, Valley Crossing, Portsmouth, which includes Cincinnati, and several connecting lines between Portsmouth and Valley Crossing. All of this is sent as local to Portsmouth, where the trains are broken up and reclassified. This refers solely to through traffic. Empty

As the cars are dropped down over the scales the gross weight is taken and this, in connection with the tare that the messenger has noted on the tag, makes it possible to fill out the record book No. 153, which forms the basis from which the general movement is known. These are the only two permanent records that are kept aside from the tissue copies of the waybills. Of course, in the matter of the train records, they are made complete for both arriving and departing trains, and in order to facilitate a search when such action is needed. In the case of an arriving train those cars that pass through with it are written in with black ink, while those that are dropped are written in red. On the other hand, for departing trains those cars that passed through the yard with the train are written in in black and those that were picked up are added in red. These are usually cars of a given classification that operating conditions make desirable to forward together and which

Form A. D. 314 B.

NORFOLK & WESTERN RAILWAY COMPANY.

No of Way-Bill _____

WAY-BILL FROM BLUEFIELD TO LAMBERT POINT. _____ 190__ No. of Car _____

CONSIGNOR	CONSIGNEE	DESCRIPTION OF LADING	BLUEFIELD SCALE WEIGHT	
			ACTUAL WEIGHT	
Castner, Curran & Bullitt.	Castner, Curran & Bullitt.	1 Car Run of Mine Coal.	Gross _____	Freight Charges Settled Through Auditor of Receipts' Office
Mine No.			Light _____	
			Net _____	

This Way-Bill to be forwarded to Agent, Lambert Point, by first passenger train; and [illegible] Receipts' Other Records

Special Waybill, Bluefield Yard; Norfolk & Western.

cars and cars for local delivery between Williamson and Portsmouth are made up in station order for such delivery in the usual manner.

For the eastbound work there are simply the local deliveries of loads and empties for the sparsely settled territory between Williamson and Bluefield and through freight which is sent unbroken to Bluefield to be classified there as already stated. In the case of the empties these are sent to mines east of Williamson for coal and coke loading. In the collection of the traffic an effort is made to avoid doubling back on the haulage as much as possible and, as westbound billing for loads originating west of Williamson is not done at this point, these cars are collected at Nolan, eight miles west and taken from there to Portsmouth with no other billing than the car tag attached at the mine. At the same time all the eastbound loads are hauled to Williamson, where they are simply sent on to Bluefield without either weighing or billing. In this way this yard is relieved of all weighing and billing of all loads originating to the west. Where cars come in from the east, as is the case at Bluefield, the destination orders are received from the

are cut out or added according to the exigencies of the train loading.

It will be seen that in these two great yards of the Norfolk & Western coal traffic, the methods of handling the work are exceedingly simple and expeditious. This simplicity is, of course, possible because of the fact that between the two yards there are no complications of foreign connections to be considered, and everything in the way of a loaded car that comes into Bluefield from the east goes, with a few exceptions, through to Williamson, while those reaching Williamson from the west go on to Bluefield, the only exceptions being those intended for way delivery, which are handled by the local freight. Empty cars, on the other hand, on reaching either yard are ordered to some coal operation for loading.

Having now considered the methods employed at the two originating yards, we can turn to the large distributing yards at Portsmouth, Ohio and at Roanoke, Va.

PORTSMOUTH YARD.

Taking Portsmouth first; we have here an entirely different set of conditions from those existing in the two yards that have been

1	2	3	4	5	6	7	8	9	0
			N&W 84 DEC 1306 B&M 29 DEC 1306						
			35620 92 - 11.06	30265 8 60 DEC 1306					

Car Record Book, Portsmouth Yard; Norfolk & Western.

considered. At Bluefield and Williamson there is a large originating tonnage. At Portsmouth there is very little originating and even that has been filtered through the small collecting yards at Nolan and Naugatuck, where a primary billing has been done. The billing is put on a card waybill of the form shown and this card follows the car through to destination, the conductor filling out blanks on the back in which there are spaces for the recording of eight train movements, with the date and hour of departure and arrival of each train. These cards, with the regular waybills, form a complete set of waybills with all of the information as to car initial, number, loading and destination that is usually carried by such a document. Regular waybills are, however, made out from the cards, which cover only those cars that have been loaded with coal west of Williamson and are sent on to Portsmouth with the car tags in position. The tags are then removed at that place and were so hidden in it that it was difficult to trace one through the yard. Sometimes hours would be required to trace the movement of a single car, or to ascertain that it had ever reached Portsmouth. Accordingly, on January 1, a new book was opened in which the record of the car movement is reduced to the acme of simplicity. The ruling and the record is substantially as given in the accompanying illustration. This book is to be worked in sections of nine pages each. The page number represents the first figure of the car number, and the column number the last figure. In the sample we have page 3, so that all cars listed on that page would have 3 for the first figure, while the entry would be made in the column corresponding to the last figure. Suppose, then, a call were to be made for a Norfolk & Western car No. 35,624. Turning to page 3 and column 4, it would be seen that the car was received on train 84, Dec. 10, 1906, and despatched on train 92, Dec. 11. A call for Bos-

FORM A. D. 134. SMALL.

NORFOLK AND WESTERN RAILWAY CO. Line Initial Road Initial Car No. W. B. No.

INTER-LINE WAY-BILL FROM TO DATE 190

ROUTE VIA Transferred Into { INITIAL No. AT 190 / INITIAL No. AT 190

THROUGH RATES 1 2 3 4 5 6

Consignor	Consignee and Destination	Number and Description of Articles	Weight	Divis'n of Rates	Freight	Advances	Prepaid	Total	TOTAL Proportion	Proportion	To

Interline Waybill.

the cars weighed and the weights, including the gross, tare and net, are sent to the owners.

Having waybills for his whole train the conductor is able to make out a switch list on form 56 before reaching Portsmouth, so that the work of reclassification can be begun as soon as the cars have been inspected. As the cars to be weighed are given on the card bills from Nolan or Naugatuck, trains containing them are run in on a special track so that they may be readily handled. They are then pulled out, weighed and thrown back upon the proper classification track, and this classification is facilitated by the mine tags from which the switch list can be checked. It may be added here that the switch list No. 10½, as used in the Pocahontas and Thacker fields, is always turned in to the yardmaster's office for record and use in the scale office. This can readily be done, as the number of "weighers," as they are called, are few in comparison with the total number of cars handled through the yard. For exton & Maine car, 30,265, shows it to have been received on train 29, Dec. 13, 1906, and delivered to the Baltimore & Ohio on the same date. As a further precaution a supplementary train list is made out on the switch list blank (C. R. 56). After a train has been made up, and before it leaves the yard a messenger goes down the side of it and enters the initial number and kind of car in the proper columns. On turning this list in to the office, the destinations are entered from the waybills. These cards are then filed away as a possible means of assistance in looking for a lost car, though they are rarely referred to.

The Portsmouth yard forwards eastbound cars classified and shipped solid for Williamson, to which point the heavy class W locomotives are rated to haul 1,000 tons. As the line for the first part of the run to Kenova is straight and level the tonnage rating is 2,200 tons; from Kenova a helping engine is used.

For the westbound traffic the road has two branches, one to

Form A. D. 133—SMALL.

NORFOLK AND WESTERN RAILWAY CO.

ORIGINAL CAR. Inl. No. POINT OF TRANSFER

CAR { INITIAL NUMBER WAY-BILL No. DATE 190

WAY-BILL to for via

CONSIGNOR	Consignee and Final Destination	Number and Description of Packages	Marks	Weight	Class	Rate	N. & W. Net Freight	Charges	N. & W. Prepaid	Total to Collect at	Proportions of Other Lines	Prepaid Beyond
	This Way-Bill to be used only for Freight destined for points beyond the line of the N. & W. Ry.											

Waybill; Norfolk & Western.

ample, in October last, 39,899 cars were passed through the yard, and of these 1,323 were weighed. In November 39,077 cars were handled, of which 1,477 were weighed. This gives an average of about 1,147 cars per day, of which about 46 were weighed. So that provision has to be made for handling less than 50 weigh cars a day.

As there are no connection for interchange at Portsmouth, with the exception of that with the Baltimore & Ohio, the records kept are of the simplest character.

Up to the first of January, 1907, two books contained all the records that were filed other than the tissue copies of the waybills that were issued. These were two books of form C. R. 9. One contained a train list of all arrivals regardless of direction and the other of all departures. It was made up from the conductors' switch lists and the waybills. It was complete, but individual cars Columbus and the other to Cincinnati. For Columbus and the Hocking Valley connection the trains are classified and sent out solid, as are all other loads to Circleville, Chillicothe, Glen Jean and Bannon. The locals are, of course, made up in station order. Trains are also made up solid for Cincinnati.

It will thus be seen that the work of the Portsmouth yard is exceedingly simple and the records and work of the yardmaster's office are reduced to a minimum, and yet they contain all of the information that is needed at a division terminal that is purely a receiving and despatching point, and where no account is taken of demurrage or car accounting. For this the single book suffices.

ROANOKE YARD.

At the Roanoke yard there is a somewhat greater complication than at either of the other points taken up owing to the fact that it is the junction point of four divisions. The main through

line from east to west there crosses the north and south road running from Hagerstown, Md., to Winston-Salem, N. C., so that there is a wider range of classification and more general breaking up of the trains than at any of the other yards. In the matter of records they are kept along practically the same lines as those used at Portsmouth previous to January 1. The traffic entering the yard differs from that of the other three points in that every car is properly billed at or near its starting point. Unlike the traffic originating in the Pocahontas and Thacker districts, that originating east of Bluefield is weighed and billed before reaching Roanoke, with the exception of an occasional stray car that may have been picked up between scale points. But these exceptions play no part of any importance in the general scheme of the yard operation. The permanent yard records are kept in books printed in the C. R. 9 form, and of these there are two for each division, one for arriving and the other for departing trains. That is to say, there are six in all, two for the line west, to Radford, Bristol and Bluefield, two to the lines east, to Norfolk, and two for the single division running through from Hagerstown to Winston-Salem. These records are compiled from the switch list, made out by the conductor, and the waybills.

Form A. D. 3½ F.

Norfolk and Western Railway Company.

No. of Way-Bill.....
No. of Car .....

COAL WAY-BILL from..... to 190

Consignor.	Consignee and Destination.	Description of Lading.	Scale Weight	Rate per Gross Ton.	N. & W. Net Freight		Charges.		Prepaid (N. & W. Proportion only.)		Total Freight and Charges.								Prepaid on Account of Other Lines.	
					Dlls.	Cts	Dlls.	Cts	Dlls.	Cts	Dlls.	Cts	Dlls.	Cts	Dlls.	Cts	Dlls.	Cts	Dlls.	Cts
		One Car COAL	ACTUAL WEIGHT. Gross..... Light..... Net.....																	
Mine No.																				

Coal Waybill; Norfolk & Western.

In the matter of the handling of the cars for switching a novelty is used in the form of a Roanoke yard tag. The form of this tag is reproduced and on it is entered all of the information needed for the handling of the car through the yard. These tags are filled out by a messenger who does the work from the waybills as soon as they are handed in by the conductor, and then goes down the train fastening each one in place by tacks, so that by the time the train has been inspected on the receiving tracks the switching for classification can be begun. The men work entirely by these tags and it is thus impossible for a car to be lost for, no matter where it may be in the yard, it bears its own destination and it is never necessary to ask any questions or search through a mass of waybills in order to determine the disposition of a car. This system is also especially valuable in the matter of bad order cars. Where these are set in on the repair tracks, the tag carries the lading mark, so that if it is perishable the repairmen go to work on it at once without further instructions. With the tags in position there is never any necessity for further references to the waybills until the car is in the train and ready to be pulled out, so that these can be kept and classified in pigeon holes just as the cars are upon the tracks. The tag has the further advantage over the usual method of chalking in that it cannot be washed out by rain and the labor involved in applying it is no more. Two messengers, one for day and the other for night service do all of the work, and this covers about 4,600 cars per day.

When a train has been made up, the conductor's car report is made out from the waybills and the list of cars in that train as brought in by a messenger. The bill is put on form C. R. 10 and is laid over the proper page of the outgoing book with a carbon sheet between so that the book contains an exact duplicate of the sheet given to the conductor and the time needed for a second copying is saved. The conductor makes the proper notations on the original as to where cars are dropped and turns the original in to the card record office.

There is, of course, a daily checking of the cars on the repair tracks for the information of the yardmaster, and a report of all movements is filed every morning at six o'clock.

The classifications, used for the Norfolk division, are for locals in station order to Lynchburg, Lynchburg and beyond, to Crewe, Crewe and beyond to Petersburg, and Lambert's Point. Going west cars are classified to Bluefield and Radford. In the locals no attempt is made at station order arrangement, the only thing being to keep the air cars in front. In fact, the classifications followed are merely those of junction points and local trains are obliged to do their own switching on the road.

It has been seen that in the classification at Bluefield, there is one for tidewater coal destined for Lambert's Point. These trains are sent through in block and are not switched on to the classification tracks at all. They are simply held in the receiving yard for inspection, where the bad-order cars are cut out and the train then sent down on to the forwarding track. The same method is pursued for westbound strings of empties. In this way a train is sent on through without obstructing the yard at all and with little or no delay. Such trains are usually made ready for despatching within 45 minutes of the time of their arrival and the engine and crew for hauling them are ordered in advance. The time required for the classification of an ordinary train of 50 cars is about 45 minutes and trains can be inspected, put through the yard and made ready for despatching in about an hour and a half.

Trains entering the yard from the west are simply run in on the receiving tracks in the usual manner, but from the north, south and east they are held outside until ordered in. These three branches come together east of the passenger station, and back on the Y is a telephone station connecting with the interlocking signal tower. As soon as a train reaches this point the conductor tele-

Form A. D. 3½ E.

Norfolk and Western Railway Company.

No. of Way-Bill.....
Car No. .....

COAL WAY-BILL from..... to 190

CONSIGNOR	CONSIGNEE AND DESTINATION	DESCRIPTION OF LADING	WEIGHT as per SCALES	Rate per Gross Ton	N. & W. NET FREIGHT Doll.	Ct.	
			ACTUAL WEIGHT. Gross..... Light..... NET.....				
		1 Car Coal.					Freight Charges Settled Through Auditor of Receipts' Office.
Mine No.							

Coal Waybill; Norfolk & Western.

phones the fact to the towerman, who, in turn, informs the assistant yardmaster at the east end of the yard. The latter is thus enabled to regulate the entrance of trains and admit the trains most desirable to handle at the time. If the trains were allowed entrance in the order of, and as rapidly as they arrive, it might happen that the yard could be congested with the number of trains of empties that had arrived in quick succession, while one loaded with perishable freight would be held back. It involves the possible holding of some of the crews for overtime, though this seldom occurs, but it does give the yardmaster a complete control of the situation.

C. R. 9, and the switching work is handled by means of the Roanoke switching tag C. T. 41. On the arrival of a train at the yard the conductor hands in at the yardmaster's office a switch list, C. R. 56, filled out with all of the information required. As this contains the car destination the switching tags are made out from it and a messenger puts the proper one on each car. This is done very promptly and the train is thus made ready for breaking up and sorting as soon as the switching crew is ready to take hold of it. The balance of the work consists merely in the yard movements that have already been described.

TRAIN CAR REPORT—SHOWING RECORD AND TONNAGE OF CARS AND THEIR SEAL RECORD.

Form C. R. 10.

_____ Division _____ Freight (Class of Train), _____ ward. Date _____ 190__

Conductor A	Train No.	Where From	Schedule Leaving Time	Actual Leaving Time	Where To	Schedule Arriving Time	Actual Arriving Time	Engine Movements: Enginemen	Firemen	Eng. No.	From	To	Time Called to Report	Time Relieved	Hours and Min. in Service: Hours	Min.
A	B	C	D	F	G	H	J	K	KA	M	N	Q	R	S	U	V
													M.	M.		

Schedule Cost for Moving the Train

Actual Cost for Moving the Train

"P" Passenger, "E" Emigrant, "A" Baggage, "R" Postal, "L" Express, "S" Combination "J" Private, "M" M. of Way, "X" Cabin, "B" Box, "D D" Single Deck Stock, "D D" Double Deck Stock, "Po" Poultry, "F" Flat, "G" Gondola, "H" Hopper, "O" Coke, "D" Coal Dump, "T" Tank, "D E" Dead Engine.

	Initial or Line of Car	Kind	Number of Loaded Car	Contents of Loaded or Number of Empt Car	Taken at Station Number	Left at Station Number	Check	Time Taken	Time Left	Billed to Station Name or No.	Light Weight of Car	Weight of Contents of Car	Seal and Fastening Record: Seal "B" Door	Seal "L" Door	End Door "L"	End Door "L"
	AB	AC	AD	AF	AG	AH	AI	AJ	AK	AM	AN	AR	AV	AW	AX	AZ
1																
2																
3																
79																
80																
	Total,			Loads		Empty										

Certified Tonnage Out of Initial Point _____ 1000 Pounds _____ Agent or Yardmaster.

Certified Tonnage at End of Run _____ 1000 Pounds _____ Agent or Yardmaster.

Correct _____ Conductor.

Total Weight of Train ("A N and A R") _____ Tons "B B" Per Cent. of Total Capacity in Lading _____ Per Cent., "B C" Total Tons Hauled One Mile _____ Loaded _____ Empty.

WEATHER REPORT.

By Forwarding Agent or Yardmaster.

Temperature _____ Above _____ Below _____ Wind _____ Storm

Temperature _____ Above _____ Below _____ Wind _____ Storm

By Conductor. In Transit.

Temperature _____ Above _____ Below _____ Wind _____ Storm

Temperature _____ Above _____ Below _____ Wind _____ Storm

The Following Schedule of Tare Weight will be Used Where Cars Are Not Stenciled:

Box, 28 foot ..... 22,000 lbs.	Flat, 33 foot ..... 24,000 lbs.	Gondolas, Hopper Bottom, 26 ft.	Empty Tank Cars ..... 28,000 lbs.
Box, 31 foot ..... 25,000 lbs.	Flat, 34 foot ..... 18,000 lbs.	21,000 lbs.	Derrick Cars, complete ..... 50,000 lbs.
Box, 34 foot ..... 25,000 lbs.	Flat, 34 foot 3¼ inch ..... 21,000 lbs.	Gondolas, Hopper, Bottom, 28 ft.	Postal Cards ..... 50,000 lbs.
Box, 36 foot ..... 29,000 lbs.	Flat, 34 foot 6 inch ..... 18,000 lbs.	27,000 lbs.	Officers' Cars, 1, 2, and 5 .. 86,000 lbs.
Stock, 34 foot ..... 22,000 lbs.	Flat, 36 foot ..... 28,000 lbs.	Gondolas, Hopper Bottom, 27 ft.	Other Officers' Cars ..... 56,000 lbs.
Stock, 36 foot ..... 25,000 lbs.	Charcoal Cars. ..... 23,000 lbs.	7⅜ inch. ..... 29,000 lbs.	Coaches ..... 54,000 lbs.
Stock, 36 foot 2½ inch .... 28,000 lbs.	Gondolas, Drop End, 35 foot. 23,000 lbs.	Gondolas, Hopper Bottom, 35 ft.	Combined Cars ..... 46,000 lbs.
Poultry Car ..... 33,000 lbs.	Gondolas, Drop End, 36 foot. 26,000 lbs.	21,000 lbs.	Baggage and Express Cars. 50,000 lbs.
Flat, 31 foot ..... 18,000 lbs.	Coke Racks, 35 foot ..... 24,000 lbs.	Refrigerator Cars. ..... 32,000 lbs.	Sleepers ..... 80,000 lbs.
	Side Dump Cars, 29 ft. 4 in. 23,000 lbs.	Patent Stock Cars ..... 26,000 lbs.	

INSTRUCTIONS TO AGENTS AND YARDMASTERS.

Agent or Yardmaster at initial point of train will make out and deliver this report to Conductor before departure of train, giving all information called for by headings "Date," "B" "C" "D" "A B" "A C" "A D" "A F" "A G" "A M" "A N" and "A R," also foot columns "A D" "A F" and "A R," placing totals at foot of column with lead pencil. If weight is not stenciled on car, use weight as per schedule above. In computing weights under column "A N" and "A R" be governed as follows: All pounds between 0 and 500 will be dropped, and between 500 and 1,000 pounds to be considered 1,000 pounds. In the case of cars used as way cars in the train, an arbirarty weight of 5,000 pounds will be used. Agents or Yardmasters must certify to tonnage and seal record of train at time of leaving terminals. Agents, in making weather report, will give temperature, direction of wind, if light or strong, whether raining or snowing, cloudy or clear.

Agents or Yardmaster at end of train run will be handed this report by Conductor of train and must receipt for same in Conductor's train book, giving date and time received. After carefully comparing this report with the yard check of the train as to car numbers, seal record and with way-bills as to tonnage, agents will certify to tonnage in train when received, forwarding this report by first passenger train to Car Record Office, Roanoke, Va.

INSTRUCTIONS TO CONDUCTORS.

Conductors will complete this report as called for by headings "A" "K" "K A" "M" "F" "G" "H" "J" "X" "Q" "R" "S" "T" "V" "A J" "A H" "A K" "A V" "A W" "A X" and "A Z" adding to the report all cars picked up by his train after leaving initial point; giving all the information called for by all columns; also total footing of columns "A D" "A F" "A N" and "A R"; also certifying to correctness of tonnage in space provided above; report weather encountered on run in space provided, and hand this completed report to the Agent or Yardmaster at end of run and take receipt for same in train book. Under Seal and Fastening Record "R" will mean right door when going toward the engine. "L" left door. "F" front and door fastenings. "B" back and door fastenings.

Train Car Report (Williamson Yard); Norfolk & Western.

SOUTH NORFOLK YARD.

As will be inferred from the description of the South Norfolk yard the records at that point need be only of the simplest character. It is known that everything that comes into the yard is intended for a Norfolk delivery. It may be in the form of coal or coke for Lambert's Point or coal, coke or general merchandise for the city yards or a connecting line, but none of these deliveries are made at the yard itself. Hence the records need only show the arrival of a car and the date of its departure with its destination. For this purpose the record is kept in a book similar to form

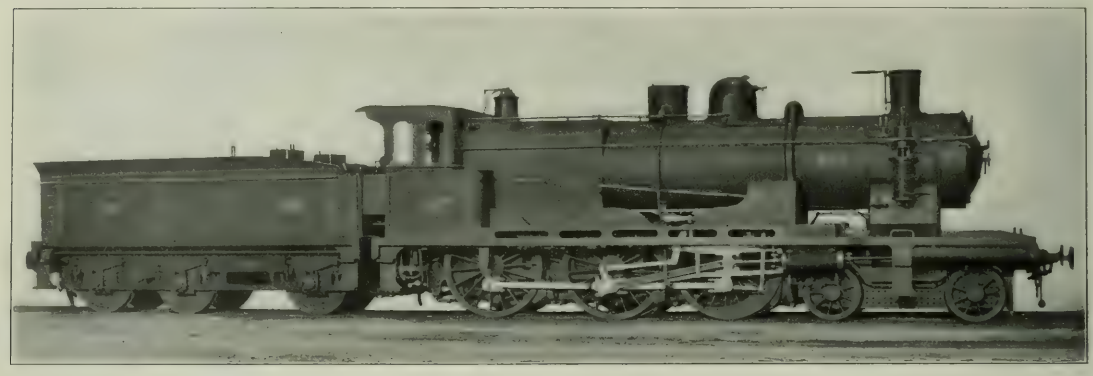
As in all large operations that are to be accomplished expeditiously the handling of cars through the yards and over the lines of a great railroad system must consist of simple movements that are not liable to delay or interruption. So in the case of the movement of coal and coke from the mines to the seaboard or the western markets, there is no doubling back on the route, but the traffic moves steadily forward from the tipple to the terminal with the minimum of clerical and switching attention. To pass the work in review the loaded cars are gathered and brought into the Bluefield yard, a miscellaneous assemblage of shipments from various mines and intended for destination lying at all points of the compass, but

mainly for the seaboard and the industrial plants in Virginia and the Carolinas. No sooner is such a train in the yard and before the car inspectors have finished their rounds, than the switch list is made out and order begins to come out of the confusion as the cars drop over the scales and in upon their proper tracks in the classification yard. Here the tidewater shipments are handled once for all and are sent forward with no breaking of bulk, with no delay for records or switching, and no need for a stop except for inspection at division points. They pass through and around the yards at Roanoke, Crewe and South Norfolk without interfering with or requiring switching and run direct to the terminal at Lambert's Point. Cars for other destinations are handled expeditiously and without back hauling, while the records of each yard are so kept that any and every car can be readily traced in its progress over the road. This means an economical handling and even this cost will probably be cut down when the yards are finished. At present the cost ranges at about 8½ cents at Portsmouth and 10 cents at Bluefield and Roanoke and this includes all of the expense of weighing and billing which does not usually fall to the share of the yard costs to the same extent that it does in this case where the volume of originating traffic is so large.

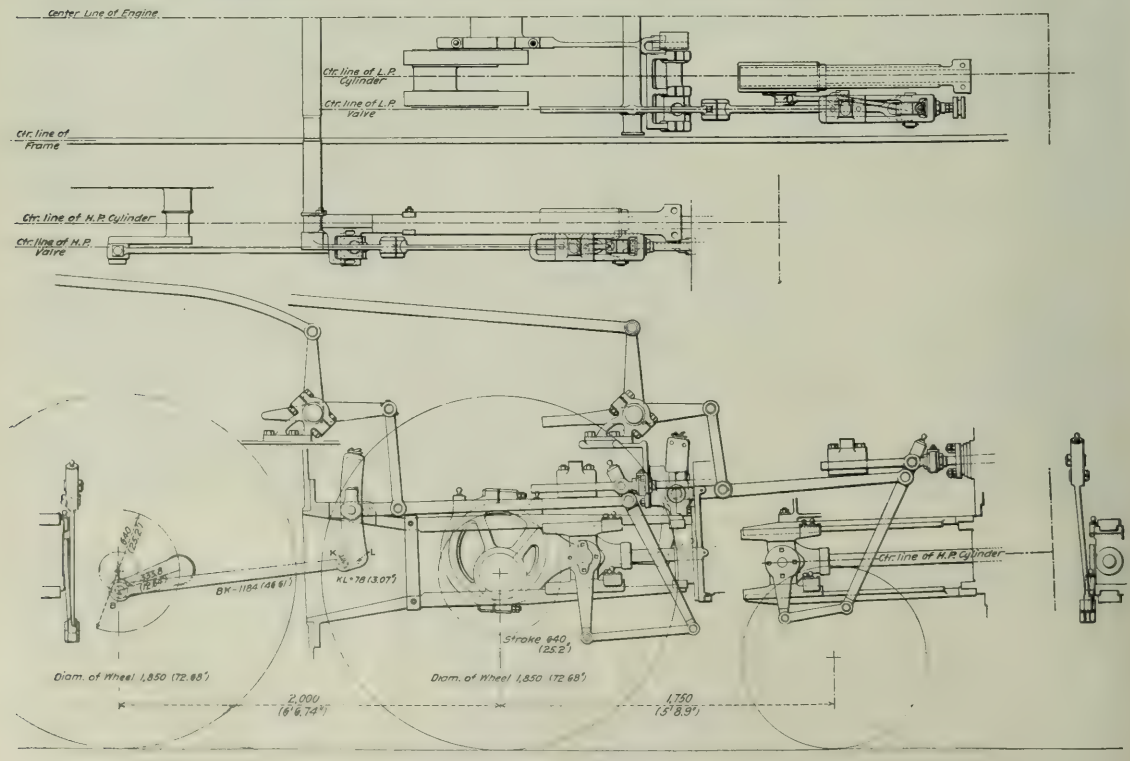
De Glehn Compound for the Paris-Orleans Railway.

The Baldwin Locomotive Works has recently built 20 ten-wheel locomotives for the Paris-Orleans Railway of France. These engines are compounded on the De Glehn system, and were built to drawings furnished by the railroad company. All measurements in their construction were made on the metric system, necessitating the introduction by the builders of many new standards and gages.

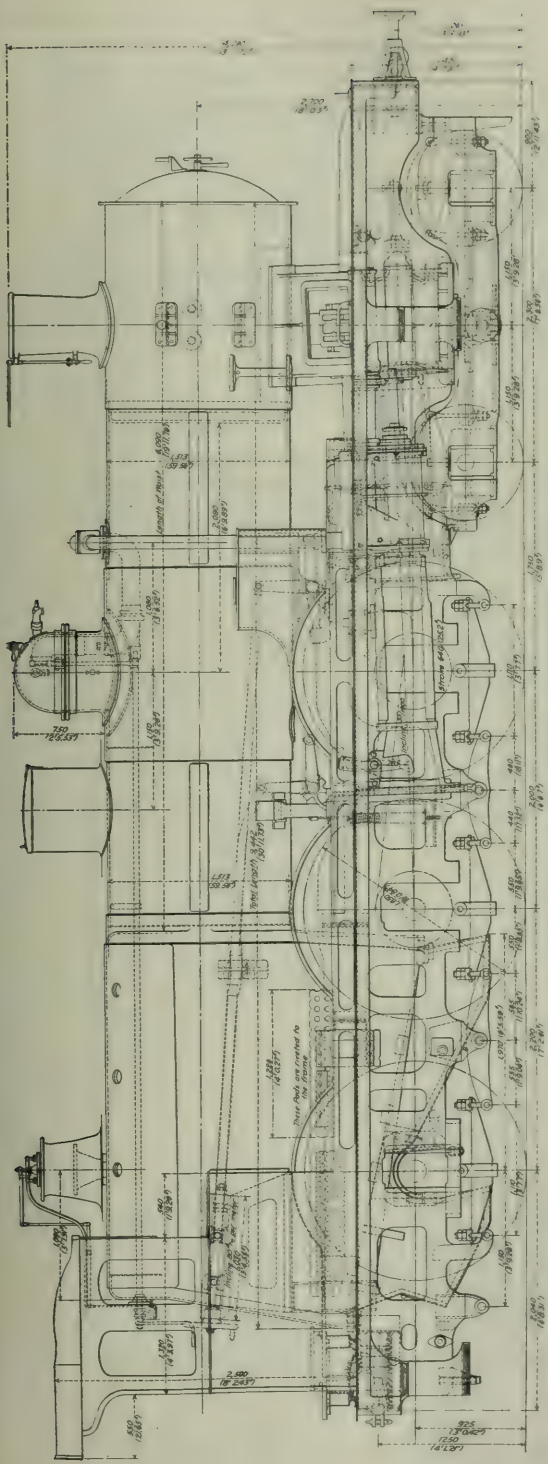
This statement is, in itself, full of significance, for one of the principal claims of the opponents to the introduction of the metric system in the United States has rested upon the assumption that its use would create endless confusion in shops where the whole organization and training of the men as well as all templates, drawings and tools are based upon the English system. Many engineers have in a small way had to do with the execution of work with the metric measurements, and have found no difficulty. But they were told that this was quite a different matter from the execution of large orders in regular manufacturing. Now an order for 20 locomotives while not large in view of present day practice, is by no means insignificant, and yet these engines were built from French drawings exclusively and entirely, and using the metric sys-



Locomotive Built by the Baldwin Locomotive Works for the Paris-Orleans Railway.



Valve Motion; De Glehn Compound Locomotive.



De Glehn Compound Locomotive; Paris-Orleans Ry.

tem of measurement in the shops. It was the first attempt at this in this country and was most successful. And what is more, the builders state that they liked the system and had not the slightest difficulty. It would seem from this that half the terrors of the mountain disappear as we begin to climb. These statements are offered merely to call attention to the conditions under which this order was executed. In sending the drawings into the shop the French terms were retained though in most cases the English translation was added, so that such expressions as *coupe par* and *vue d'arriere* abound. These drawings were complicated and intricate in their conception but thoroughly well executed.

In the reproduction of these drawings, the metric measurements are retained, and to these are added the English equivalents for the benefit of those who do not readily convert one to the other mentally.

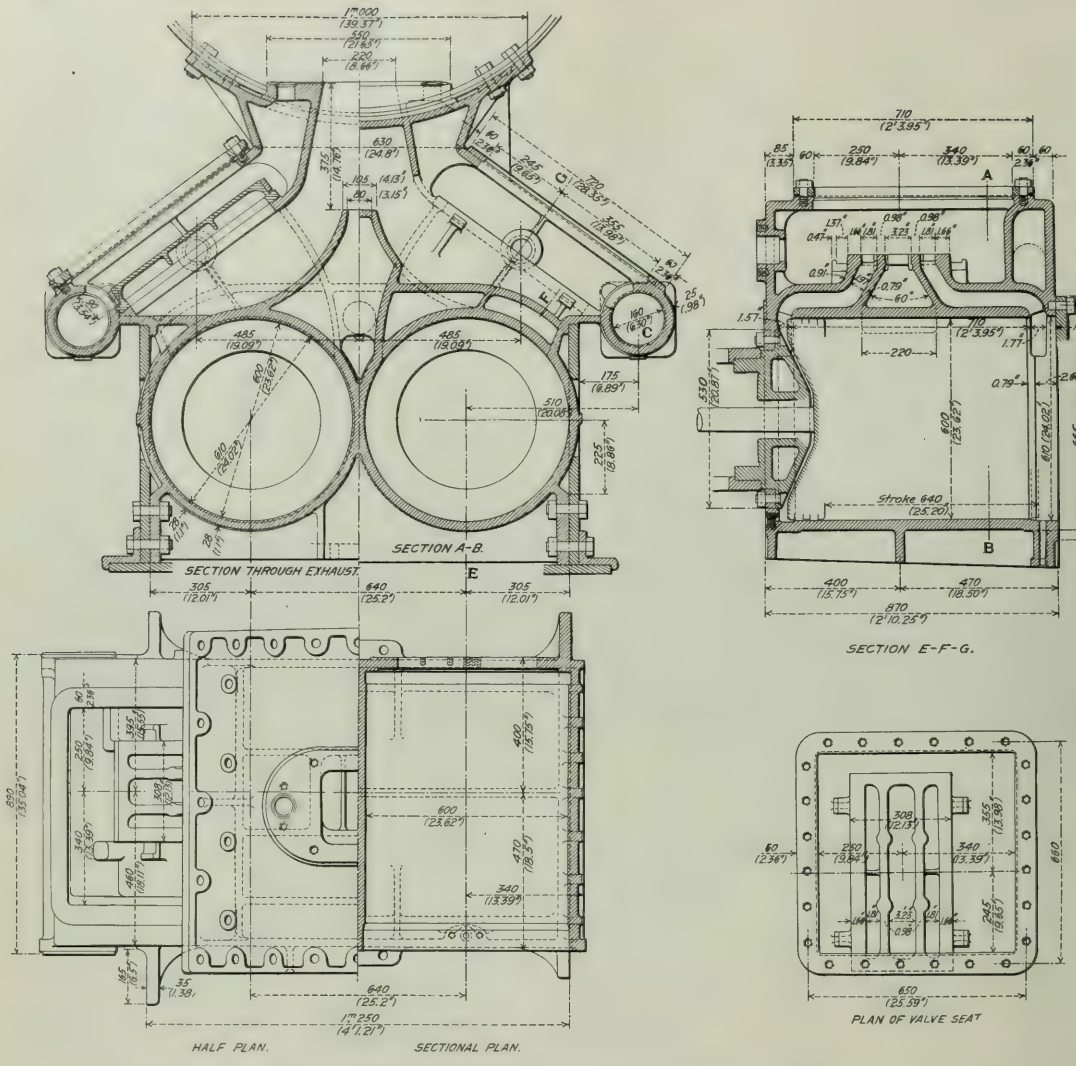
The De Glehn type of locomotive is characterized by an arrangement of cylinders which divides the application of the power between two driving axles, and provides a separate valve gear for each cylinder, so that the high and low-pressure cut-offs can be independently varied. The high-pressure cylinders are placed outside, while the low-pressure are inside between the frames. The Walschaerts valve motion is used throughout. The gears for the inside cylinders are driven from eccentrics placed on the first driving axle, while those for the outside cylinders are driven from the second pair of driving wheels by return cranks placed on the crank pins.

The outside, or high-pressure cylinders, are connected to the second pair of driving wheels, while the inside, or low-pressure, are connected to the first pair, which has a cranked axle. In order to keep the main rods of as nearly the same length and weight as possible, the high-pressure cylinders are set some distance in the rear of the low-pressure. This arrangement of cylinders is facilitated by the use of plate frames to which the cylinder castings are conveniently bolted. In the locomotive under notice, the high-pressure cylinders are located immediately in front of the leading pair of driving wheels. Each steam chest is cast in one piece with its corresponding cylinder. The slide valves are balanced, and are of bronze. Both the low-pressure cylinders are formed in one casting, the upper part of which constitutes a saddle for the support of the smokebox. The plate frames are cut out on each side, as the width over the low-pressure cylinders is greater than the distance between the frames. The low-pressure valves are also of bronze, but unbalanced; they have inclined seats, and their steam chests are formed within the cylinder casting. All the cylinders are set on an inclination of 3½ per cent., this being done to provide clearance for the engine truck under the low-pressure cylinders. Steam is conveyed to the high-pressure cylinders through external pipes, and is passed on to the low-pressure cylinders through special valves which are operated by air pressure controlled from the cab. These valves are in the form of sleeves, with suitable openings cut in them, and according to their position the engine may be operated as a compound or single-expansion locomotive.

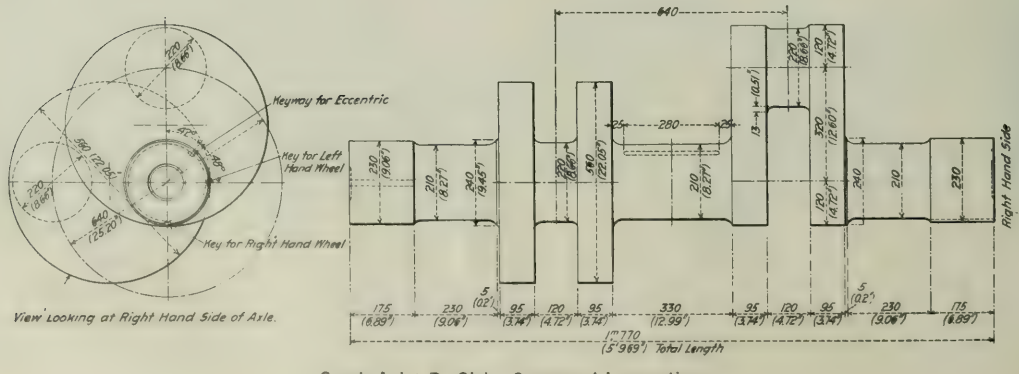
Thus tracing the flow of steam from the dome, it enters the high-pressure steam chest, from the outside pipes, at the top at A, and, after doing its work in that cylinder is exhausted at B, which is in line with the steam inlet at C of the low-pressure steam chest. From the low-pressure cylinder it passes to the exhaust. As will be seen from the ratios published at the end of this article, that existing between the high and low-pressure cylinder follows the trend of current practice and is higher than that prevailing a few years ago.

The guides are of forged steel and of the two-bar type. Those for the outside cylinders are braced by steel castings bolted to the frames, while the inside guides are secured to a heavy steel casting which braces the frames between the high-pressure cylinders, and also forms a support for the low-pressure links. The crossheads are of wrought-iron, case hardened. Forged steel main and side rods are used throughout, the outside main rods being of I-section. The side rod stubs are of a modified strap form, the bolts being in one piece with the straps. With this arrangement, the bolts are in tension instead of shear. The return cranks for the outside valve motions are forged in one piece with the crank pins, which are guided into their seats in the wheel centers by means of key ways. By placing the center lines of the high-pressure steam chests 120 m/m (4.72 in.) outside the cylinder center lines, all parts of the valve motion can be located in the same plane. With the low-pressure cylinders such an arrangement is impossible, as the valves are driven by eccentrics which are placed on the first axle between the inside crank cheeks. The links, therefore, are mounted on rock shafts, which serve to transfer the motion from one plane to the other. These rock shafts are supported at three points, thus avoiding, as far as possible, any tendency to spring the valve motion. Independent reverse shafts are provided for the high and low-pressure valve gears, which may be operated together or separately by means of an ingeniously arranged screw reverse mechanism placed in the cab on the left-hand side.

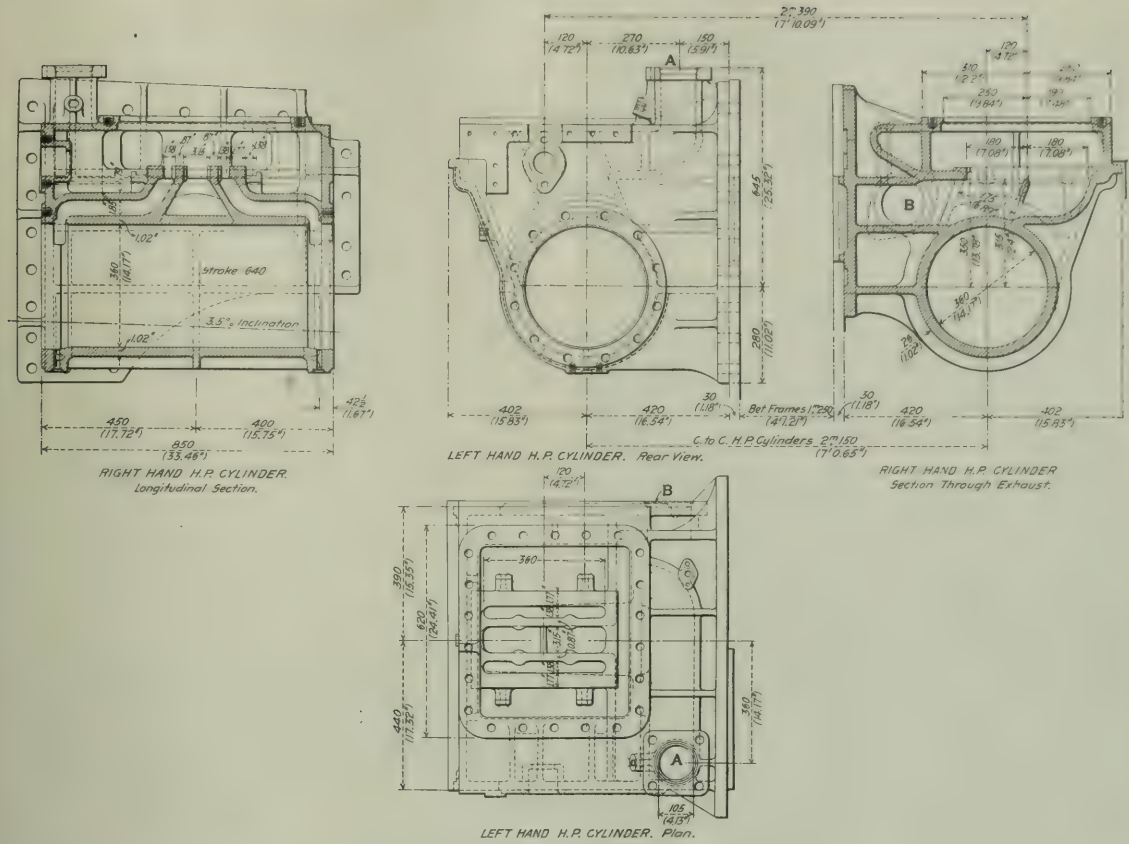
The driving wheel centers are of cast-steel with solid balances.



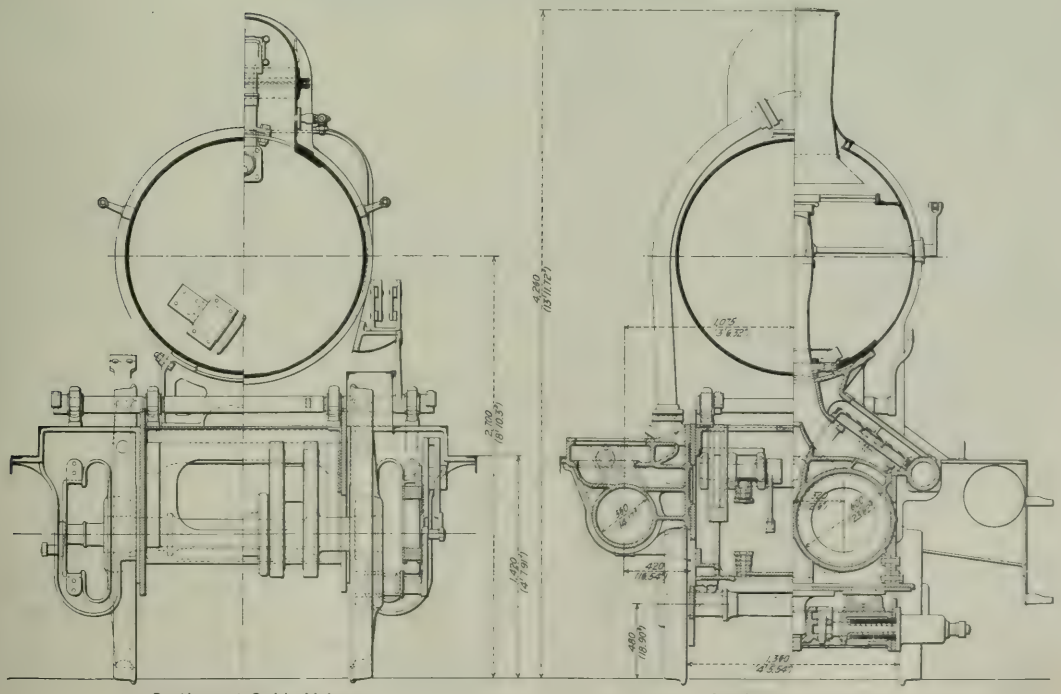
Low Pressure Cylinder; De Glehn Compound Locomotive.



Crank Axle; De Glehn Compound Locomotive.



High Pressure Cylinder; De Glehn Compound Locomotive.



Sections at Guide Yokes. Sections at Cylinders.

The driving axles are of forged steel, the crank axle being forged in one piece. Wrought-iron driving boxes are employed, and the weight is transferred to the frames through underhung springs and forged steel equalizing beams. The engine truck side frames are of slab form, placed inside the wheels. The weight is transferred to the truck through two hemispherical bearings whose centers are 900 m/m (34.43 in.) apart, measured transversely. These bearings are seated in suitable castings which can slide on a heavy cast-steel crosstie. Lateral motion of the truck wheels is also provided, and is controlled by means of coiled springs. The center pivot supports no weight and is used simply for pushing the truck. The truck frame is suspended directly on the springs, no equalizing beams being used.

The boiler is of the Belpaire type, built of steel plate, with the exception of the inside firebox, which is of copper. The grate is placed between the frames and is inclined toward the front at a sharp angle, thus giving an exceptionally deep throat. The staybolts in the water legs are of manganese bronze. Each bolt is drilled throughout its entire length with a hole 6 m/m in diameter. These holes are closed up at their inner ends by riveting the bolts over after they have been screwed into the sheets. The firebox is provided with a brick arch which is supported on copper strips, secured to the side sheets by copper studs. The grate is of the rocking type. The tubes are soft steel, of the "Serve" pattern, with internal ribs.

The boiler shell is built with longitudinal butt joints having double covering strips, while the circumferential seams are double riveted with lap joints. The throat sheet completely encircles the barrel. The steam dome is built of flanged plate, with a full sized opening in the barrel, and the base is strengthened by an inside liner. In accordance with general European practice, the throttle valve is of the sliding type, and is fitted with a pilot valve which opens first. The pressure on the main valve is thus equalized, and it is more readily moved on its seat. The smokebox is provided with a high variable exhaust nozzle, above which is placed a horizontal grating composed of round rods set in a wrought-iron frame. The stack is of cast-iron with a covering plate for checking the draft. The locomotive is fitted with high-speed brake equipment furnished by the Westinghouse Air-Brake Company of London, and also with steam heating equipment. Screw couplings and spring buffers are provided at the front end of the locomotive and the rear end of the tender. The cab is built of steel plate, and has narrow side windows. Access to the running boards may be had by climbing around outside of the cab, and for this purpose suitable hand rails are provided. An interesting part of the equipment is the Hoesler Chronotachymetre, which keeps a complete record of the speed throughout the run, and also shows the enginemen the rate of speed at any instant. The motion for this device is derived from a stud which is screwed into the rear right-hand crank pin and works in a slotted arm on a gear shaft located under the running board.

The tender is carried on six wheels, the two rear pairs of which are equalized. The frames are of the plate form, placed outside the wheels. Both the engine and tender are provided with steps and handholds, and the gangways can be closed, on each side, by means of suitable gates.

The following are some of the principal dimensions of these engines:

	Metric.	English.
Gage	1.450	4 ft. 9 in.
Cylinder, h. p., diameter	.360	14.17 in.
Cylinder, l. p., diameter	.600	23.62 "
Piston stroke	.640	25.20 "
Boiler, type	Belpaire	
" material	Steel	
" diameter of shell	1.513	59.57 in.
" thickness of sheets	.0185	.73 "
Fuel	Coal.	
Steam pressure	16 kg. per cm.²	227 lbs.
Firebox, material	Copper.	
" length	3.043	9 ft. 11.8 in.
" width	1.000	3 " 3.37"
" depth front	2.100	6 " 10.68"
" depth back	1.470	4 " 9.87"
" thkness, side, bk. crwn.	.016	.63"
" thickness tube sheet	.030 & .016	1.18 in. & .63 in.
" water space, frnt & back	.095	3.74 in.
" sides	.074	2.91 "
Tubes, type	Serve ribbed.	
" material	Steel	
" number	139	
" diameter	0.070	2.76 in.
" length	4.455	14 ft. 7.39 in.
Heating surface, firebox	16.17 m.²	174.0 sq. ft.
" " tubes	223.23 m.²	2,402.0 "
" " total	239.40 m.²	2,576.0 "
Grate area	3.10 m.²	35.36 "
Wheels, diameter, driving	1.850	72.84 in.
Wheels, diameter, trucks	.960	37.8 "
Wheel base, driving	4.200	13 ft. 9.36 in.
" " total	8.250	27 " 0.8 "
" " engine and tender	14.860	48 " 8.01 "
Weight on driving wheels	Light.	110,000 lbs.
" " truck wheels	Light.	42,900 "
" " total	Light.	152,900 "
" " engine and tender	Light.	195,000 "
Tank capacity, coal	20 cm.	705.8 cu. ft.
Tank capacity, water	6,000 kg.	1,580 gals.
Service	Passenger.	
Tractive effort		21,466 lbs.

$$\frac{\text{Weight on drivers}}{\text{Tractive effort}} = 5.12$$

$$\frac{\text{Total weight}}{\text{Tractive effort}} = 7.12$$

$$\frac{\text{Tractive effort x diameter of drivers}}{\text{Heating surface}} = 606.98$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 77.22$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = .0675$$

$$\frac{\text{Weight on drivers}}{\text{Heating surface}} = 42.7^*$$

$$\frac{\text{Total weight}}{\text{Heating surface}} = 59.35^*$$

Volume 2 h. p. cylinders ..... 4.6 cu. ft.

$$\frac{\text{Total heating surface}}{\text{Volume 2 h. p. cylinders}} = 560$$

$$\frac{\text{Grate area}}{\text{Volume 2 h. p. cylinders}} = 7.69$$

Equivalent of tube heating surface in firebox heating surface ..... 628.8 sq. ft.

Total equated firebox heating surface Vaughan's formula ..... 752.8 sq. ft.

Ratio of high to low pressure cylinder ..... 1 to 2.78

*By English equivalent.

Gasolene Motor Cars for Railroad Service.*

We have, in pumping and coaling stations, stationary gasolene engines that are delivering power at a cost of $1.56 per horse-power hour for fuel; this as compared with $1.92 per horse-power hour for steam power. There is no logical reason why this very economical power cannot be utilized for operating a transportation medium on an isolated railroad line. Furthermore, the electric lines have demonstrated that large profits result from the economical operation of self-propelled cars. These electric lines, with their frequency of service and ability to handle a large number of passengers, when brought into competition, take all the steam railroad passenger business.

I do not believe steam power for motor-car service will ever be economical. Steam dummy service is and always has been inviting; yet, in the face of the many failures in the past, even under favorable conditions, there has not been sufficient advancement or improvement made in the utilization of the steam power of to-day to insure the success of the steam motor car.

The modern locomotive and steam motor car, with high steam pressure and the attendant flue and firebox troubles—the troubles due to formation of scale, broken staybolts, leaky front-ends, defective draft, poor coal and kindred necessary evils incident upon the use of a separate power-generating unit, such as a boiler entails—are much more complicated and vulnerable pieces of machinery than the gasolene motor car in which, technically speaking, there is nothing present but (1) vehicle, (2) "prime mover," and (3) transmission; the complicated generator with its attendant multitudinous parts likely to give trouble being absent here. It necessarily and logically follows, to a mechanical mind, that a gasolene motor car, properly constructed and built with the same skill and care as a locomotive, is a much less vulnerable machine than a locomotive, and will undoubtedly give more continuous service without failures.

There is a great demand for a low-cost-of-operation, self-propelled passenger car; there are several kinds of transportation service to which the gasolene motor cars are particularly well adapted, and to which they are almost a necessity; many steam passenger trains are being operated at a financial loss, yet the passenger service must be maintained.

To meet these demands it seems necessary, in the present advance of civilization, that gasolene motor cars be designed for use particularly on steam railroads.

Branch lines collect freight traffic and feed the main line, and the limited passenger business, of course, can be handled economically when turned over to the main line. Thus it is, if the steam train could be replaced by a combination motor car, a great saving could be made in the operating expenses. Passenger traffic which would be insufficient to fill a steam train in most cases would justify the operation of a gasolene motor car. Frequency of service could be given the public, which, of course, is much appreciated. The number of trips, cost of operation, etc., is entirely dependent upon

*From a paper read before the New York Railroad Club, April 19, by W. R. McKeen, Jr., Superintendent of Motive Power of the Union Pacific.

the density of traffic and the length of the branch line. Now, on steam railroads in direct competition with the frequent service of electric lines, a motor car of high power is necessary to obtain the rapid acceleration and high speed required for this class of service. However, with these high-power engines there seems to be no particular increase in the cost of operation, as larger engines work more economically per horse-power developed than the smaller one. These cars are an entirely new style of transportation medium, and should be built, not along the conventional lines of an electric car, a steam passenger coach or railroad locomotive, but should be designed on entirely new lines; in other words, on lines particularly adapted for this new class of service.

In designing the car body of the motor car, three points must be considered, viz.: weight, cost and strength. In evolving a design of motor car, I thought it absolutely essential to use steel only. A motor car operated in connection with steam train service will, at times, be subjected to severe shocks, and it has been my idea to design a car of steel that would stand any sort of a shock without danger of collapsing or telescoping. Instead of having an underframing of excessively heavy sills with a light cracker-box framing above, we have endeavored to make the whole car body a unit structure, heavy parts of which brace its adjacent members, and in case of a wreck every bit of steel in the car would be utilized in offering resistance to same. Thus, our underframing comprises but one moderately heavy center sill; the side sill is a light-weight continuous channel extending around the body of the car. From this outer channel bar we have continuous steel ribs running up the side through the roof and down the other side of the car; these are braced to each other by suitable cross-braces. The sides of the car form a truss; the plate of the car being the top chord and the sill being the bottom chord. This framing is well tied together at all points, and is further reinforced and strengthened by the sheet steel covering. The ends of the car are enormously strengthened by the round shape at the rear and the pointed lines in front. In a collision this car could be punctured or bent, but it could not be telescoped. One of these cars in an accident struck a switch locomotive while running at about thirty miles an hour. The car was struck in the rear and but slightly damaged; the steel plates were bent up; the ribs of the car were broken loose and badly bent, but the frame of the car was not in any way damaged, except just at point of contact with the locomotive. Beyond where the car was struck the paint was not even cracked, showing that even under this severe shock there had been no movement of the members of this steel frame except in unison with each other.

The latest design of car, with metal frame round windows, enables the diagonal braces of the steel frame to be brought very close to top of car, and by lowering the roof and bringing plate of car closer to the side sill we get an enormous increase in the strength of the car side, and the side of the car comes more nearly to the form of a girder.

AIR RESISTANCE.

(*From the Berlin-Zossen Test of* 1902.)

The test conducted with the car having 97 sq. ft. of flat end surface, the air resistance was as follows:

At 25 miles per hour, 2.5 lbs. per sq. ft.
At 50 miles per hour, 8.2 lbs. per sq. ft.
At 62 miles per hour, 12.6 lbs. per sq. ft.

No figures are given for wedge-shaped or parabolic front ends, but summing up these tests, the following statement is made: As the air resistance forms the greater part of the total resistance of rapidly moving trains, it is essential to design the outer form of the car so that the air resistance should be reduced as much as possible. According to the results of the tests described above, the best conditions would prevail if the front end of the car had the form of a very sharp parabolic wedge.

(*From the Report of the Electric Railway Test Commission, Louisiana Purchase Exposition*, 1904.)

In the car used with flat ends, the maximum speed obtained was fifty miles per hour; with parabolic ends, maximum speed was increased seventy-five miles an hour.

The head-on pressure for all speeds averaged about one-fourth for parabolic front what it did for a square front.

Unit pressure at eighty miles per hour was ten times that at twenty miles per hour.

At sixty miles per hour the unit pressure on a wedge-shaped front was 2.10 lbs. and on a flat vestibule 8.2 lbs.

On a flat vestibule unit pressure at twenty miles per hour was 1.4 lbs., at eighty miles per hour it was 14 lbs.

On a wedge-shaped end, .4 of a pound at twenty miles per hour, and 4 lbs. at eighty miles per hour.

The suction at the rear end on the standard vestibule was equivalent to 16 horse-power at sixty miles per hour.

TRANSMISSION.

The gasolene engine is unquestionably a successful, practical and economical power generator; the motor car body, trucks, etc., built of steel, have been perfected. The means for connecting the gasolene engine to a motor car is the main difficulty in utilizing the power of an internal combustion engine. A variable speed engine, adapted for controlling the car at various speeds, and a mechanical means for throwing in a gear for starting car, to be used in case of emergency on excessive grades, is so simple that it leaves no doubt as to the practicability of this form of construction. With the Union Pacific motor cars, after the car is once in motion, the propelling mechanism consists simply of an engine and a sprocket mounted on crankshaft, the power being transmitted therefrom through a chain, into a second sprocket keyed on the driving axle. There are no noisy gears, no complicated mechanism for absorption of the power; it is so simple that the economical and practical features of this transmission can be readily appreciated.

THE ENGINE.

It is generally conceded that a gasolene engine is a constant speed machine; that used as a power generator, any variation in speed must be secured by mechanical methods outside the gasolene engine. The gasolene engines used for stationary purposes are all regulated by a governor and maintained at a constant speed. In the automobile business it is particularly noticeable that foreigners, in building their machines, figure on controlling the speed of the automobile by a multiplicity of gear speeds, often as high as four or five gear speeds, thus by their design admitting that the gasolene engine should run at a certain fixed speed. American builders of automobiles frequently control their machines with only two gear speeds, although many of them use as high as four and five.

All motor car experiments up to date have been based on the constant speed of a gasolene engine.

One of the most attractive features of the steam automobile is the ease with which the speed of the machine is controlled. This is due to the flexibility in control of the steam engine. We see on the locomotive every day the flexibility of the steam engine utilized in starting passenger and freight trains from a condition of rest, accelerating same to a speed of seventy to eighty miles an hour. Now, for a motor car to operate on a steam railroad where the simplicity of the machine is almost imperative, and all the conditions such that an operator with a reasonable amount of experience may direct his mind to guiding the car from station to station, at the same time being able to keep his eye continually on the track—the gasolene engine and machinery for propelling the car must be flexible of control and of itself require very little attention; in other words, it must be analogous to a steam locomotive—able to stand hard service, hard work and abuse, and yet at the same time be sure, be reliable in its performance, and avoid stoppages between stations where same would cause undue complications in the operation of regular train service.

Union Pacific motor cars were originally designed and developed on the basis of controlling the speed of the car by varying the speed of the engine; accelerating the speed by opening the throttle, thus giving the engine more gasolene, this being analagous to opening the throttle on a locomotive; advancing or retarding the spark being analogous to varying, by the reverse lever, the valve motion and the lead of the valve on the locomotive.

Motor car No. 8 was equipped with 200 h.p. gasolene engine, designed and built at the Union Pacific shops, at Omaha. The engine was designed particularly for motor car service, and the hope for a flexible-control engine has been fully realized, the engine being able to start and accelerate car from zero to sixty miles an hour simply by varying the speed of the engine. If car attains speed of fifty miles an hour, and it is desired to run slower, the same can be accomplished by simply closing off the throttle, reducing the consumption of gasolene, and therefore saving fuel. Thus you control the horse-power developed in the engine by means of the gasolene supply, and the cost of fuel, then, must be in proportion to the power demanded from the engine. In my opinion this saving in a gasolene engine is proportionately greater than in a steam locomotive. This flexible control is obtained through the following: (1) Utilization of six cylinders, giving a power impulse to the shaft three times each revolution; (2) by balancing the crankshaft and reciprocating parts (the uniformity of speed is improved); (3) the gasolene vapor pipes from carburetor to cylinders are, by special design, all equally divided, and the distance the vapor travels is the same in each and every case; thus no one cylinder takes its charge of gasolene at the expense of another; (4) the dimensions of the cylinders, the opening and closing of the inlet and exhaust valves and the relative timing of these valves to each other, as well as to piston, have all been of particular importance; (5) (as before mentioned) the valve motion of a six-cylinder gasolene engine is analogous in many ways to the valve motion of a steam locomotive. We know perfectly well that a valve motion suitable for a high-speed passenger train is not economical, nor is it satisfactory for hauling heavy freight trains. The idea in the valve motion of the motor car gasolene engine is to operate the valves so as to produce as nearly as possible uniform horse-power by these cylinders at various speeds.

In moving the car through a series of switches in a busy yard,

with the necessity for letting the brakeman off to run ahead and throw switches, pick him up after passing through same, it is almost imperative that the operator be not bothered or interfered with by the necessity of throwing speed-changing devices, etc. With the Union Pacific variable speed engine the operation is very simple, throwing on or off the friction clutch being the only move necessary to vary the speed of the car. Even though the car reduces to a speed of two or three miles an hour by simply throwing in the clutch, the load will be assumed and taken care of by the engine without any bucking, such as is often experienced with automobiles and other constant-speed engines. The throwing on or off of the clutch is actuated by air, this air being controlled by an operating valve, the lever of which, being small and in the hands of the operator, it is easy for him to keep his head out of the window, watch the brakeman, the movements of the car, and handle the gasolene engine mechanism without any undue complications or without taking his eye off the track.

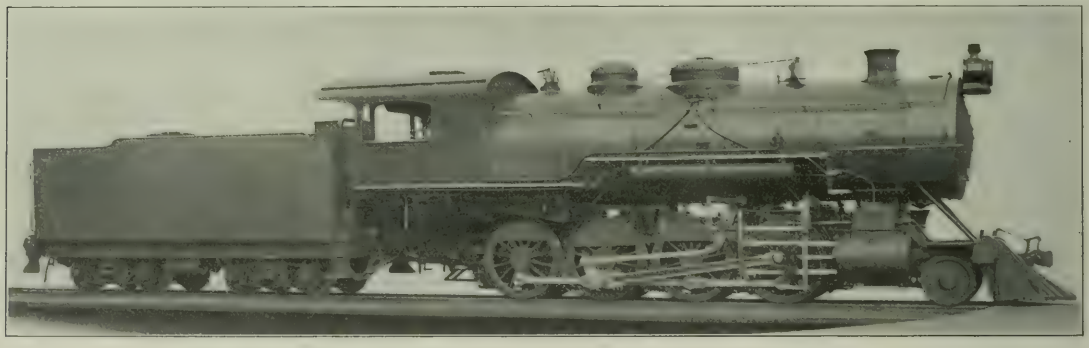
COST PER MILE FOR OPERATION OF MOTOR CARS.

This includes cleaning, running and shop repairs, fuel, lubricating oil, and wages of motorman and conductor. The expense of fuel, repairs, cleaning, etc., runs very uniformly, but with the expense per mile being so largely dependent upon the number of miles run per day, as well as on the wages paid the car crew, comparisons are very unsatisfactory. In actual service cars run, some months, as low as 10 and 11 cents a mile; whereas, cars in other localities will run as high as 16 and 18 cents a mile, and in one case, where a 100 h.p. motor car and trailer has replaced a steam locomotive and train (account of the limited mileage made per day), the cost of operation runs as high as 20 cents a mile. On branch lines the motor car should make not less than 100 miles a day. The service of the gasolene motor car is unquestionably different from that of either electric or steam cars. To man the gasolene car with a steam train crew is exceedingly expensive and inadvisable, and does not produce proper results; to man the gasolene motor car with an electric car crew would be equally as unsatisfactory. A well-paid mechanical man to have entire charge and run the motor car, with an assistant to collect tickets, is the best and most economical arrangement possible.

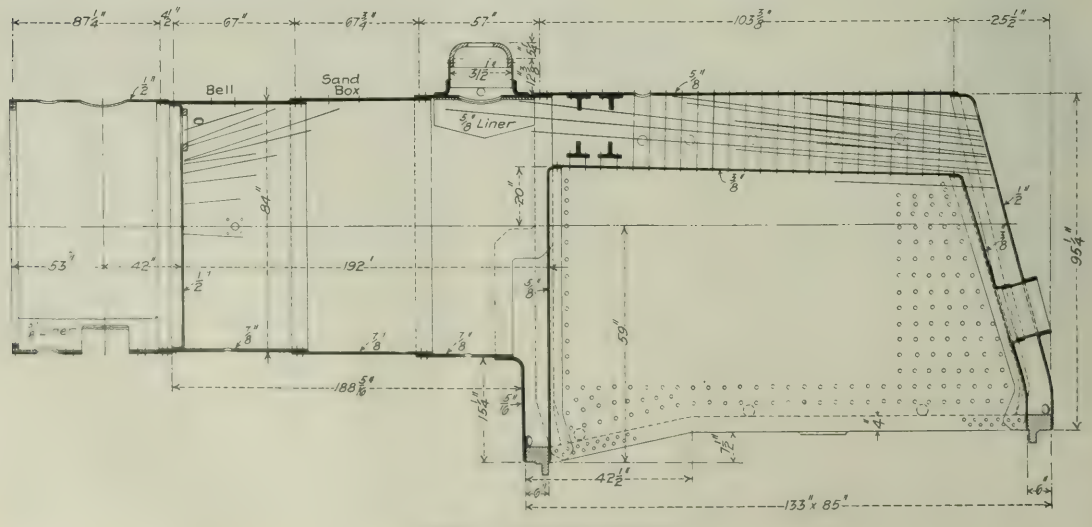
The Baldwin Superheater.

The Baldwin Locomotive Works is exhibiting at the Jamestown Exposition a consolidation locomotive equipped with a smokebox superheater. A distinctive feature of this device is that only the waste gases are utilized for superheating purposes, while the full heating surface of the boiler is retained. Hence no reduction in evaporative efficiency need be expected.

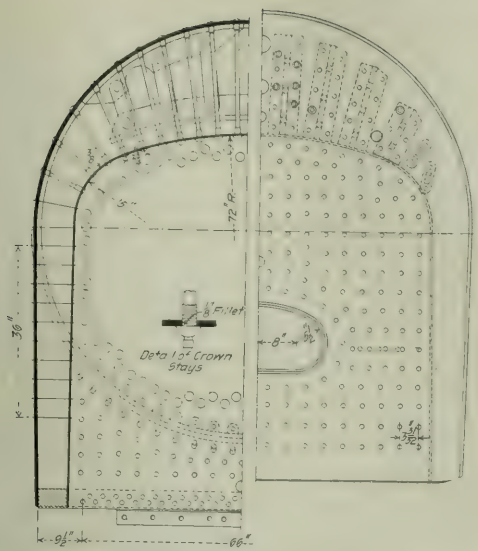
In the smokebox there is the usual tee to which is bolted a header or drum on each side that extends along the upper part of the smokebox to the front. This drum is divided by transverse and longitudinal partitions in such a way that the flow of steam is so controlled that it passes up and down from the upper to the lower drum and back as it moves to the front. This arrangement can be more readily understood by an examination of the plans of the two drums and the half section through the center of the boiler. In these it will be seen that the tubes are divided into five groups marked A, B, C, D and E respectively. The tubes forming these groups are expanded into flat plates that form one side of the drum and which are held in place by bolts as shown, so that removal for repairs is comparatively easy. The tee connection from the dry pipe leads directly into the space above the group A, and passing down through these tubes, crosses at the bottom to group B. It rises through these and then moves longitudinally to the top of group C; goes down C, crosses and rises through D, then moves ahead to E, down through which it passes to the space that appears like a jacket beneath the drum on the section through the stack and is led back to the steam pipe delivering to the cylinder. These



Consolidation Locomotive with Baldwin Superheater, at Jamestown Exposition.



Boiler for Baldwin Superheater.



Cross Section and Rear Elevation of Firebox for Boiler in Baldwin Superheater.

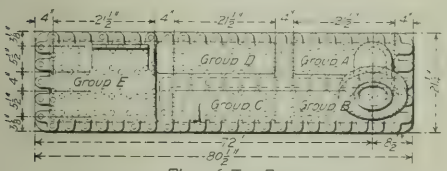


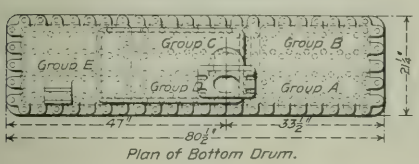
Half-Section of Front End Showing Tube Arrangement of Boiler with Baldwin Superheater.

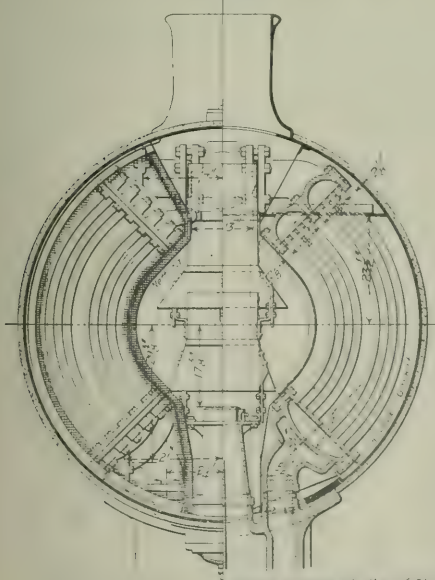
cross passages at the bottom and the longitudinal partition at the top are clearly shown in the section at the center of the stack.

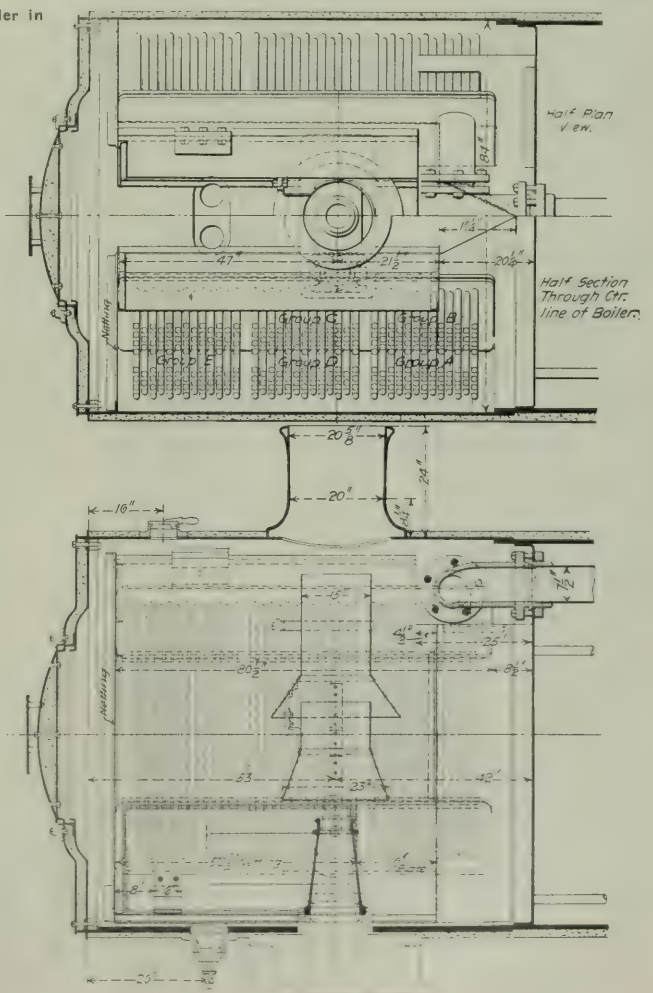
The course of the hot gases can be followed in the same way. As they emerge from the tubes they are separated at the center by a V-shaped partition by which they are diverted and made to pass forward on either side of the exhaust and petticoat pipes and through the nests of tubes to the front. Here they turn back and reach the stack opening by the middle passage that is clearly shown on the plan and vertical cross sections.

With this arrangement no part of the superheating apparatus is subjected to a higher temperature than that naturally belonging to smokebox gases that have passed through the tubes in the regular way, so that no provision is needed for checking or diverting the draft from the superheater tubes when the engine is shut off and no steam is passing through them. In the case of the boiler for this locomotive the shell has an outside diameter of 84 in. at the smallest ring and contains 474 tubes 2 in. in diameter and 16 ft. long. The firebox has inside dimensions of 121 x 73 in., so that there is a large









The Baldwin Superheater.

grate, but not one upon which an excessive amount of fuel could be burned, consequently the smokebox temperatures will probably be no higher than those ordinarily obtaining in regular practice.

These temperatures are, however, here preserved as far as practicable for superheating purposes by jacketing not only the shell but the front of the smokebox.

In the most recent development of this form of superheater, steam is passed first through the forward group of tubes, so that it circulates through the hottest part of the device immediately before reaching the cylinders.

The application has not yet been made for a sufficient length of time to make it possible to draw definite conclusions from the results that have been obtained; a matter that will be taken up later.

Changing the Gage on the Louisville & Nashville.

BY REUBEN WELLS.

(The complications and delays to traffic which were occasioned by the diversity of railroad gages in use in this country 20 years ago, and the long battle which the *Railroad Gazette* fought for the adoption of the standard 4 ft. 8½ in. gage, are well known to the older readers of the paper. For the interest of the younger railroad force, and for the historical record thus presented, we asked Mr. Wells to describe the changing of gage on the Louisville & Nashville from 5-ft. gage to standard, which was done in 1886. Mr. Wells was second assistant to the president at that time, and to him was assigned the duty of preparing plans and issuing instructions for carrying out the work.—EDITOR.)

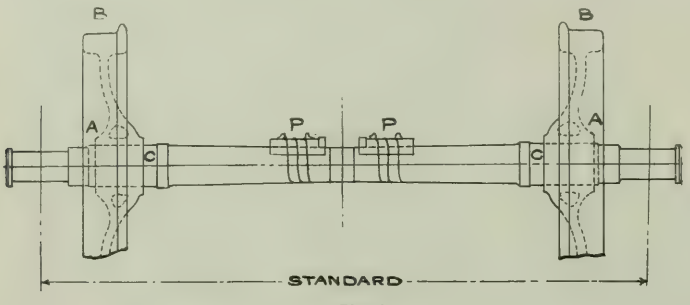


Fig 1.

On taking charge of the mechanical department of the Louisville & Nashville lines in 1878, it was decided that in adopting standards for new rolling stock that should afterward be put on the line, provision should be made for a change of gage, then foreseen as likely to occur some time in the future, consequently all new equipment, renewals of old, such as axles, boxes and trucks, was made the same as the M. C. B. standards, used on standard gage roads. To do this, however, all car and tender wheels were made with 1 in. more "dish" on "the outside" (at A, Fig. 1) than usual for standard gage wheels, to give sufficient room for the standard oil box when the tread of the wheel (at "B") was 5 ft. gage. All new car and tender axles were made M. C. B. standard, and turned to the diameter of the wheel fit, inward at "C" 1¾ in. farther than necessary for the wheel when at 5 ft. gage, so that in changing to standard the wheel had only to be pressed inward on "C" that distance.

In the case of new locomotives, their driving wheel centers and those for renewals were made with a wider face than the standard width of tires, the extra width being on the inside, as at "D," Fig. 2.

To change such engines to standard gage, it was only necessary to raise the wheels off the rail 3 or 4 in., heat the tires by enclosing them in a sheet iron, circular shaped box, about as shown in section at "E," Fig. 2, using wood for fuel, or oil, in a hoop shaped pipe, about as shown at "F" (both plans were used), the same as commonly used now for removing tires, without taking the wheels from under the engine.

For wood fuel an opening at the top of the box "E" produced the required draft. In using an oil pipe "F," small holes on its inner side "sprayed" the oil on to the face of the tire.

When expanded so as to become loose on the center, the tire was then driven inward to "K" against the four gage clamps at "G," previously set and bolted to the wheel, which made the gage right and tire true on the center. In the case of engines with wheel centers of the usual width, and at 5 ft. gage, tires of an extra width, as at "H," Fig. 3, at change of gage, previously provided, bored to suit the wheel centers, were on hand ready to be applied.

In such cases after removing the old tire, the new wide tires was put on, as shown at "I," the inner face at standard gage projecting over the wheel center at "L" about 1½ in. Tires of that section, put on previous to the change of gage (as many had been in making renewals), were placed on the centers as at "J-J." In changing gage they were then simply moved in to "I" (standard), remaining so until worn out. Such tires put on at 5 ft. gage gave no trouble whatever in service either before changing or after.

The width of the main frames of the engines over all was small enough to admit of the tires being set in to standard gage, as at "I," and the connecting rods were far enough out to allow of the tires being at 5 ft. gage (as at "J-J") without interference, consequently, no change of engine frames, wheel centers, axles, crank pins, etc., was necessary. Brake hangers, heads and beams, of course, required changing to suit the gage.

At change of gage, new standard gage engine truck wheels and axles were in most cases previously provided for each engine, and on hand for replacing the originals. Some truck wheels, however, had a separate collar between their hub and the box. In changing gage these collars were removed by splitting, and the wheels then pressed in on the axle to standard gage. No change in the width of the truck frames or truck boxes was necessary. Each individual locomotive was previously carefully examined, and all the supplies needed for changing it were on hand at the time, ready to be applied.

The above explains mainly the preparatory work that had been done from time to time in arranging the rolling stock, so that its change of gage could be made within as short a time and at as small expense as practicable, when the time should arrive for changing.

Four months previous to changing gage notice was given that the change of the whole line would be made on Sunday, May 30, 1886, and that everything must be ready in men and material to accomplish the work during the 24 hours of that day. Printed instructions were issued to every division, branch and section of the line, how the work was to be carried on. One rail only was to be changed.

There was 1,574.6 miles of main line, single track, and 187.3 miles of side track on the 11 divisions, and 328.1 miles of branch line track and sidings, a total of 2,090 miles of track to be changed. The 11 short branches (328.1 miles) were changed the day before the main line, leaving, 1,761.9 miles to be changed May 30.

During the three months previous the face of the ties for 6 in. inside of the rail to be moved had been "adzed" off level by the regular gang of section men as they found time to do it, and spikes were driven partly down, as at "M," Fig. 4, 3½ in. from the flange of the rail, a suitable gage being used between rail and spike, at "N" in driving, to insure correctness in the alinement, so that in changing, after drawing the old spikes on the inside, and moving the rail to the spikes at "M," then driving new spikes on the outside, previously distributed at "O" for the purpose, and driving home the spikes at "M," the rail would then be secure and the track standard gage.

Switch tie-rods of lengths to make the rails standard gage, and also standard gage crossing frogs, were previously distributed to all places where required for changing.

The "sections" of track in charge of one gang of six or seven

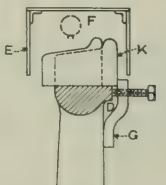


Fig. 2.

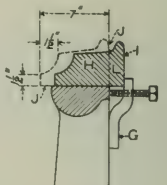


Fig. 3.

repair men averaged about four miles. Previous to changing each section was furnished with all the tools and appliances necessary for two gangs of men changing track, and the additional number of men to give four men to the mile were arranged for, to assemble at 4 o'clock a.m. on the day of change at the middle of the section, with a day's provisions with them. The regular section gang was then divided in two, and the full quota of men required for each was made up from the additional men employed for the day. The instructions were that the two gangs should start changing at the middle of the section at the hour mentioned, and work from each other, and continue until they met the gang working towards them from the adjoining section regardless of section terminals, so as to avoid a gap of unchanged track that otherwise might be left for a time. When the gangs changing met, each was then to go back over the track they had changed to the point of beginning,

correcting anything that might at first have been overlooked.

For changing the 1,761.9 miles of main line, over 7,000 men were required for the day. In the operation changing the rail, three men passed along drawing the inside spikes, two followed with lining bars moving the rail inward against the spikes previously driven at "M," Fig. 4; these were followed by the three or four men driving the spikes, as explained.

For storing and changing the rolling stock 13 different shops and points at terminals were selected. Extra wheel presses were located there where necessary. Some were stationed on platform cars with a portable engine and boiler. These were taken to convenient points in yards where cars were to be stored, the trucks removed and body placed on the ground for convenience in getting the wheels to and from the press.

Careful estimates were previously made as to the number of cars and locomotives that would be assembled at each place for changing at the hour when the lines and branches would be cleared of rolling stock. A sufficient amount of trackage in the yards at each place was selected for holding the rolling stock that would be assembled there (in all 45 miles was required). During the previous day one rail of these storage tracks was moved inward to 4 ft. 11 in. gage. In storing the rolling stock it was run in on these compromise tracks.

After changing the wheels to standard and putting them under again, the cars (or engines) could be hauled off from these tracks without the wheels dropping between the rails. This arrangement made it unnecessary to lay more than a total of two and a half miles of track in changing gage. In removing the wheels from cars "hooks" or short jacks were used between the ground and the truck bolster for raising the car body and truck together 3 or 4 in. so as to take the weight from the journals and boxes and allow the box bolts to be removed, wheels run back, as at "R," Fig. 5, swing around, then run out and rolled to the press to be changed. In most cases wheels that had been changed were put in their place at once. As all axles, boxes and bearings were interchangeable, wheels when changed were put under cars indiscriminately that happened to be most convenient.

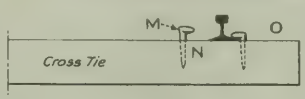


Fig. 4.

The journal bearings, however, were wired to the middle of the axle, as shown at "P-P," Fig. 1, and followed it, so as to be put back on their respective journals again, regardless of the truck the wheels were afterward put under. This served to avoid trouble from hot journals after going in service again.

For changing the passenger equipment in daily service on the line, new wheels and axles, previously provided, were at the terminals where the change was to be made. These cars were run in on tracks of 4 ft. 11 in. gage, jacked up and had their wheels replaced by those of standard gage during the day of change, and were ready to go in service again that evening. The wheels removed were pressed to standard gage and used under freight or other cars the same day.

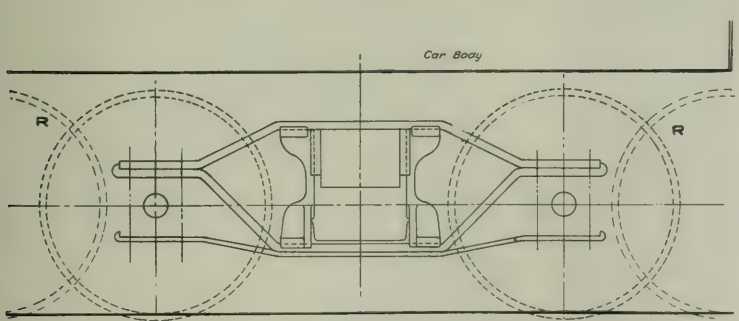


Fig. 5.

At both Louisville and Henderson, Ky., where the standard gage roads north connected, power car hoists for raising car bodies for exchanging their trucks for others of the gage of the road over which the car was to go from there, carrying certain classes of freight, and for through sleepers, mail and express cars had been used for years. These hoists at the change of gage were a help. At the proper time, orders were issued on all divisions and branches that all cars and locomotives must be assembled at the terminals specified, before midnight of May 29, 1886. This order was carried out to the letter, and not a car or locomotive was left away from the storage point designated. Passenger trains were run on schedule time as near as practicable up to midnight, and then laid up for change at the terminals specified, had their gage changed next day (May 30), and were ready to resume their run in less than 24 hours after the time they were laid up.

It was arranged to have an engine with track inspectors start from each terminal of a division as soon as the track there was changed to make a careful inspection of the track and report by wire to headquarters at what time trains could resume their runs again. This was done in every case. The different branches mentioned a total of 328.1 miles were changed May 29th, and all complete by 6 o'clock p.m. of that day (in 14 hours). This was done in order to get the services of the men the next day for changing the main line. Of the 1,761.9 miles of main line and side tracks, eight of the divisions (1,072.3 miles) were finished changing in 15 hours and 30 minutes from the time of beginning. Of the other four divisions, one of 275 miles was 28 hours in changing, delayed five hours by a violent rain storm. One division of 87.6 miles was 29 hours in changing, not having a full quota of men, and having to change the tracks in two terminal yards. One division of 163.3 miles was changed just within the 24 hours allowed, and another division of 163.6 miles (in Florida) was a few hours over the 24, on account of the lack of a sufficient number of men. All divisions and branches, however, were changed in time for all trains of any importance to resume their schedules on the night of the day of change (30th) and morning of the 31st. No accidents occurred, nothing off the track, and everything went on as scheduled.

ROLLING STOCK.

There were 278 locomotives and 8,665 cars to be changed at the 11 different terminals. Previous to the day of change of track (May 30th) about 24 per cent. of the locomotives, 30 per cent. of the freight cars, and 17 per cent. of the passenger equipment had been changed, mostly those in shops for general repairs, and others that could be spared from service. Up to May 31, 3,437 freight cars had been changed, and by June 12 7,166, and by the 19th all were changed to standard gage. The day before the track was changed 38 cars of the passenger equipment were changed, on the 30th 92 were changed, on June 1 30, and by June 19 the entire car equipment was changed, just 30 days from beginning to change.

The change of gage of the 278 locomotives was made as follows: Number of shop engines and others that could be spared, changed up to May 30, was 122; changed on 30th, 93; changed from 30th to June 8, 31. The remainder (32) were put in the shops for change and repairs, and all were changed by June 30. Both the locomotive and car equipment was all changed within 30 days from the time of beginning the work of changing them.

Twenty-eight new standard gage locomotives, previously received and tested, were put on the line the day after the track was changed.

Cost of Changing Gage.

Changing 2,090 miles of track	$107,355.84
" 278 locomotives	57,281.90
" 8,665 cars	50,319.60
Total	$214,957.34
Average cost, per mile of track	$51.36
Average cost per locomotive	206.05
Average cost per car	5.80

"Change of gage" was charged with just what properly belonged to it. For instance, if at changing a locomotive its tires were found to be worn out, the cost of the new tires applied was charged to repairs, as in that case the engine required new tires whether the gage was changed or not, so in the case of worn out car wheels and axles. Where wheels were cracked in pressing to gage the cost of replacing them was charged to change of gage. Also, the cost of the extra tools supplied for changing the track and rolling stock was charged to change of gage. The change of the rolling stock was made entirely by the force of men regularly employed in the shops and yards at terminals, except on the day of change extra labor for car on wheel press work was employed for that day. The comparatively low cost of changing the rolling stock was due to the preparation made for it during the previous years, as mentioned. There was practically no interference with the regular every day traffic of the line, as it was closed to trains for only 24 hours, and that, too, on a Sunday. By Monday morning all trains had resumed their schedule time again. Between Saturday afternoon and Monday morning the 2,090 miles of 5 ft. gage track had been changed to standard gage, and traffic moving as usual, but on a new gage, and as quietly and safely as on the original. By good management and doubling some of the engine service for about two days no lack of cars or of motive power was experienced, either before or after the day of change.

M. Noblemaire, since 1881 General Manager of the Paris, Lyons & Mediterranean Railroad, the greatest of the French systems, and

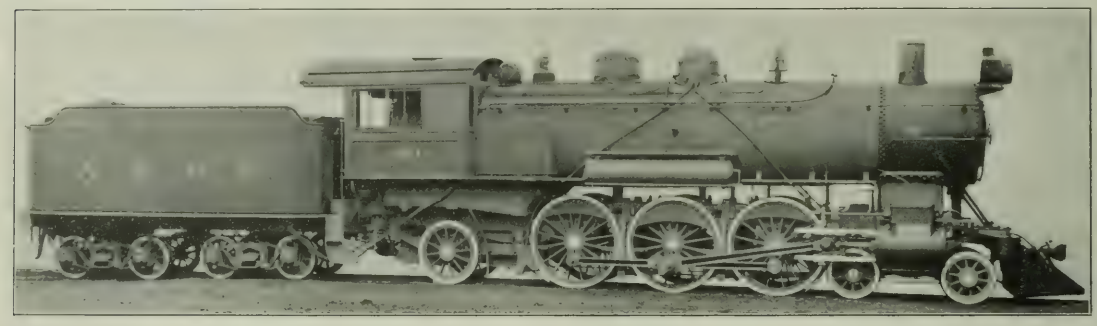
for 38 years in the service of that company, retired April 1, and was succeeded by M. Mawris, heretofore Assistant Manager and Chief Engineer. M. Noblemaire was decorated with the grand cross of the Legion of Honor on his retirement.

Pacific Locomotive for the Atlanta & West Point.

The American Locomotive Co. has recently built two Pacific (4-6-2) locomotives for the Atlanta & West Point at the Rogers Works. While possessing no unusual features of construction, they are excellent examples of a modern heavy passenger engine. In working order they have a total weight of 212,000 lbs., of which 130,000 lbs., or 61.3 per cent., is carried on the driving wheels.

The cylinders are 22 in. diameter by 28 in. stroke, and are equipped with slide valves actuated by the Stephenson link motion. With 72-in. driving-wheels and a boiler pressure of 200 lbs., these engines will develop a maximum tractive power of 32,000 lbs.

The boiler is the straight top design and is made in three courses, the outside diameter of the first and smallest course being



Pacific Locomotive Built for the Atlanta & West Point by the American Locomotive Company.

72½ in. It is fitted with 278 tubes of 2¼ in. diameter and 20 ft. long, and has a total heating surface of 3,532 sq. ft. This gives a ratio of heating surface to the total volume of the cylinders of 287, a figure which would indicate a large boiler capacity for sustained high speed.

The firebox has a width of 73¼ in. and is 107½ in. long at the mud-ring, and has a grate area of 55 sq. ft., or 1 sq. ft. of grate area for every 64.2 sq. ft. of heating surface. With this proportion between grate area and heating surface there should be no difficulty, with an average grade of bituminous coal, in generating plenty of steam without forcing the fire to an uneconomical rate of combustion.

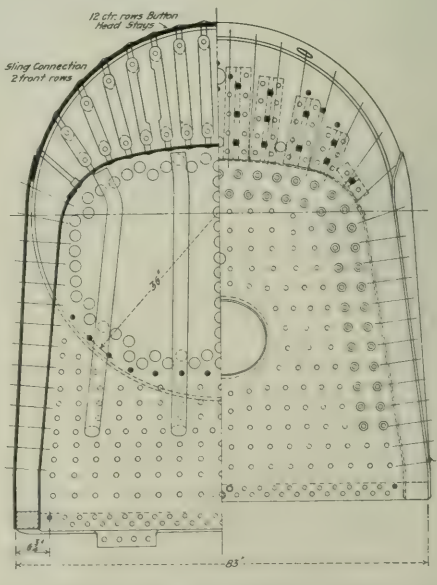
There are one or two features, also, in connection with the boiler to which attention should be called. One, which will be at once noticed in the reproduction of the photograph, is the location of the injector check on top of the front course of the shell and about 30 in. back of the forward tubesheet. This is simply another variation in the position of the injector check that will be a novelty to some and which merely emphasizes the fact that there is no uniformity in practice regarding the placing of this important article on American locomotives. We find it set all the way from the back head to close to the front tubesheet. It is emphatically claimed that the location of the injector check has a very important bearing on the liability to tube leakage and quite convincing figures have been published in proof of the claim and yet there is no sort of agreement among the doctors. Years ago there was no question on the subject. In the days of the pump the boiler check was invariably set near the front end of the shell, but since the quantity of water to be evaporated has increased to its present volume the location of the check is being discussed, but usually from a purely academic standpoint. It certainly seems that there should be some best place, and if it is on the back head or the top of the shell there should be some means of proving it, and the gathering of this proof would probably be well worth while.

The general construction of the boiler is shown by the engravings of the firebox sections. The horizontal and circumferential seams have the usual sextuple and double rivetting, and at the dome the shell is stiffened by a liner 75½ in. long, 66 in. wide and ⅝ in. thick. This one feature emphasizes very strongly the difference between the old and the new. In the seventies when 125 lbs. per sq. in. was a maximum steam pressure, and the shell was ⅜ in. thick, the dome alone was quite sufficient to stiffen the opening that was made and little or no trouble, beyond an occasional leak, was experienced. In this boiler, however, with a shell thickness of ¾ in., where a pressure of 200 lbs. is carried, not only is the opening stiffened by a heavy dome base 1⅛ in. thick, but the liner above referred to is also considered essential. The high boiler and low dome also necessitates a special safety valve dome which is a hollow pear-shaped steel casting.

The firebox is fitted with a brick arch carried on circulating pipes, and the tubesheet is sloped forward to form a combustion chamber, although, of course, every boiler fitted with a brick arch has a combustion chamber in the space above it. Tate flexible staybolts are used along the front and top of the side sheets with plain bolts for the balance of the area. These are clearly indicated by the marking on the engraving. Attention is called to these matters as they are all indicative of current practice.

Finally the boiler emphasizes modern tendencies in the length of the tubes, which is 20 ft. This is not a novelty but is still enough of a rarity to attract attention when it is used. If Mr. Vaughan's formula for equivalent heating surface holds, the use of a 20 ft. tube as compared with one of 16 ft. gives an increase of but about 12 per cent. in equivalent heating surface in return for the 25 per cent. increase in the length of the tube. But 12 per cent. is a great gain in steaming capacity for a locomotive called upon for heavy passenger service, and this is but another item in the construction, already alluded to, that should make the steam supply on this engine ample without forcing, which further appears in the high equated firebox heating surface given in the schedule of dimensions.

Other minor details consist in the means of fastening the reverse lever bracket beneath the foundation ring, and the use of the electric headlight. At the rear, the tender is fitted with a Pullman vestibule, though it does not show in the photograph. This use of the vestibule on the tender, though old now was once new,



Half Rear Elevation and Section of Firebox of Boiler for Pacific Locomotive; Atlanta & West Point.

and before it reached a tentative realization was regarded as beyond the dreams of a possibility by even progressive railroad men. To illustrate this; when the vestibule was first applied to passenger cars, the late J. N. Lauder, Superintendent of Motive Power of the Old Colony Railroad, was an enthusiastic advocate of it on the grounds of safety. Speaking of it at one time, he said: "Its one of the greatest advances that has been made in passenger car construction in 25 years, and if I could have my way I'd put it on everything; yes sir, I'd put it on the rear of every passenger tender on the road." And now it is taken as a matter of common practice.

The main frames of the engine are 4½ in. wide while the section under the firebox, which is of cast-steel and spliced to the main frame, is 2 in. wide. Although the Stephenson valve gear is used, it has been found to be possible to brace the main frame with crossties at four points beneath the shell to which as many buckle plates for the support of the boiler are attached. The trailing truck is of the radial type with inside bearings.

The following are some of the principal dimensions of these engines:

Cylinder, diameter	22 in.
Piston stroke	28 "
Wheels, diameter, driving	72 "
" " trailing	50 "
" " front truck	36 "
Wheel base, driving	12 ft. 8 "
" " engine	32 " 5½ "
" " engine and tender	60 " 0 "
Boiler, type	Straight top
" diameter	72½ in.
" thickness shell sheets	¾ "
Firebox, length at top	127½ "
" length at bottom	107½ "
" width at mud ring	73¼ "
" thickness side and back sheets	⅜ "
" " crown sheet	½ "
" " tube sheet	⅝ "
" water spaces	4½ "
Tubes, number	278
" diameter	2¼ in.
" length	20 ft.
Heating surface, tubes	3,261 sq. ft.
" firebox	238 "
" arch tubes	33 "
" total	3,532 "
Grate area	55 "
Steam pressure	200 lbs.
Weight on front truck	46,000 "
" " drivers	130,000 "
" " trailing wheels	36,000 "
" total engine	212,000 "
" tender	133,000 "
Journals, driving	9½ in. x 12 in.
" truck	6 " x 12 "
" trailing	8 " x 14 "
" tender	5½ " x 10 "
Valves, type	Slide
" admission	Outside
" travel	6 in.
" steam lap	1 "
" lead in full gear	⅛ "
Tank capacity, water	7,000 gals
Tank capacity, coal	12 tons
Tractive power	32,000 lbs.

$$\frac{\text{Weight on drivers}}{\text{Tractive power}} = 4.06$$

$$\frac{\text{Total weight}}{\text{Tractive power}} = 6.63$$

$$\frac{\text{Weight on drivers}}{\text{Total weight}} = 61.3$$

$$\frac{\text{Tractive power} \times \text{diameter drivers}}{\text{Heating surface}} = 652.32$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 64.2$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 6.75$$

$$\frac{\text{Weight on drivers}}{\text{Total heating surface}} = 36.9$$

$$\frac{\text{Total weight}}{\text{Total heating surface}} = 60$$

Volume of cylinders.....12.32 cu. ft.

$$\frac{\text{Total heating surface}}{\text{Volume of cylinders}} = 287$$

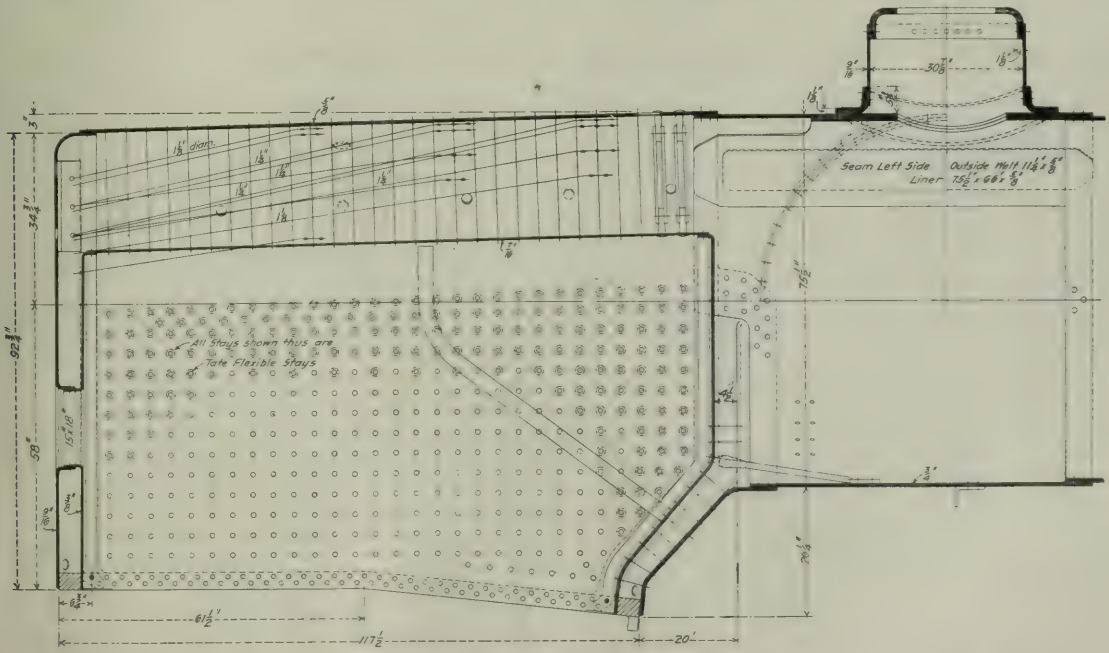
$$\frac{\text{Grate area}}{\text{Volume of cylinders}} = 4.46$$

Tube heating surface equated to firebox heating surface (Vaughan's formula) ..... 720.8 sq. ft.
Total equated firebox heating surface ..... 1,000.8 "

While these engines have been in service but a short time, the officials of the road report that their performance up to date has been entirely satisfactory and that they have exceptionally good riding qualities.

Thirteen Centuries of Service.

A dinner was given to the operating officers of the Chicago & North-Western by Vice-President Gardner several weeks ago at which there were some 56 men present from the President down to the chief train despatchers. There was represented in the party 1,300 years of service in the aggregate. The Chicago & North-Western does not think any other railroad, at least in the West, could make as good a showing.

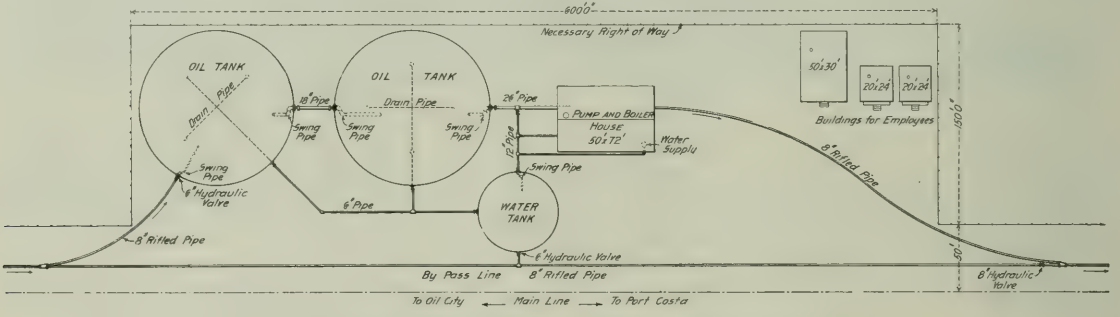


Longitudinal Section of Firebox and Boiler for Pacific Locomotive for the Atlanta & West Point.

Proposed Long Rifled Pipe Line for California Oil.

The rifled pipe process for pumping California crude oil adopted by the Southern Pacific was described and illustrated in the *Railroad Gazette* of June 8, 1906. The oil from some of the California fields is a very heavy, thick and viscous fluid with an asphalt base. This is particularly true of the product of the Kern river fields, near Bakersfield, with which ordinary pipe-line methods are of no avail. As a result of systematic experimental study of the problem the process above referred to was finally worked out. This process, in brief, is the lubrication of the oil core within the pipe by a film of water enveloping it. A small percentage of water is injected with the oil and the effect of the rifling is to throw the water to the outside, forming the film mentioned and greatly reducing the friction. The practical details included the rifling of the pipe and involved the designing of a machine to accomplish same, the operation being done cold. A line was then built for commercial transportation of the oil. It lies between Volcan, which is on the Southern Pacific and is a central point in the oil fields, and Delano, 31 miles north on this same road. This line has proved so successful that it has been decided to extend it to San Francisco bay. The contract for the station equipment for this extension has just been let to the George E. Dow Pumping Engine Company, of San Francisco.

The new line will be 256 miles long, extending from Delano to Porta Costa, on the straits of Karquinez. These straits connect San Pablo bay, which is the upper part of San Francisco bay, with Suisun bay. It will be an 8-in. line, the same as the present one, and the pipe will be made by the National Tube Company. It will, however, be rifled hot, instead of cold after delivery as heretofore. There are to be 23 complete pumping stations on the line. A ground plan of the station layout, all 23 of which will be alike, is shown herewith. The principal station equipment comprises the boiler plant, oil pumps and water injection pumps. The accessories include electric lighting equipment and the usual feed pumps, feed-water heaters, piping, etc. The stations will contain a number of improvements, especially in the oil pumps, suggested by the experience with the existing line.



Layout for Pumping Plant; Southern Pacific Company's Rifled Pipe Line.

One of the peculiarities of the oil pumps in this process is that they require a much larger valve area in proportion to the size of the plunger than is usual with fluid pumps, to prevent cavitation in the plunger barrel; therefore the pumps contracted for are to have a valve inlet and outlet area each equal to the area of the plunger. The valves also must have a very limited lift, the maximum specified to attain the given area being ¼ in. If the lift is large the inlet valves will not close through the heavy viscid oil promptly enough and much of the oil is forced back into the suction instead of into the discharge. The water injection pumps are nearly in accordance with standard hydraulic practice; however, they are made quite large in proportion to their required capacity of discharge, as it has been found of great advantage in this system of pumping to insure a very steady and uniform flow without surging or irregular motion in the pipe line. All of the apparatus is to be in duplicate, and each part of each piece of apparatus is to be interchangeable with the like part in every one of the 23 stations. All like parts are to be made to templet and gage for all stations. Another special feature of the station arrangement is that the oil and water pumps are to be installed in duplicate instead of triplicate. The purpose is to run all the pumps all the time, at less than the maximum capacity of each but at maximum efficiency. They will be so connected, however, that in case a pump is stopped from breakage or any other cause, its duplicate immediately and automatically assumes the entire load at quickened speed, and therefore at some cost in efficiency. The station buildings are to be made some longer than originally planned, as the oil pumps are to be given a greater number of valve pots than at first provided in the plans, increasing their length and therefore that of the enclosing building. The boiler plant for each station will be of 750 h.p. capacity in three equal units, the equipment to be of the Edgemoor water-tube type.

The daily capacity of the system is estimated at 23,000 barrels for 24 hours. There is storage capacity at each station for a maximum of five days' supply of oil. In the event of a break in the pipe the line can continue in use on each side of the break for about two days and a half; that is, from the initial point to the station preceding the break, and from the station beyond the break to the terminus, and the tanks will be kept about half full all the time while running. These tanks are steel, two at each station, with a capacity of 55,000 barrels each. There is also a water tank holding 10,000 barrels.

The oil entering a station through the rifled pipe passes into the first of these storage tanks and the line water almost entirely settles from the oil. It is then drawn, through a swing pipe, into the second tank where practically all of the remaining water separates from it. The pump suctions are connected to this tank, drawing the oil through a swing pipe. The discharge swing pipes in these tanks are automatically maintained so that the pipe always delivers at the level marking the division of oil and water, facilitating separation. The water from each of the oil tanks is bled into the water tank from which the water injection pumps draw their supply.

The contract requires that for every other station, one oil pump, one injection pump and two boilers shall be ready in nine months; and that the remaining stations be this far advanced in 14 months. The entire installation is to be complete in 18 months. As soon as the first condition above noted is fulfilled, the line will be put into operation, running at reduced capacity, of course. The present contract is for all apparatus within the station buildings, except the foundations up to the ground level, which are to be provided by the company. The amount of the contract is $1,448,785. The total cost of the line will be between $4,000,000 and $5,000,000. We are indebted to John D. Isaacs, Consulting Engineer of the Southern Pacific, for the foregoing information.

Rail Corrugation on English Electric Lines.

The Institution of Electrical Engineers (London, Eng.,) devoted its sitting on March 21st to a consideration of the rail corrugation question which is one of the most puzzling problems with which the traction engineer has been called upon to deal. Some efforts have been made to ascertain the extent of corrugations on English street railway systems, and the views of the managers of these lines as to the probable cause, according to the evidence at their disposal. But the great diversity of opinion expressed by these authorities points to one or both of two things, i.e., that insufficient experience has been obtained to enable many to arrive at a right conclusion, and that a very careful and precise tabulation and analysis of available information is very necessary.

The matter was introduced at the above meeting by Joseph A. Panton, an electrical engineer who has had some years practical experience on the Liverpool Overhead Electric Railroad.

The present practice of grinding rails (and money) away was described as only a partial remedy which did not enable us to make headway toward finding the actual cause of the trouble. Recent experiments with rail-grinders had turned out more or less unsuccessful. After grinding, corrugations soon reappear, thus indicating that it is to the equipment directly or indirectly in contact with the rails that we must look, and not to the rails themselves, for the cause.

It was stated that enough evidence had been accumulated to

contradict any theory that the quality of the rail accounted for the presence of corrugations. Some reasons stated were:

(1.) Because rails manufactured by every firm in the world have corrugated since the advent of electric traction.

(2.) That the rails did not corrugate in the days of horse and steam cars.

(3.) That the check rails are corrugated to an equal degree, and parallel to that on the crown of the rail.

(4.) That rails did not corrugate so long as the armatures were built on the axle.

(5.) That it takes on the average three years to develop corrugations on a new system, and only three weeks on relaying with new rails thereafter.

(6.) That an ordinary railroad rail taken from the straight road of an electrically-operated railroad (no corrugations occur) and relaid on a checked curve soon corrugates.

Mr. Panton said that there was absolutely no foundation for the statement that the trouble was due to the chattering of the rollers at the rolling mills, owing to play in the pinions and bearings of the rolls driven by antiquated steam engines.

He referred next to the probability of defects in rolling stock being the cause, his attention having been drawn to this point three years ago by the action of a flanged brake block then being tried to keep down wheel flanges. This and subsequent investigation and experience led him to the conviction that corrugations are caused, directly or indirectly, by lateral play in weak trucks, the weakness being intensified by unsymmetrically driven axles. On the Liverpool Overhead line during the first nine or ten years of its existence, when the armatures were built on the axle, whereby a symmetrical drive was obtained, there was no sign of any corrugations. But, on introducing single ended geared axles into the same bogies, a series of difficulties cropped up when running over the same rails, necessitating the renewal of rails on checked curves —a serious additional expense. Mr. Panton says that at least 75 per cent. of present day electric railroad and tramway equipments in England are unsuitably mounted on trucks of weak design.

The roaring rails, found principally on Indian steam railroads, were said to have their trouble originated in much the same way as corrugations, namely, from defects in the rolling stock such as excessive play at the journals or longitudinal play between the journal box and pedestal, which would in time, by constant hammering, cause the sides of the truck frame to spread outwardly, at the same time distorting other parts of the frame connected therewith. Such faulty truck design, said Mr. Panton, allows the centrifugal forces to center at various points in the truck, thereby shifting the center of gravity horizontally, and causing unequal strains on the wheel flanges and unequal tires on the same axle.

In regard to truck design it was said to be necessary to give up the riveted and built-up construction of bogie frames, which were not capable of withstanding the excessive strains of single-ended gear-driven axles on modern high-speed electric railroads. It was entirely due to the weakness in bracing the two sides together, especially under the axle box, that trucks now in use were unable to withstand the severe side strain to which they were subjected. It would therefore be necessary to supplement the present trucks with suitable underframes well-braced on either side of the wheels in order to prevent the spreading and buckling of frames which was occurring, amounting in serious cases to 1½ in. For modern electric interurban services on railroads and tramroads, the motor truck must be more substantially designed in view of the different service as compared to that required from early tramroads. Solid forged side frames equally as strong under the axle box as over it, securely braced together, and capable of withstanding side strains and shocks in every direction by the use of journal springs to bring the load to the wheels without interfering with the easy action of the boxes in the jaws, and, if possible, by equalizing the weight on the frame before it was equalized on the wheels—these were among the essential points.

Mr. Panton mentioned that his observations, however erroneous they might seem, and however crude his remedies, they were the direct result of practical experience gained since the year in which accelerated electric railway traction made a substantial start.

He suggested that the entire corrugation question should be finally settled and tested by a full technical investigation carried out either by the Board of Trade or by a Royal Commission.

In the discussion that followed the reading of the paper there was noticeable the same diversity of opinion that has already been mentioned.

Compression in Locomotive Cylinders and Means for Its Relief.

BY H. G. MANNING,
Assistant Chief Engineer, Crucible Steel Co. of America.

The object of this paper is to call attention to compression in locomotive engine cylinders as demonstrated by the St. Louis tests made by the Pennsylvania Railroad which stand as the most modern, complete and elaborately made tests presented to locomotive engineers. The writer desires to show:

First.—That compression in modern locomotive cylinders is excessive, particularly at the time the engines are exerting the average power.

Second.—That this excessive compression in locomotive cylinders far exceeds the necessary compression, as demonstrated in stationary engine cylinder practice, in which the shocks to machinery are as severe as in locomotives, and in which the point of exhaust closure is constant.

Third.—That relieving the excessive compression in locomotive cylinders will result in economy of fuel or greater hauling capacity.

Fourth.—That a relief valve having a constant point of compression for all points of cut-off of the valve gear will produce the results desired.

Table I with its accompanying indicator cards, all taken from locomotives tested on the Pennsylvania Railroad testing plant at the St. Louis Fair, gives results which are being duplicated in general railroad practice to-day. Comparing locomotive and stationary engine practice in regard to amount of compression necessary for smooth and economical running, Figs. 1, 2 and 3 are average conditions. Fig. 1 shows an indicator card taken from a locomotive making 190 revolutions per minute and cutting off steam at an economical point. The cylinders are 18 in. x 24 in. and the drivers 70 in. in diameter. It is the average card of a series of tests on the road, extending over two weeks, with the same route, same time and practically the same train in express service.

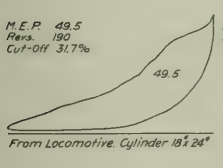


Fig. 1.

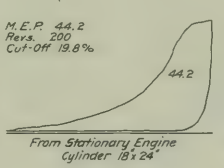


Fig. 2.

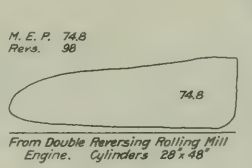


Fig. 3.

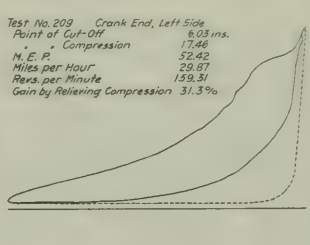


Fig. 4.

For 98.7 per cent. of the time the throttle was open, the average point of cut-off was as shown, and this card shows plainly the excessive compression this engine worked under in every-day service for practically 99 per cent. of the time it was using steam. This card is not an extreme, but represents squarely and fairly the ordinary. running conditions of a passenger locomotive. This engine was using something more than 30 per cent. of the steam actually needed to perform the work, as will be shown later in the article.

Fig. 2 shows a card from a stationary engine having a constant point of compression, running 200 revolutions per minute, having the same stroke, and practically the same diameter of cylinder, with a greater piston speed than the locomotive from which card Fig. 1 was taken, and the amount of compression necessary for smooth running is clearly shown on the card.

Fig. 3 is a card taken from a stationary double reversing engine with cylinders 28 in. x 48 in., having at times a piston speed equal to a locomotive running 70 miles per hour, with a Stephenson link motion and rocker arms, identical with a locomotive valve motion in every respect, reversing on an average five times per minute, or 300 times per hour, 20 hours out of every 24. This work is equivalent to 420,000 miles per year if the engine was running on a rail, with common diameter of drivers, and this particular engine has done this for nine years. During this time the piston heads and rods have not been removed from the cylinders or crossheads, and the running repairs are exceedingly light.

Is compression more necessary on a locomotive than on this

engine with vastly greater shocks to machinery than ever occur in a locomotive outside of a collision?

If the defenders of excessive compression will simply admit what is a fact, namely, that the locomotive valve motion will not permit any reduction, then the matter becomes clear. Excessive compression in a locomotive exists because it cannot be avoided with the present design of valve motions.

The stationary engine cards show proper compression, and the engines run smoothly without detrimental shocks from lack of compression. What is done in stationary engine practice, as shown in Figs. 2 and 3, can be accomplished on a locomotive with the resultant economy in a simple and practical way, by using a compression relief valve of a design shown further on, that it is well to consider in these days of getting all that is possible out of a locomotive.

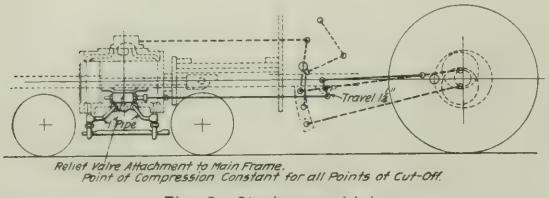


Fig. 5—Stephenson Link.

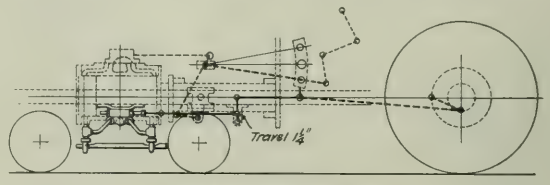


Fig. 6—Walschaert Link.

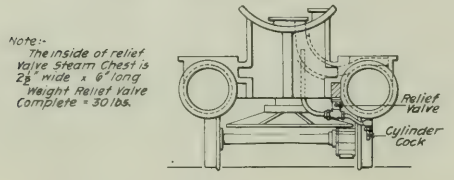


Fig. 7.

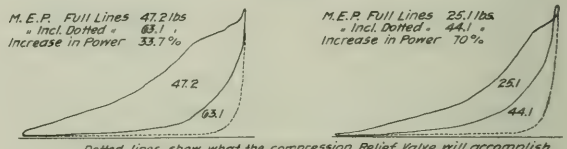


Fig. 8. Fig. 9.

The Manning Compression and Water Relief Valve as Applied to Locomotives.

Fig. 4 shows in full lines a card taken at the St. Louis tests by the Pennsylvania Railroad from a simple locomotive running only 29.83 miles per hour, making 159 revolutions per minute.

The dotted lines show the possibilities if the compression is relieved to the same amount used in stationary engines having greater piston speed. This card shows an increase by relieving compression of 31.3 per cent. in M. E. P. with the same volume of steam taken from the boiler. This means that practically one-third more load can be hauled for the same quantity of steam generated, or the same load can be hauled for a less quantity of steam. As an example, suppose that two-thirds of the above increase in M. E. P. is realized by relieving compression. This means that a freight locomotive hauling, with compression, a load of 2,000 tons, can by relieving compression haul 2,400 tons, or six to eight more cars to the train. The profit on the extra freight hauled one trip would pay for the installations of a compression relief valve.

It will be noticed from the table that at speeds from about seven miles to 30 miles per hour, the average increase in M. E. P. by decreasing compression as shown by the indicator cards, is practically 11 per cent., or about 5 per cent. at the slower and 14 per cent. at the higher speeds. At speeds from about 40 miles to 75 miles per hour the average again is about 41 per cent., or about 17 per cent. at the slower to 60 per cent. at the higher speeds.

In this connection it must be understood that the high speeds were made from compound engines with the correspondingly longer cut-off in the high-pressure cylinder than would be the case on the simple engine doing the same work.

Summing up, the Pennsylvania tests show that on simple freight engines at speeds from seven to 30 miles per hour an average gain of about 11 per cent. can be made in M. E. P. for the same point of cut-off, and on compound engines at speeds from 40 to 75 miles per hour a gain of about 40 per cent. by decreasing compression in the cylinders.

The indicator card in Fig. 1 is an excellent example of the average running condition of simple passenger engines and the gain in M. E. P. by decreasing the compression to what we know is practical for a locomotive of 33.7 per cent. is worthy of notice.

The writer does not wish to be understood as claiming originality in bringing forward the decreasing of compression on locomotives. The intelligent student of the locomotive well knows the many designs of valve motions which have been tried to accomplish this object, but he also knows that any attempt to radically change existing locomotive valve motions has resulted in cumbersome devices which have soon shown their inferiority for continual service, although they admittedly released and compressed steam properly. It would therefore appear that any attempt to radically change the design has resulted in failures which the relief valve described below overcomes.

To relieve compression the writer has designed and put into use on many stationary engines, both high and low speed, a compression relief valve, receiving its motion from the main valve motion of the engine. Fig. 5 shows its adaptation to a locomotive with the Stephenson valve gear, in which the relief valve stem receives its motion from the "go ahead" eccentric rod or its equivalent, and Fig. 6 to a Walschaert gear, in which the relief valve stem receives its motion from the lower end of the link.

Fig. 7 is a cross section of relief valve in position on locomotive. Figs. 8 and 9 are average locomotive cards. Figs. 10 and 11 show the relief valve consisting of a simple slide valve, opening only the exhaust ports, having the same travel and angular advance for all points of cut-off, the ports leading to it from the cylinder entering underneath the valve, and the exhaust cavity connecting with main exhaust pipes of the locomotive.

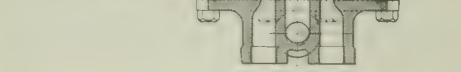


Fig. 10.



Fig. 11.

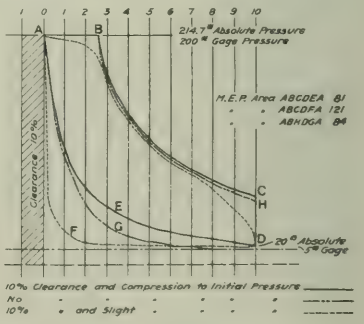


Fig. 12.

The valve also becomes an automatic water relief, as the flat valve rises under any undue pressure, instantly relieving the cylinder and heads. The cylinder cocks can be used as at present, if thought necessary. The valve is in use on stationary engines which have been greatly troubled with water in the cylinder, in spite of separators, and good pipe covering, where it was necessary to keep the cylinder cocks open all the time, but since the relief valve was

applied and the cylinder cocks taken off there has been no trouble, and the saving in steam was shown immediately on the coal sheets.

On a 20 in. x 26 in. cylinder the pipes leading to the relief valve should be not less than 1¼ in. On a cylinder with 10 per cent. clearance the increase in clearance is about one-quarter of 1 per cent. of the cylinder volume, an amount hardly large enough to mention. On a locomotive carrying 200 lbs. pressure and realizing 195 lbs. in the cylinder for an initial pressure the direct pull on the valve stem of the relief valve is about 50 lbs., a stress so slight that it might be disregarded as far as repairs are concerned. The balancing pressure on top of the slide valve is held at practically 40 lbs. per sq. in. when engine is up to speed, by the admission of steam to the small chest through a small hole drilled through exhaust cavity of the relief slide valve.

This balancing steam takes no useful steam as it comes only from the exhaust. The rushing through this hole of the exhaust pressure at each exhaust of engine, and the minute time the steam from the small chest has to escape, keeps the pressure in the small chest practically constant, determined by the size of hole drilled in exhaust cavity. An indicator card from the small steam chest draws a practically perfect straight line, showing beyond a doubt that the pressure can be kept constant.

The valve needs no oil as the steam passing through it keeps the valve surface perfectly lubricated. The valve stem is packed with metallic packing and wears for a long period without leaking. The point of compression can be made to occur at any point of the stroke desirable, but when once set is constant for forward gear for all points of cut-off.

When the locomotive is running backward the relief valve is thrown out of action in the following manner. In the exhaust pipe leading from both cylinders is a very loosely fitted plug cock operated from the tumbling shaft of the locomotive. This plug cock motion is so arranged that the opening remains practically constant from full gear forward to mid gear. From mid gear to full back gear the plug cock is rapidly closed, and while cylinder pressure passes through the relief ports it does not pass to the atmosphere, as the plug cock is closed. Any other arrangement providing for the compression relief valve to act in both forward and back gears makes an undesirable complication of parts, and as a locomotive is built to run forward ordinarily, and only runs backward about 1 per cent. of its lifetime, the saving by the relief valve in forward gear covers the essential working time of the engine. The patent papers cover a relief valve driven by the main valve motion of engine, or its equivalent.

With this simple, inexpensive and practical device it is possible, with passenger locomotives, to pull in the neighborhood of 30 per cent. more load at the same speed, or the same load at the same speed for about 30 per cent. less fuel, and the cylinder will be protected against undue water pressure. A piston valve in place of the slide valve would relieve the compression but would not relieve the water pressure and would be constantly breaking packing rings and valve stems from this water pressure. Large high-speed engines are working with this relief valve at numerous rolling mills in the city of Pittsburg, Pa., district.

Reviewing the indicator cards of the article, the thinking engineer readily sees that in stationary engine practice as demonstrated in cards Fig. 2 and Fig. 3 it is perfectly feasible to run engines at high speeds with a degree of compression comparable with economy and without shocks of any detrimental nature to the engine machinery.

What is accomplished in stationary engine practice can be accomplished on a locomotive by the aid of the device shown, and the writer's own experience with locomotives has been that with the compression relieved as shown the economy is practically that shown by indicator cards.

It should be remembered that the most economical steam engines we have at work to-day are those on which the point of compression is constant for all points of cut-off, and a locomotive provided with a simple arrangement which accomplishes this will have an efficiency approaching very near to the best performance of stationary engines.

It might be well to remind our railroad friends that Mr. Mark Baldwin, one of the best locomotive designers this world ever had, was averse to the adoption of the Stephenson link motion for the reason of the excessive compression obligated by its use, and did not build any engine with the Stephenson link until compelled to

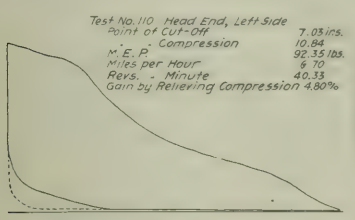


Fig. 13.

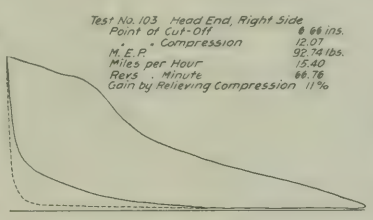


Fig. 14.

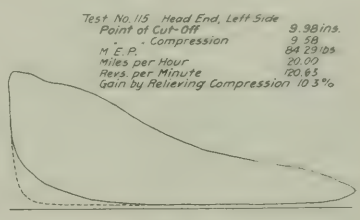


Fig. 15.

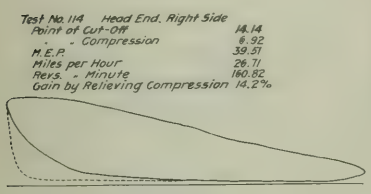


Fig. 16.

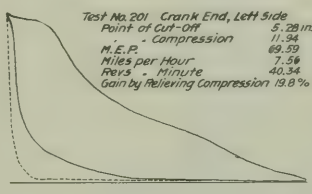


Fig. 17.

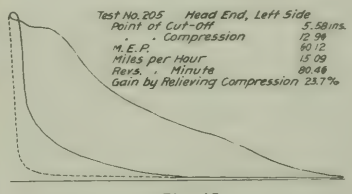


Fig. 18.

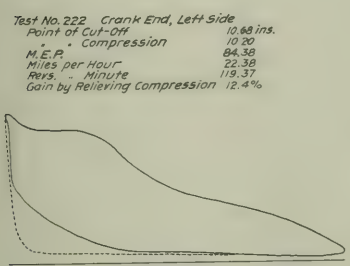


Fig. 19.

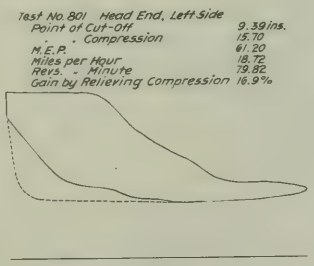


Fig. 21.

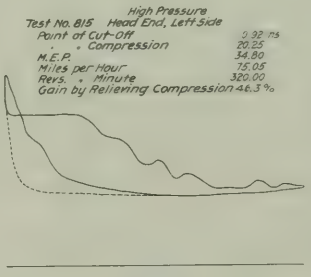


Fig. 22.

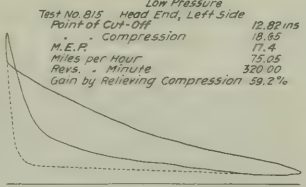


Fig. 23.

do so by the railroad officials. Baldwin's own valve motion, which had the point of compression constant for all points of cut-off, was as economical in the use of steam as any motion ever applied to a locomotive, but it was considered cumbersome, and the Stephenson link appealed to railroad engineers as being simple, which, indeed, it is, but nevertheless in the writer's opinion we are sacrificing economy for simplicity, and the application of a device which can at its worst give slight trouble in repairs for long periods, should be considered seriously.

In the past, in order to be more economical in the use of steam we have thought it wise in the compound locomotive to practically double the troublesome working parts. In the writer's opinion more can be gained by relieving the compression in locomotive than by compounding, and the cost of relieving compression is so slight as to be scarcely mentioned in comparison with the necessarily high cost of compounding.

To those interested in the theoretical side we refer to Fig. 12, which shows expansion and compression curves drawn according to Mariotte's law, in which no heat is given out or taken up by the steam in expanding or compressing. The card has 10 per cent. clearance volume, 25 per cent. cut-off with 200 lbs. gage pressure.

It will be noticed in round numbers that the loss with 10 per cent. clearance and compression to initial pressure is about 4 per cent. over that of no clearance and compression to initial pressure, theoretically.

The relieving of compression results in a theoretical gain as follows:

Gain in M. E. P/ by relieving compression,

$$\frac{121 - 81}{81} = 49.5 \text{ per cent.}$$

which is reduced in practice to practically what the indicator cards show.

TABLE I.—*Taken from Pennsylvania Railroad St. Louis Tests.*

Item.	No. of test.	Average indicator card.	Dimens'ns of cylinder.	Miles per hour.	Revolutions per min.	Apparent point of cut-off in.	Apparent point Com. press'n. in.	Point of compression with relief valve. in.	Gain in M.E.P. with compression relieved. per cent.
1.	110.	Fig. 13..	22 x 28	6.7	40.3	7.03	10.84	3.00	4.8
2.	103.	" 14..	22 x 28	15.4	92.7	6.66	12.07	3.00	11.1
3.	115.	" 15..	22 x 28	20.0	120.6	9.98	9.58	3.00	12.7
4.	114.	" 16..	22 x 28	26.7	160.8	14.14	6.92	3.00	14.2
	Average			17.4	103.6	9.45	9.85	3.00	10.7*
5.	201.	Fig. 17..	21 x 30	7.6	40.3	5.28	11.94	3.00	19.8
6.	205.	" 18..	21 x 30	15.1	80.5	5.58	12.96	3.00	23.7
7.	222.	" 19..	21 x 30	22.4	119.4	10.68	10.20	3.00	12.4
8.	209.	" 4....	21 x 30	29.9	159.3	6.03	17.46	3.00	31.3
	Average			18.7	99.9	6.89	13.14	3.00	21.8*
9.	801.	Fig. 21..	15.5x 26	18.7	79.8	9.39	15.70	3.00	16.9
10.	815.	" 22..	15.5x 26	75.1	320.0	10.92	20.25	3.00	46.3
11.	815.	" 23..	26 x 26	75.1	320.0	12.82	18.65	3.00	59.2
	Average			56.27	239.9	11.04	18.20	3.00	40.8

*Average, 16.3 per cent.

The Proposed Klamath Falls Line of the Southern Pacific.

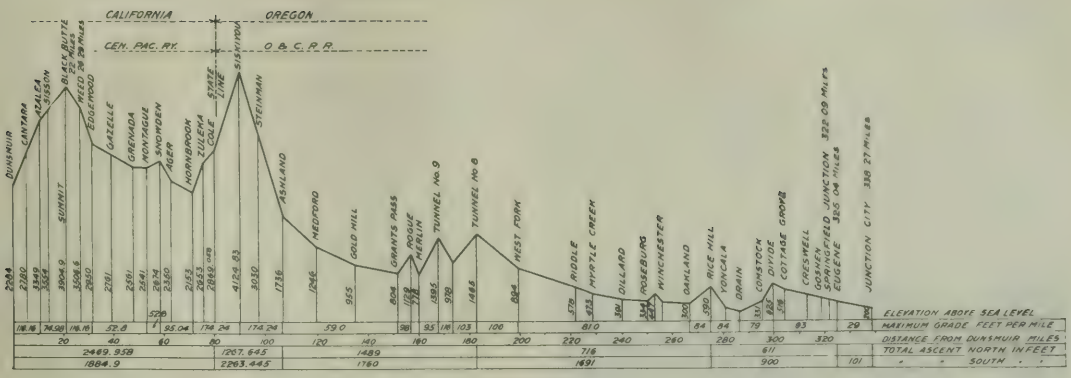
The "Shasta Route" of the Southern Pacific, which is the line from San Francisco to Portland, Ore., is famous for the scenic attractions in the splendid mountain country which it traverses. It was completed some 20 years ago, when the Oregon & California, which is the name under which the lines in Oregon were built, was extended to connection with the Central Pacific at the California state line. The Southern Pacific acquired control of the Oregon & California shortly after its completion. The topography of the country traversed is extremely rugged, and the line is for the most part one of heavy grades and curvature. These attain a maximum in the Siskiyou mountains, lying approximately east and west adjacent to the Oregon-California boundary, where the railroad attains an eleva-



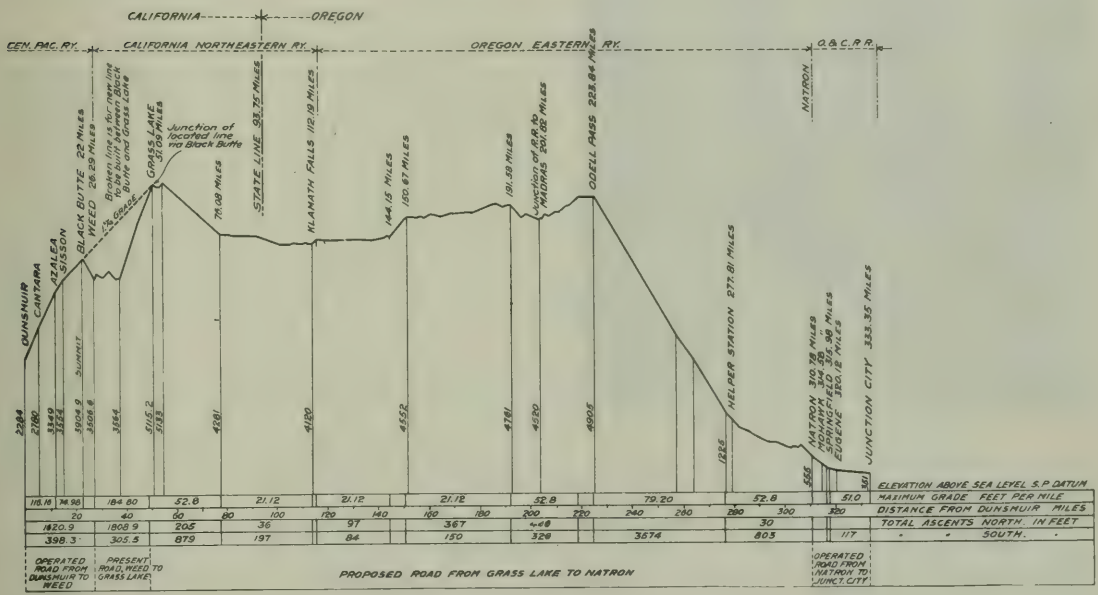
Map of Proposed Klamath Falls Line.



Upper Klamath Lake, Looking West from Steamer Landing.



Condensed Profile of Present Line Between Dunsmuir, Cal., and Junction City, Oregon.



Condensed Profile of Proposed Line, Dunsmuir, Cal., to Junction City, Oregon.



Crescent Lake, Near Survey of Oregon Eastern.



Grass Lake Station.

tion of over 4,000 ft. at the station of Siskiyou, and reaches same by a continuous grade of 174.24 ft. per mile (3.3 per cent.) over a distance of 20 miles northbound and 17 miles southbound. There are also long grades of 116 ft. to the mile in northern California, where the summit at Black Butte is crossed at an elevation of 3,905 ft.

Relief from the difficulties which the physical characteristics of this section of the road impose are obtainable in only one way, that is by an alternative line east of the Cascade mountains, where a location permitting much more favorable grades has been made. This proposed new route is shown on the accompanying map. It is composed of the California & Northeastern, projected from Weed, Cal., to Klamath Falls, Ore., and a southeasterly branch of the proposed Oregon & Eastern, originally chartered to build from Natron east across the state of Oregon to connection with the Oregon Rail-



Timber Lands, Shore of Klamath Lake.

road & Navigation. Profiles of the present and proposed routes between Dunsmuir, Cal., and Junction City, Ore., are shown herewith. The California & Northeastern, originally an independent project and later acquired by the Southern Pacific, had already been built from Weed to Grass Lake, about 29 miles. It was only a logging road, however, of light construction with 3½ per cent. grades, and is to be rebuilt to a maximum gradient of 1 per cent., as the profile shows, and shortened about five miles by relocations. From Grass Lake north the new route will be on a high plateau, having an average elevation of 4,500 ft., to Odell's Pass, where it passes through the Cascades and follows the Middle Fork of the Willamette river northwesterly to Natron.

Between Black Butte and Springfield Junction, which are the limiting points for the new construction, the routes compare as follows:

	Line		
	Present.	Proposed.	Diff. in favor of new.
Distance, miles	290.09	290.2	9.89
Total curvature, degrees	36,023	23,158	12,865
Grade rise northward, ft. vertical	4,919	2,651	2,268
Grade rise southward, ft. vertical	8,370	6,115	2,255
Maximum grade, per cent.	3.3	1.5	1.8

Equating the curvature and grade rise to straight and level track, the difference through curvature and grade saved in favor of the proposed route is 28.59 miles. Hence the present road may be regarded as made up of an actual distance of 300.9 miles and 28.59 miles handicap, or 328.68 miles, as against 290.2 miles by the new route. This means that the cost of operation as affected by curvature, distance, and grade rise and fall, will be by the new route roughly about .88 of the cost by the present route. With the exception of the climb of 1.5 per cent. at the north end to get through the Cascades, the maximum grade on the new line will be 1 per cent. The locomotives now working on the present line will be able to haul trains about twice as heavy over the new route, and helper service will be required only on the 1.5 per cent. grade.

The territory which this new route will open up is rich in natural resources and has large areas of fertile lands. It has been practically undeveloped up to the present, with cattle and sheep raising the chief industries. The United States Government has now in progress a plan to irrigate and reclaim an area of 250,000 acres in the Klamath Basin. Half of this area is a marsh or completely submerged by shallow water. The irrigation work is well under way and the reclamation work will come afterward. These lands will produce alfalfa, grains, fruits and vegetables in abundance and of high quality. The climate is said to be delightful, with an abundance of clear days and no extremes of temperature. As soon as the railroad is ready for traffic, lumbering and its attendant industries will doubtless be among the chief activities of the region. The principal town on the route is Klamath Falls, between Upper and Lower Klamath lakes. It has a population of 2,500, and is the headquarters for the irrigation and reclamation projects of the region.

Work on the new line of railroad will be pushed as fast as practicable. It is expected to have the south end completed to Klamath Falls during 1908. Work on the Natron end will be begun this year. We are indebted to J. Kruttschnitt, Director of Maintenance and Operation of the Harriman Lines, for this information.

Superheated Steam on Locomotives.

At the recent meeting of the American Society of Mechanical Engineers, H. H. Vaughan, assistant to the Vice-President of the Canadian Pacific Railway, presented a paper in which he gave a resumé of the results that have been obtained on that road with locomotive superheaters. According to the author, the first application of superheated steam in North America was made by Mr. Roger Atkinson, then mechanical superintendent of the Canadian Pacific Railway, who applied a "Schmidt" smoke-box superheater to a 4-6-0 simple freight engine in 1901. In 1903 Mr. E. A. Williams, then mechanical superintendent of the same road, applied a "Schmidt" smoke-tube superheater to two 4-6-0 compound freight engines, and the results obtained from these installations were exceedingly satisfactory, the first engine showing a saving of 25 per cent. over corresponding simple engines and 18 per cent. over corresponding compound engines of the same class, while the latter engines showed a saving of from 15 per cent. to 20 per cent. over similar compound engines using saturated steam.

In 1904 the New York Central & Hudson River applied a "Cole-Field" smoke-tube superheater to a 4-4-2 passenger



Government Irrigation Canal Near Klamath Falls, Oregon.

engine, and in the latter part of the same year the Canadian Pacific Railway purchased 41 engines, 21 of which were equipped with this type of superheater, and 20 with the "Schmidt" smoke-tube superheater. Since that date all engines, other than those in switching service, constructed on the Canadian Pacific Railway have been equipped with smoke-tube superheaters of various types, and on December 31, 1906, there were in service on this road 197 engines equipped with superheaters of the following types.

Type	No.
Schmidt smokebox	1
Schmidt smoke tube	32
Cole Field tube	21
Cole return bend	55
Vaughan Horsey return bend	88

At the present time this road has on order 175 locomotives for delivery during the present year, all of which are to be equipped with the "Vaughan-Horsey" type of superheater, which will make a total of 372 engines to which this principle has been applied.

On the railroads in the United States the progress has been far less rapid, and a reasonably complete list of the engines equipped at the end of 1906 is as follows:

Railways.	Co.e.	Schmidt.	Vaughan Horsey	Total.
N. Y. C. & H. R.	1	..	..	1
Chic., Burl. & Quincy	1	2	..	3
Rock Island.	6	..	..	6
M., St. Paul & S. S. M.	1	..	..	1
Chic. & North-Western	1	..	..	1
Boston & Maine	1	..	..	1
Lake Shore & Mich. South.	1	..	1	2
Totals	12	2	1	15

ECONOMICAL RESULTS.

The results obtained in coal economy have on the whole been exceedingly satisfactory. The results obtained from the first three engines on the Canadian Pacific Railway have already been referred to. Subsequent results on a large number of superheaters have not, however, shown as large a percentage of saving as would naturally be expected, when a device of this nature is applied in sufficient quantities to insure the engines with which it is equipped being treated in exactly the same way as other engines to which no particular attention is given and taking their chance with reference to the ability of the engine crews which handle them.

Unfortunately it is difficult to compare superheater simples with ordinary simples on the Canadian Pacific Railway, as previous to the introduction of the superheater most of the recent power purchased was of the compound type, and care has also to be exercised in making comparisons on account of the large variation in the coal consumed per ton-mile on the Canadian Pacific in the summer and winter.

The most satisfactory comparison is arrived at by taking engines working over similar sections during the summer months, and the following table shows the performance of 2-8-0 superheater simples as compared with similar 2-8-0 compound and a 4-6-0 compound of about equal weight and also similar in design. The superheaters are of two types. M-4a being a Schmidt smoke-tube return bend and M-4b a Cole-Field tube, M-3a are 2-8-0 compounds and D-9 a 4-6-0 compound. These results are those obtained during the summer of 1905.

The D-9 engines may also be advantageously compared against three classes of 4-6-0 simple superheater engines of the D-10a class equipped with Schmidt smoke-tube return bend, the D-10b with a Cole return bend and D-10c with a Vaughan-Horsey return bend.

These engines were run against each other during the months of September, October, November, December and January, inclusive, on the Canadian Pacific between Fort William and Winnipeg, and the general result is given in Table 2, with reference to which it should be noted that this section of the line is an exceedingly favorable one for compound locomotives.

Previous to the introduction of the superheater, the D-9 engines had been by far the most economical yet used on that section. The superior economy of the D-10c engines is not easy to explain, and although the writer has discussed this question at some length before the New York Railway Club, he does not feel that there is sufficient data on the subject to regard it as a definite fact.

	Section: Fort William to Ignace.	Section: Ignace to Kenora.	Section: Kenora to Winnipeg.	Total.
1300, D—9, Compound:				
Coal used	13,144	2,520	8,416	24,080
Relative consumption	100	100	100	100
700, D—10a Schmidt-Sup.:				
Coal used	207	6,073	2,170	8,450
Relative consumption	101.0	98.3	100.8	100.7
710, D—10b, Cole Sup.:				
Coal used	2,993	14,082	10,443	28,418
Relative consumption	88.5	105	100.5	99.5
740, D—10c, V. H. Sup.:				
Coal used	5,842	...	...	5,842
Relative consumption	84.7	...	...	85.5

In the early part of 1906, the Cole superheaters were removed from the M-4 engines, and therefore during 1906 were used as simple engines, thus offering a good basis for comparison with the M-4a engines. This year some other classes of engines have been introduced. Two 4-6-0 simple passenger engines class E-5 have been converted to Vaughan-Horsey superheaters, class E-5d and some 2-8-0 simple engines class M-4e have been equipped with the same device, as well as some Pacific type 4-6-2, passenger engines class G-1-2. For purposes of comparison the results obtained from 2-8-0 class compound engines, M-1-2 of slightly smaller size than the M-4 are also shown. These engines are an economical and satisfactory type and offer a good basis for comparison.

In the majority of cases the superheater engines showed a decided saving, and the results between the 4-6-0 and 2-8-0 vary somewhat in accordance with the relative economy of these two general types of engines. Under some conditions the 2-8-0 are more economical, while under other conditions there is very little difference.

A very interesting result is that obtained from Field to Revelstoke. These are engines working on very heavy grades and are fairly comparable for two classes of locomotives involved, as they were both working together, and it will be noticed that a saving of 11 per cent. for the six months in favor of the superheaters was obtained. For the larger portion of this section the engines were working at long cut-offs where the gain from superheat would be expected to be less marked.

An interesting difference is shown between Swift Current and Medicine Hat. In freight service the D-9 freight compound engines show up exceedingly well in comparison with superheaters, but in passenger service on the same section the superheaters are much more efficient, the compound taking about 60 per cent. more coal, due to the loss in efficiency in the compound in passenger service and the relative gain in the superheater.

Tests on other roads so far as information has been received show in general a reasonable amount of saving. On the Chicago, Burlington & Quincy the road records show but little difference, and on this road the experience was not satisfactory, due very probably to trouble experienced with leakage at the joints in the headers.

On the Boston & Maine comparative tests of two 4-6-0 engines equipped with Cole return bend superheaters in passenger service showed a gain of 14.7 ton-miles per pound of coal on the engine equipped with superheated steam.

On the Chicago & North-Western tests comparing identical 4-4-2 passenger engines with and without Cole superheaters showed an economy of 9 per cent. in coal in favor of the superheater.

On the Lake Shore & Michigan Southern tests of engines equipped with Cole and Vaughan-Horsey superheaters compared to similar engines using saturated steam showed a saving of 18.8 per cent. for the Cole and 22.1 per cent. for the Vaughan-Horsey superheater in coal per ton-mile.

From the general results of these figures it would appear safe to state that from 10 to 15 per cent. saving is obtained in freight service and 15 to 20 per cent. in passenger service on engines equipped with superheaters as compared with those using saturated steam although this economy will be to a considerable extent lost if leakage occurs at the headers.

MAINTENANCE RESULTS.

Results obtained from superheaters on the Canadian Pacific Railway are such as to justify a continued construction of engines equipped with this device. The past three years have developed many troubles, but they have also indicated their remedy.

The automatic damper, first looked on as a desirable attachment, has proved to be a most important factor in the successful operation of the superheater engine. During the first year's experience it appeared to make but little difference whether this damper was operative or not, but it has been found that if neglected there is a gradual but serious deterioration in the ends of the superheater pipes. The structure of the metal becomes entirely destroyed and leaks occur at the return bends, and the metal in the pipes changes its structure until it can be broken in the hands. The damper is not difficult to maintain, simply requiring proper attention, but the design which has been used and which was introduced with the original Schmidt superheater is not satisfactory, and can certainly be very much improved, and its maintenance made easier.

The writer sees no reason whatever for abandoning a valuable and important principle such as the use of superheated steam because troubles have been incurred through neglect in maintaining a small attachment which could easily have been attended to had its importance been appreciated, and after three years' experience feels justified in stating that if the dampers are properly maintained the trouble through the destruction of the ends of the superheater pipes will not occur.

With properly maintained dampers the next source of trouble is leakage at the connections of the superheater pipes to the headers. In the Schmidt design properly put up, this occurs but very seldom, and the majority of engines with this arrangement will run from shopping to shopping without attention. The objection that has developed in the Schmidt arrangement is that should any leakage occur, especially in the flanges attached to the upper rows of superheater pipes, it is practically necessary to take down all the flanges and make the joints afresh, and this takes considerable time with a corresponding loss in the service of the engine.

The greatest trouble has come from having to do this on ac-

count of the leaks occurring at the return bends caused by dampers not being properly maintained, but apart from this trouble the writer considers the Schmidt to be a satisfactory design, although the inability to take out any defective element without disturbing others is to his mind a great objection.

The Cole type of superheater has given considerable trouble from leakage at the joints between the sub-headers and the main header. While this may be overcome by a modification in the design, the number of defects which have developed has been most serious. The joints are probably loosened by the action of the weight of the superheater pipes working backward and forward when the engine is in service, and the loosening of the joints causes a leakage of steam across the face of the copper gasket and rapidly cuts it away. Arrangements are now being made to support the lower ends of headers so as to prevent their movement, and it is thought that this will largely overcome the difficulty. No trouble is experienced in the joints between the superheater pipes and sub-headers, but the latter are difficult to take out one at a time without disturbing those adjacent, and thus in case of a defective superheater pipe it is generally necessary to make all the joints over again, which means considerable work.

The Vaughan-Horsey type gave considerable trouble at first on account of the fittings and union nuts being made of brass, which deteriorated in the heat of the gases, but since these parts have been made of steel, the trouble has been practically overcome, and on account of this design permitting any pair of superheater pipes to be withdrawn without disturbing another, a defective element can be taken out, the joints blinded, and the element replaced at the first convenient opportunity, which is of considerable advantage in roundhouse maintenance where engines are worked as hard and as continuously as they are in American practice.

In general the maintenance of superheaters has not proved expensive, but the troubles enumerated have led to annoying and inconvenient delays to power, which if not treated on their merits might be held to condemn the device, but when analyzed, there seems to be no insuperable difficulty in remedying these, and with the proper remedy the writer firmly believes there is nothing about a superheater which should lead to its giving a less efficient service than a simple engine, and the slight additional expense is amply warranted by the saving obtained.

The smoke-tubes have given but little trouble, in fact less trouble than the ordinary 2 in. or 2¼ in. tubes which they replaced. On some bad water districts where the small tubes have to be reset every 20,000 or 30,000 miles, the smoke-tubes can be allowed to run through at least one resetting of the small tubes, which is probably due to the considerably better circulation and their greater thickness. Some difficulty has been experienced from the smoke-tubes stopping up with cinders, especially with the Field-tube type of superheater which seems particularly bad in this respect. With the return bend type, however, on the majority of the roads there is no serious difficulty in this respect, although it is necessary to see that the tubes are properly and systematically blown out and kept clean. The expense in the labor involved in doing this is, however, negligible.

The maintenance of valve and piston rod packing is slightly greater on engines running with superheated steam than on simple engines, but with proper lubrication the difference is not serious. It is necessary to use hard close grained cast-iron for the valve and piston rings, but with suitable types of piston and valve stem packing there is practically no difference in the maintenance of simple and superheater engines.

In general, the writer believes that while it may be necessary to insist on the proper maintenance of superheaters the expense involved is not great, and with proper maintenance and the improvement in detailed design which experience is leading to, there will be practically no decrease in the mileage to be obtained from the superheater as compared to the simple engine, and that the additional cost of maintenance will be unimportant.

LUBRICATION.

When engines equipped with superheated steam were introduced, it was considered necessary to use forced lubrication to the valves and cylinders, and this belief led to considerable trouble owing largely to the various forced feed lubricators employed which did not work satisfactorily with their rapid wear and the small amount of attention they received from the enginemen. During the past year, however, it has been found that the ordinary hydrostatic sight feed lubricator is quite as satisfactory on engines using superheated steam as on those using saturated, but it is necessary with the oil at present employed to lubricate the cylinders in addition to simply lubricating the valves, as in common simple engines. The present practice is to use separate feeds to each end of valve and to center of cylinder near the top, and with this arrangement no difficulty is experienced with lubrication, although the writer believes it would be advantageous to use a rather heavier valve oil than is at present customary.

CONCLUSIONS.

The writer's experience with locomotives using superheated steam has not been free from vexations and annoying troubles, but it has on the whole been exceedingly satisfactory.

The troubles encountered are being overcome as experience develops their cause and the saving obtained is apparent in the reduction of the amount of coal used per ton-mile on various divisions of the road as superheater locomotives are introduced. The additional capacity of the engines and the reduction of the work required of the fireman, enabling trains to be handled better, and the development of an engine which in extremely cold weather can be as easily maintained as a simple engine with an economy equal or superior to that of a compound is an important advantage to any railroad working in northern latitudes.

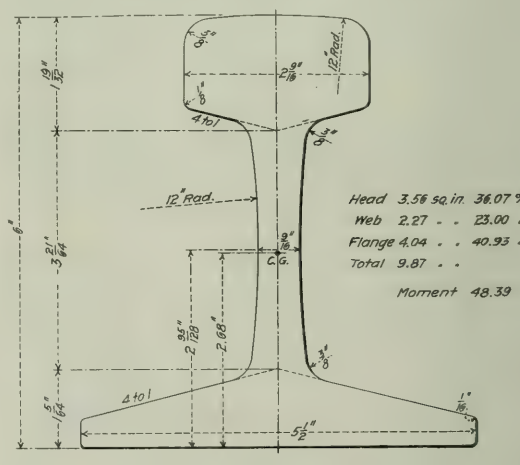
So far as can be seen at present there is no valid reason for discontinuing the application of superheaters, and the writer expects that a considerable increase in the number in use will take place in the next few years.

A Proposed New 100-lb. Rail Section.

One of the large railroad systems has adopted the 100-lb. rail section illustrated herewith, which was designed by Capt. Robert W. Hunt, of R. W. Hunt & Co., Chicago. Concerning the characteristics and advantages of this section its designer says:

The section differs quite radically from any now in use, particularly in the proportions of metal in the head, web and flange. In the very much lighter-sectioned rails, which under old conditions were the standard-weight ones, those proportions were not of so much importance, either from a user's or manufacturer's standpoint.

Railroad officials have generally insisted upon a large, or at least a deep head, arguing that as the wear of traffic was upon the



Proposed New 100-lb. Rail Section.

top and sides of the head, it was logical that the greater part of the metal should be located in that part of the rail. While this view is plausible, unfortunately it ignores metallurgical and manufacturing conditions. As the finished section of the rail is increased, so is the work upon the metal in it decreased, and, of necessity, the heavy rail, when it leaves the finishing rolls, contains more heat than the smaller-sectioned one. It is a well established fact that the work applied, and the temperature of the steel when receiving such work, are vital factors in regulating the structure, and hence quality of the finished article. Therefore to secure the best structural results it is important that the rail section should be one easy to develop in the rolls, and therefore requiring the minimum degree of heat. It is also important that the proportions of metal in the head and flange should be so balanced that as the rail cools it will remain as nearly as possible to a straight line and thus require the least possible amount of work under the cold straightening press.

In rolling steel it is much easier to elongate the metal than to spread it, hence the difficulty in producing rails with wide and thin edged flanges. This tends toward the practice of rolling and finishing the metal in such sections at too high a temperature for the best quality results. As the use of tie plates increases the necessity for very wide flanges decreases.

In a large percentage of recently broken rails of the heavier sections the fractures have occurred at the bottom of the web, extending longitudinally along and up through the flange, the pieces breaking out in crescent shape. In many instances such failures started at a seam or fold in the steel, which was formed in rolling

the rail and resulted from the spreading of the metal in that process in developing a wide and thin flange. The narrower and thicker flange of the proposed section should prevent this, and at the same time it is much strengthened at the point where such failures have occurred.

As renewed or re-rolled rails are giving satisfactory results, in designing the proposed section this subsequent rolling and use of the rail was kept in view, and it is believed that at least two satisfactory renewals can be made, leaving the last section weighing over 80 lbs. per yard.

Moment of Inertia and Curvature.

BY G. R. HENDERSON.

The recent distressing accident on the New York Central Railroad near Woodlawn has caused a great deal of interest to be taken in the mechanics of curvature, and it is probable that more attention has been given to this subject within the last three months than ever before.

The well-known work of the late A. M. Wellington, "Economic Theory of Railway Location," contained probably the earliest dis-

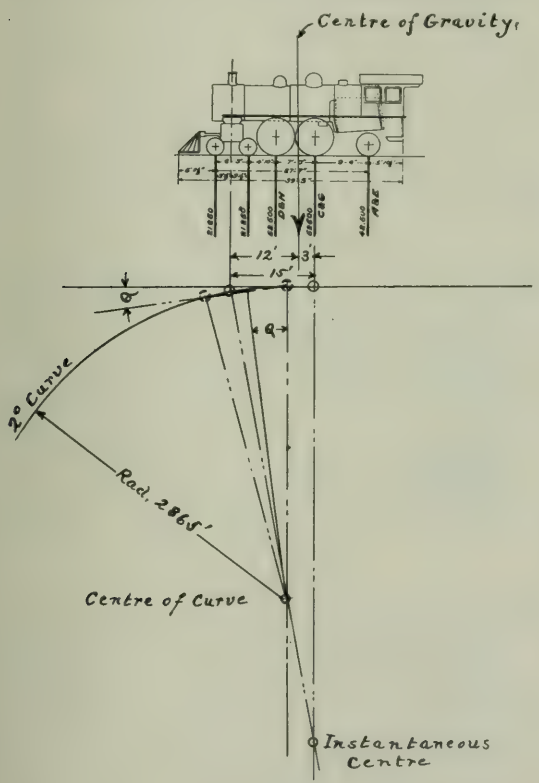


Fig. 1.

cussion of the effect of wheel and rail friction upon curve resistance, and Mr. Wellington explained in his work some experiments which he had made with models regarding the slewing action which takes place when any body with a rigid wheel base passes around a curve. The effect of centrifugal force is well-known and has been very thoroughly studied in connection with the question of super-elevation of the outer rail.

Publicity having been given through the medium of the technical press to the calculations and analyses made by college professors and railroad experts upon the accident above referred to, the matter is placed before us in such a position that we feel free to add to the discussion upon this point. The reports that we have seen state that three fundamental principles of the mechanics of curve resistance were considered in making the computations. The first of these was the component of slipping in the direction of the rails due to curvature and was based principally on the coefficient of friction between the wheels and the rail, and was figured for the pressures with which the different wheels bore upon the rail. The second consideration was the component of slipping in the direction of the tangent of the track due to unequal rail lengths on the inside and outside of curve, and this was figured in a similar way as the first item. The effect of centrifugal force and its partial neutralization (as far as horizontal forces against the rail were concerned) by means of super-elevation were also considered.

These three forces, as far as our conception goes at the present time, and outside of various oscillations, vibrations, etc., due to irregularities of the track or intermittent reciprocating action of certain parts of the locomotive, include all the horizontal forces that act upon the locomotive, or in fact a car while passing around a curve of uniform curvature, but when the rate of curvature either increases or decreases, another force must be brought into play which, so far, we have not seen mentioned in any of the discussions upon this matter. Our attention was called to this by Mr. T. H. Brigg, but as far as known the writer is the first to work out the actual calculation of the amount of this force.

While attention may not have been brought specifically to the existence and the amount of these forces, they have been recognized by constructing easement or spiral curves at or near the point of tangency so that when a train enters or leaves a curve the sudden turning of the equipment in a horizontal plane is much reduced by the means of these easement curves.

Let us consider what happens when a vehicle traveling on a railroad enters a curve. We have already seen that when on the curve the centrifugal force comes into play, and also certain slipping of the wheels in order to make up for different lengths of rail on inside and outside of curve, and for the slewing of the engine; but if we consider that the vehicle enters the curve with a high velocity, it is apparent that in addition to these forces there is also the force of inertia of the vehicle itself to be overcome in causing it to turn in a horizontal plane. This is entirely separate from and independent of the centrifugal force, and as will be shown later is greatest when the centrifugal force is least, and vice versa. Any body traveling in a straight line desires by its inertia to continue traveling in that same straight line, and unless some force be applied, the axis of the body (if originally parallel to its line of travel) will also continue in the same line. In order to make this matter clear, let us consider that a car is propelled on a plane surface with loose wheels on the axles and without flanges. If it has a velocity in a certain direction, let us suppose parallel with its axis of shape, it will continue indefinitely in the same direction, but if we should wish to guide this body in a curve and instead of using a track, should attach a cord to its center of gravity and secure the other end of the cord to a fixed center, the body will describe a circle about that fixed center, but the axis of the body would continue to point in the original direction. This is similar to the constant direction of the polar axes of most of the planetary bodies, and in the case of certain members of our solar system, whose axes of rotation have a less inclination to the plane of their orbits than has the earth's, is more marked in its effect than in the terrestrial body which we inhabit. It is evident therefore that some force is needed when entering a curve to give the body or car an angular acceleration in a horizontal plane. This angular acceleration will commence when the front wheels strike the curve and will end when the last wheel enters the curve and the velocity will be constant while the radius of curvature remains constant, but when the curve is left and the next tangent entered the same process will be repeated in the opposite direction.

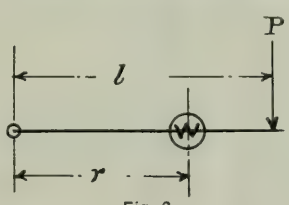


Fig. 2.

Referring now to the diagram, Fig. 1, let us consider a piece of track consisting of a tangent and a 2 deg. curve whose radius is about equal to 2,865 ft. Consider also an Atlantic type of engine, such as is shown in the diagram, to enter this curve at a velocity of 80 miles per hour, or 117 ft. per second. While on the tangent there will be no centrifugal force as the radius of a straight line is infinite, and the regular formula for centrifugal force is represented by a fraction whose denominator is a function of the radius of curvature. As soon as the front wheels enter the curve the locomotive begins to depart from its original path in a straight line, and the instantaneous radius of its curvature at any point can be determined by drawing normals to the track at the points of contact of the truck, and, if you please, the rear driving wheel which is the last point in the rigid wheel base. It is evident that the intersection of these normals will be the instantaneous center of curvature; and it is also evident that their length will diminish from infinity on the tangent to the actual radius of curvature when the engine is completely on the curve. Owing to this fact the centrifugal force will increase from zero to the full amount while the engine is entering the curve, as at any point when completely on the curve the normals must cross at the center of curvature. In this short time, however, the locomotive must have imparted to it

a certain velocity of rotation, and these will depend upon the speed of the engine, the radius of curvature and the length of the wheel base. In order now to figure out the actual amount of force for the conditions which we have assumed, we determine as explained above, that the velocity in feet per second, corresponding to 80 miles an hour, is 117. The weight of the engine in this case is 190,000 lbs., and the length for uniform weight approximately 30 ft., the center of gravity lying about 12 ft. back of the truck center. For an approximation we can consider that the moment of inertia around the center of gravity is equal to the weight multiplied by the square of the length and divided by 12, or

$$\text{moment of inertia} = I = \frac{190,000 \times 30^2}{12} = 14,250,000.$$

If we consider, however, rotation around the rear drivers, our moment of inertia will be increased by the product of 190,000 multiplied by 3 squared, or $190,000 \times 3^2 = 1,710,000$, and adding 14,250,000 we have 15,960,000 foot pounds as the total value of I when rotating around the rear drivers.

In Fig. 2 consider a weight W, on a rod without weight itself, hinged at the left, the weight being distant from the hinge an amount r, and a force P applied at a distance from the hinge l, acting in a horizontal plane. The effect of the weight at l can be found by $\frac{W r^2}{l^2}$, and we know that the acceleration is to 32.2 (g) as the force is to the weight, so that if a load placed a distance l from the hinge were acted upon by the force P, the acceleration would be $p = \frac{P g}{W_2}$, W_1 being the weight of the load. But for W_1 we may substitute $\frac{W r^2}{l^2}$ so that we obtain the equation $p = \frac{P g l^2}{W r^2}$. Now the angular acceleration $A = \frac{p}{l} = \frac{P g l}{W r^2}$, and as Wr^2 is the moment of inertia of the body W about the hinge and at a distance r from it, $Wr^2 = I$, so that $A = \frac{P g l}{I}$ and the torque, or rotating moment $= P l = A \times \frac{I}{g}$.

The angular acceleration A is obtained from the final angular velocity N and the time in seconds t during which the acceleration A produces the velocity N, thus: $N = A t$, and the angle traveled through in this time $= Q$ so that

$$Q = \frac{N t}{2} = \frac{A t^2}{2} \text{ and } A = \frac{2 Q}{t^2}.$$

When the engine enters the curve and the last driver passes the point of tangency, the engine has been rotated through the angle Q (as shown by the dotted location in Fig. 1), and for a 15-ft. wheel base and a radius of curvature of 2,865 ft., this angle $Q = \frac{7.5}{2865} = .0026$ radians, and as the velocity of the engine is 117 ft. per second, it requires a time $t = \frac{15}{117} = .128$ second to assume the angle Q. This means an angular acceleration of

$$A = \frac{2 Q}{t^2} = \frac{2 \times .0026}{.128 \times .128} = .32$$

And as the torque is P l we have this

$$P l = A \times \frac{I}{g} = .32 \times \frac{15,960,000}{32.2} = 159,600$$

foot pounds approximately. The center of front truck is about 15 ft. ahead of the rear driver so that this constitutes the lever arm and the force itself $= \frac{159\,600}{15} = 10,640$ lbs.

We see therefore that the normal horizontal force at the truck center necessary to give this engine such an angular acceleration that by the time the 15-ft. wheel base has completely entered the curve its angular velocity will be equal to the angular velocity of the body itself around the center of curvature, will be 10,640 lbs., and that this will be fairly constant during the time that the locomotive is entering the curve, this being based upon the assumption that the angular acceleration is uniform, which, however, is probably not strictly correct, but it will no doubt be near enough for our demonstration. The centrifugal force on the curve itself would be

$$.0000\,117 \times 6,400 \times 2 \times 190,000 = 28,454 \text{ lbs.},$$

or nearly three times as much, but it must be remembered that at the instant that the last driving wheel enters the curve the centrifugal force is at its maximum, and the force overcoming the angular acceleration is also in action, so that at this point we should no doubt have the greatest strain upon the truck, as in addition to the slewing effects spoken of above, and the centrifugal force, we should have the force due to the turning of the engine around a vertical axis. While passing through the curve the velocity of rotation would be constant as long as the speed on the curve was maintained uniformly, but on entering the following tangent the proceeding would be reversed, the centrifugal force would diminish from its maximum to zero, but at the instant when it began to diminish the full effects of the moment of inertia against rotation would appear.

We have assumed the case of 2 deg. curvature, and 80 miles an hour speed as it is generally customary to spiral curves that are sharper than 2 deg., therefore the effect of turning the engine in a horizontal plane would be less severe, but any case desired can be figured out in the manner above indicated by substituting the proper figures, and while we do not claim that this action had any responsibility in the case in question, and have no desire to associate it in any way with that accident, yet we believe that it will be of interest to engineers generally to compute in certain cases the effect of the moment of inertia of the engine in being rotated about a vertical axis when entering a curve.

Program of the American Railway Master Mechanics' Association, Atlantic City, June 12 to 14.

The sessions of the convention will be held, as was done last year, in the sun parlor near the ocean end of the steel pier. The Marlborough-Blenheim Hotel has been selected as headquarters. The President, Executive Committee and Secretary will have offices there. The enrollment committee will be located in the entrance to the steel pier. Each member of the Association, immediately upon arrival, should go to the enrollment booth, register and receive his membership button, if he has none, and be furnished a properly numbered celluloid disc showing his registration. Members will also be furnished with badges for their families. Cards for registration will be furnished at the enrollment booth at the entrance to the steel pier. Those members who expect to attend the M. C. B. convention should register twice, once for each convention, in order that a proper record may be kept of those present at each convention.

OPENING SESSION,
WEDNESDAY, JUNE 12, 1907.
9:30 a. m. to 1:30 p. m.

Prayer	9:30 a.m. to 9:35 a.m.
Address of President	9:35 a.m. to 9:45 a.m.
Intermission	9:45 a.m. to 9:55 a.m.
To allow those who desire to retire, although all are requested to remain.	
Action on Minutes of 1906 Convention	9:55 a.m. to 10:00 a.m.
Reports of Secretary and Treasurer	10:00 a.m. to 10:15 a.m.
Assessment and announcement of dues; appointment of committees on Correspondence, Resolutions, Nominations, Obituaries, etc.	10:15 a.m. to 10:25 a.m.
Election of Auditing Committee	10:25 a.m. to 10:30 a.m.
Unfinished business	10:30 a.m. to 10:35 a.m.
New business	10:35 a.m. to 10:45 a.m.
Discussion of Reports on:	
Mechanical Stokers	10:45 a.m. to 11:00 a.m.
Shrinkage Allowance for Tires	11:00 a.m. to 11:30 a.m.
Locomotive Lubrication	11:30 a.m. to 12:00 m.
Topical Discussion:	
Apprenticeship System on the New York Central Lines. To be opened by Mr. C. W. Cross	12:00 m. to 1:00 p.m.
Discussion of: Individual Paper on Shop Cost Systems. By Mr. A. Lovell.	1:00 p.m. to 1:30 p.m.

Adjournment.

MIDDLE SESSION.
THURSDAY, JUNE 13, 1907.
9:30 a.m. to 1:30 p.m.

Discussion of Reports on:	
Results of Use of Different Valve Gears	9:30 a.m. to 10:30 a.m.
Proper Spacing of Flues in High-Pressure Boilers	10:30 a.m. to 11:00 a.m.
Blanks for Reporting Work on Engines Undergoing Repairs	11:00 a.m. to 11:15 a.m.
Development of Motor Cars for Light Passenger Service	11:15 a.m. to 11:30 a.m.
Proper Width of Track on Curves, to Secure Best Results with Engines of Different Lengths of Rigid Wheel Base	11:30 a.m. to 12:00 m.
Topical Discussions:	
1. Is it desirable to eliminate water-gage glasses on locomotives to enforce the use of gage-cocks? To be opened by Mr. F. F. Gaines	12:00 m. to 12:30 p.m.
2. Relative merits of outside and inside delivery pipes in connecting with locomotive injectors. To be opened by Mr. Strickland L. Kneass	12:30 p.m. to 1:00 p.m.
Individual paper on Cause of Leaky Flues. By Mr. M. E. Wells.	1:00 p.m. to 1:30 p.m.

Adjournment.

CLOSING SESSION.
FRIDAY, JUNE 14, 1907.
9:30 a.m. to 1:30 p.m.

Discussion of Reports on:	
Superheating	9:30 a.m. to 10:30 a.m.
History of Movement of Locomotives at Terminals	10:30 a.m. to 10:45 a.m.
Individual paper on Locomotive Failures. By Mr. W. E. Dunham	10:45 a.m. to 11:15 a.m.
Subjects	11:15 a.m. to 11:30 a.m.
Unfinished business:	
Reports of Committee on Resolutions, Correspondence, etc.	11:30 a.m. to 12:00 m.
Topical Discussion:	
1. The corrugated tube for locomotive service, with the view of bringing out the reasons and advantages for its use. To be opened by Mr. George West	12:00 m. to 12:30 p.m.
2. What is the best metal for hub liners for driving and engine truck wheels, the best method of applying and limiting lateral hub play for such wheels before repairs are required? To be opened by Mr. J. F. Dunn	12:30 p.m. to 1:00 p.m.
Election of officers	1:00 p.m. to 1:30 p.m.
Closing exercises	

Adjournment.

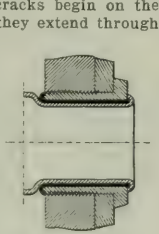
New Zealand Railroads.

The question whether state railroads are to be worked as commercial undertakings, so as to produce a surplus over and above working expenses and interest, or so as to give the greatest possible service to the public at the lowest possible charge consistent with payment of expenses and interest, is raised by the Commissioner of Railways for Western Australia in his latest report. New Zealand has long acted on the second alternative, but the Australian administrations have not been so definite. So far as western Australia is concerned, the management of the railroads appears to have been placed under the control of the commissioner, subject to certain matters requiring ministerial approval. Comparisons have been put forward and statements publicly made which show that the goal aimed at by the state was to secure the utmost direct profit possible from the railroads. Yet, when the indisputable results have come forth, an agitation for reduction of rates has at once cropped up. With regard to the timber industry this has been successful, and the commissioner estimates that the current year's revenue must lose some $79,000. If the working railroads have to pay more for both coal and water than the fair price, to reduce freight rates considerably, to pay an ever-increasing interest bill, and to construct non-paying spur lines for the development of agriculture, the commissioner considers it evident that a surplus cannot long be maintained, and that if the country really wants the second alternative the parliaments should definitely say so.

Tests of Very Mild Steel Tube Sheets.

According to the *Organ der Fortschritte des Eisenbahnwesens* the repair shops of the Prussian railroads for the line running from Cologne to Nippes, have recently made a test of some steel tube sheets under the following conditions:

The feedwater that is used in engines which are repaired at these shops is very bad, with the result that after a short term of service, cracks are apt to appear in the red copper tube sheets, so that they are soon unfit for service. The cracks begin on the fire side and gradually increase in depth until they extend through the sheet. The cracks always run on a line with the second vertical row of tubes, and on each side of the sheet, and work across the five first bridges between the tubes. They then extend over them all until the sheet is rendered useless. It has been noted for several years that the method of building the boiler had little or no influence upon the production of these bridge cracks. It can, however, be said that the flexible or expanding staybolts and the use of short wood fireboxes has slightly improved the situation. The principal elements influencing the matter on the other hand are: The steam pressure and the nature of the scale. As the pressure is increased, and with it the temperature of the copper, the plate is weakened in its tensile strength accordingly. In the matter of scale, its influence depends upon its permeability. The waters in the neighborhood of Cologne are charged with magnesium salts, and the locomotives carrying a pressure of 170 lbs. to the sq. in. begin to show cracks in 10 or 12 months, and those carrying 200 lbs. pressure in from four to six months, while others working in a territory where the water is better will run from two to three years without developing any cracks in their tube sheets. The reduction in the number of tubes in the upper corners of the sheets for the purpose of increasing the size of the bridge does not seem to have any influence. The means taken to increase the life of the sheet is by the insertion of a screwed bushing, as shown in the engraving. The number of each is limited to 40, and when more than this is required the sheet is changed. As will be seen from the engraving, this method of repairing consists in applying a copper washer about ⅝ in. thick to the fire side of the sheet, and holding it in place by a screwed bushing of very mild steel, into the inside of which the tube is expanded, and as every kind of hammering is positively forbidden it will be seen that the adjustments will have to be made very carefully in order to secure tightness. This is the only method of repairing that is proven effective up to the present time. In this way the life of the sheet can be prolonged from two to three years. When it is necessary to change the sheet, it takes from four to six weeks work at the Lippes shop.



Detail of Copper Ferrule.

This rapid destruction of the tube sheets has naturally led to investigations in order to obtain a metal offering greater resistance than copper. In these attempts, copper, zinc, iron, silicon bronze and aluminum bronze made by Eckman & Duisbourg have been tried, but all these attempts have resulted in failure.

On the other hand, trials that were made in 1894 and 1896, with fireboxes made of very mild steel, showed that the steel in direct contact with the incandescent coal changed so rapidly that after only three or four months it was necessary to replace the firebox, although the whole zone that was not in direct contact with the coal was still in very good condition. A chemical study of the steel that had thus been changed showed that it was due to a rapid carbonization of the metal in direct contact with the coal. Thus in a sheet $^{6}/_{16}$ in. thick the percentage of contained carbon rose to .13 per cent. instead of .01, which it originally had. True cementation, therefore, had taken place, as confirmed by the tensile and bending test. The conclusion of this inquiry was, then, that it was necessary to continue to make those parts of copper that were in direct contact with the coal, while those that were in contact with the gases could be made of steel. On account of the unusual form which it would thus be necessary to give to the firebox, it was decided not to resort to this last expedient until every other method had been exhausted. Not until 1900 was an eight coupled engine fitted with a new tube sheet that was to be subjected to a pressure of 170 lbs. The firebox had never run more than two years. This sheet was run for more than three years in spite of the bad quality of the feedwater, and without showing the slightest signs of deterioration. At the end of three years the sheet was subjected to an exceedingly careful inspection, and it was found to be free from defects. Furthermore, during these three years far less trouble had been experienced with the tubes than

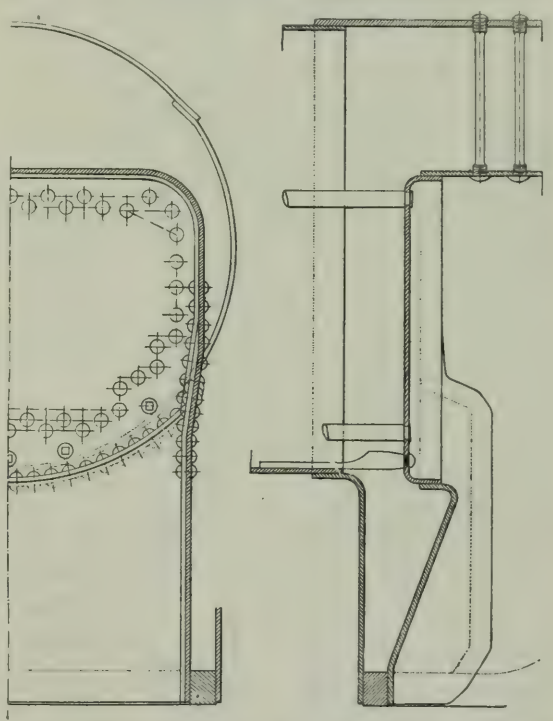


Fig. 2—Composite Copper and Steel Tube Sheet; Prussian State Railways.

with the ordinary copper sheet. The maximum elongation of the tube holes amounted to .06 in. As a result of this trial, the same system of construction was applied to a six-coupled engine, carrying 200 lbs. pressure. The new copper sheet, which had been put in this engine in June, 1901, had developed cracks in the month of November of the same year. It was repaired by means of the screwed bushings, but the sheet had to be replaced in January, 1904. The locomotive left the shops in May, 1904, with a composite copper and iron sheet, and was put into service on the line between Cologne and Treves in heavy traffic. This sheet has in the meantime, that is, during the period of about two years, remained in a perfect condition, and has thus shown that this system of construction meets all the requirements of the heaviest service.

The engraving given herewith shows the design of the new sheet. It presents no difficulties in the boiler shop, simply requiring that care be employed in putting it together, and that attention be turned to the point where it is attached to the steel tube sheet; to the side sheets of the firebox, and to the copper portion of the tube sheet, which is doubled, and thus brings four thicknesses together. Naturally, with this system, a construction as

applied to a new boiler is so arranged as to do away with the sharp angles.

It is also to be noted that the tubes are expanded into copper ferrules of .06 in. thickness, set in the sheet as is common practice with steel tube sheets. The copper portion of the tube sheet is held by copper staybolts, and not of iron, for experience has shown that the heads of iron staybolts will sink down into the copper.

Liability for Injuries to Live Stock.

BY JOHN EDSON BRADY.

The responsibility in damages of a railroad company for injuries to live stock, which manage to get upon the company's right of way and in the path of its trains, varies greatly according to the jurisdiction in which the question comes up. Practically every state has upon its statute books enactments intended for the government of the liability of railroads in such cases and, though the same statutory provision is occasionally found to exist in several states in substantially the same form, but very few states are found to have the same general combination of statutes regulating the matter. To this cause may be partially attributed the wide diversity of rules of legal liability found in the different states.

The one general proposition which is supported by the decisions of all states is that there must be negligence on the part of the railroad company in order to warrant a recovery of damages for animals killed or injured by the company's trains. But this general harmony is of slight extent, for there is no similarity among the various jurisdictions as to what may or may not constitute negligence. For instance, there are statutes in many states which declare that a railroad company shall be presumed to have been negligent upon a showing that an animal has been run into and injured while on the tracks of the company. These statutes make out a *prima facie* case of liability against the railroad and place upon the company the burden of overcoming the presumption of negligence. The introduction of sufficient proof to establish the company's freedom from negligence will, of course, always act as a rebuttal of the statutory presumption. Thus, in an action to recover damages for the killing of two horses by the defendant's train, testimony in the company's behalf that the animals were killed by a passenger train in the night time, when the train was running at a rate of sixty miles an hour or more, and that, under the circumstances, it was impossible to stop the train in time to avoid injury, although it was thoroughly equipped with proper appliances, is sufficient to overcome the *prima facie* case of negligence made under the statute. (Felter vs. Anderson [Kentucky], 66 S. W. Rep. 182.)

The legislatures of a number of states have, at different times, enacted laws under which the owner of live stock was permitted to hold a railroad company absolutely liable for damage to his stock by the company's locomotives or cars, without any regard to the actual negligence of the company's agents and irrespective of whether the company had complied with its statutory duty to fence its right of way or whether such a duty was in fact imposed. But, fortunately, such statutes have been uniformly declared unconstitutional on the ground that their enforcement would amount to a taking of the property of railroads without due process of law. A fair example of the class of statutes referred to is one which became a law of the state of Alabama in 1877 and provided, "That from and after the passage of this act, all corporations, person or persons, owning or controlling any railroad in this state, shall be liable for all damages to live stock, or cattle of any kind, caused by locomotives or railroad cars." Under such a statute, no matter what prudence and skill those having charge of a train might employ, the railroad company would be liable for any damage to live stock without opportunity or right to defend. It would be necessary to establish two facts only in order to authorize a recovery of damages from the railroad company, viz.: ownership of the animals and injury by the locomotives or cars of the company. In declaring the Alabama statute, quoted above, unconstitutional, in the case of Ziegler vs. S. & N. Alabama Railroad Company, 58 Ala. 599, the Supreme Court of that state said: "We have said above that the statute under discussion dispenses with all proof of the most material element of the wrong it seeks to redress. It declares that the railroad corporation shall make reparation for an injury inflicted in the authorized prosecution of its lawful business, without a semblance of fault, negligence or want of skill in its employees; an injury, which no human prudence or foresight could prevent; and yet, the statute will not allow the railroad to exculpate itself, by proof of the highest qualifications and the most watchful vigilance. This falls short of due process of law. We have heretofore declared a rule which exacts from railroad corporations a high degree of skill and diligence, to prevent injuries to persons and property. We have no wish to modify that rule. But when these very useful corporations conform to this strict rule of diligence, we can perceive no reason, in law or morals, for holding them to a stricter measure of accountability for inevitable misfortunes, than would be exacted from natural persons for injuries which result from unavoidable accident, or accidents which no human prudence can foresee or avert." Statutes, similar in character to the Alabama provision, have been declared unconstitutional in Colorado, Florida, Idaho, Montana, Nebraska and Utah.

The legislatures of several states, including Illinois, Indiana, Kansas, Missouri, Montana, Tennessee, Utah, Vermont, Wisconsin and Colorado, have adopted a statute which imposes upon railroad companies the duty of erecting and maintaining fences and declares them to be liable for any injury to live stock in event of a default in the performance of the duty to fence. The statute in this form, while undeniably less harsh than the Alabama statute mentioned above, nevertheless holds the railroad corporations to a fairly strict liability. These statutes have generally been stamped with the approval of the courts when the question of their constitutionality has been raised.

The Missouri statute, rendering railroads liable for double the amount of damage to animals occasioned by the failure of the company to construct or maintain fences and cattle guards, was passed upon by the Supreme Court of the United States in the case of Missouri Pacific Railway Co. vs. Humes (115 U. S. 512), wherein an action was brought to recover double damages, provided for in the statute, for the loss of a mule valued at $135. The defense was that the statute was void in that it violated the constitution of the United States as well as that of the state of Missouri, amounting to a deprivation of property without due process of law. But the statute successfully stood the scrutiny of the learned tribunal before which it came for examination and was held to disclose no constitutional defects. "The omission to erect and maintain such fences and cattle guards in the face of the law," said Mr. Justice Field, who delivered the opinion of the court, "would justly be deemed gross negligence, and, if, in such cases, where injuries to property are committed, something beyond compensatory damages may be awarded to the owner by way of punishment, the legislature may fix the amount or prescribe the limit within which the jury may exercise their discretion. The additional damages being by way of punishment, it is clear that the amount may be thus fixed; and it is not a valid objection that the sufferer instead of the state receives them. This is a matter on which the company has nothing to say. And there can be no rational ground for contending that the statute deprives it of property without due process of law."

In an action to recover damages from a railroad company upon a cause of action such as is within the contemplation of this article, a defense which is interposed more frequently than any other is that of the contributory negligence of the owner of the injured property. For the purpose of taking up the efficiency of this defense under various circumstances it is necessary to divide the cases into two classes, namely: (1) cases in which the railroad was properly fenced at the point where the injury occurred or in which no duty to fence was imposed by statute; (2) cases in which the company failed to fulfil a statutory duty to fence. In cases belonging to the first of the two mentioned classes, that is where the question of liability may be determined independently of any statutory obligation to erect and maintain fences, the ordinary rules of contributory negligence apply and where it is shown that the negligence of the owner of the animals contributed to the cause of the injury there can be no recovery against the railroad. The chief difficulty lies in reaching a satisfactory conclusion as to whether a certain set of facts show the presence of contributory negligence. Driving cattle across the tracks of a railroad without taking the precaution to look and listen before doing so has been held to constitute contributory negligence. (McGill vs. Minnesota, etc., Railroad Co., 85 N. W. Rep. 620.) And it has been decided that a recovery of damages is barred by proof that the plaintiff walked behind a wagon, to the rear of which two cows were tied, when approaching a crossing, instead of remaining on the seat of the wagon in control of the horses. (Snell vs. Minnesota, etc., Railroad Co., 91 N. W. Rep. 1108.) But allowing animals to enter and remain upon the unenclosed lands of another is not contributory negligence (Texas, etc., Railway Co. vs. Seay, 69 S. W. Rep. 177), nor is the leaving open of a pasture gate, with the knowledge that a cattle guard at a nearby crossing is defective. (Herrell vs. Chicago, etc., Railroad Co., 90 N. W. Rep. 1071.)

As to whether it is contributory negligence to allow stock to run at large, the authorities are at variance. In the absence of any statute making it unlawful to allow cattle to run at large and of any legal requirement as to the erection of debarments it is held that the owner of cattle is guilty of contributory negligence if he allows them to become trespassers upon the right of way of a railroad company in Indiana, Maryland, Michigan, Minnesota, New York, New Jersey, Pennsylvania and Rhode Island. On the other hand, in Alabama, California, Florida, Illinois, Iowa, Kansas, North Carolina, Ohio, Texas and other states it is not contributory negligence to allow stock to be at large. But where animals are unlawfully at large, for instance, where the owner allows them to run at large in a town or elsewhere when their being at large is prohibited by statute, such violation of the law constitutes contributory negligence and, under these circumstances, a recovery of damages

cannot be had. The authorities are practically unanimous on this point. However, it has been held that this rule does not apply when the animals are at large through no fault on the part of the owner. (Toledo, etc., Railroad Co. vs. Johnston, 74 Ill. 83.)

In cases belonging to the second of the two classes mentioned above, that is where the railroad company's failure to maintain proper fences under a statute is a factor, the decisions are again irreconcilable. The statutes of California and Oregon provide that in actions for injuries to animals, grounded upon laws requiring railroads to fence, the plaintiff's contributory negligence bars a recovery, while in Iowa it is expressly declared by statute that contributory negligence in such a case is no defense. The other jurisdictions are about evenly divided upon the question of whether an owner of animals injured by trains, who is shown to have been contributorily negligent, is entitled to recover damages from the railroad company.

The Barnes Skimmer and Blow-Off Valve.

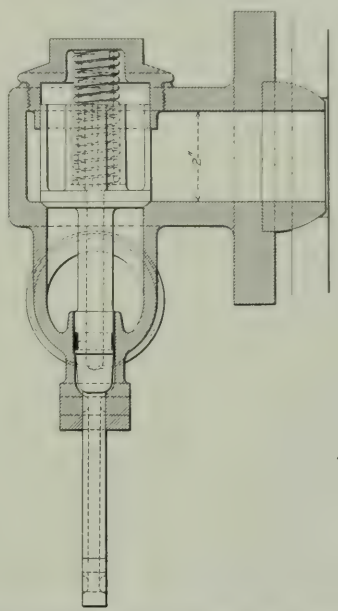
Somewhat more than a hundred locomotives on the Wabash Railway are equipped with a skimmer and blow-off valve designed by the Superintendent of the locomotive and car departments, J. B. Barnes. The idea of using a skimmer for the removal of the sludge that rises to the surface of a boiler using water impregnated with carbonates of the calcium and magnesium compounds, is old in stationary practice. It is also successfully used where non-incrusting solids that are the compounds of the alkalies are present, and which, when present in excessive quantities cause foaming. It is believed by some that "boiler-foaming takes place only in the presence of particles of matter suspended in the water." Skimming, therefore, serves to collect such particles as may come to the surface and remove them through the blow-off. It is, in fact, a surface blow-off that draws from a wider extent than a simple pipe could be made to do.

Attempts have been made, from time to time, to apply the skimmer to the locomotive, but its inaccessibility, the jars to which it is subjected and the great difficulty of cleaning has made all former attempts at its application unsuccessful.

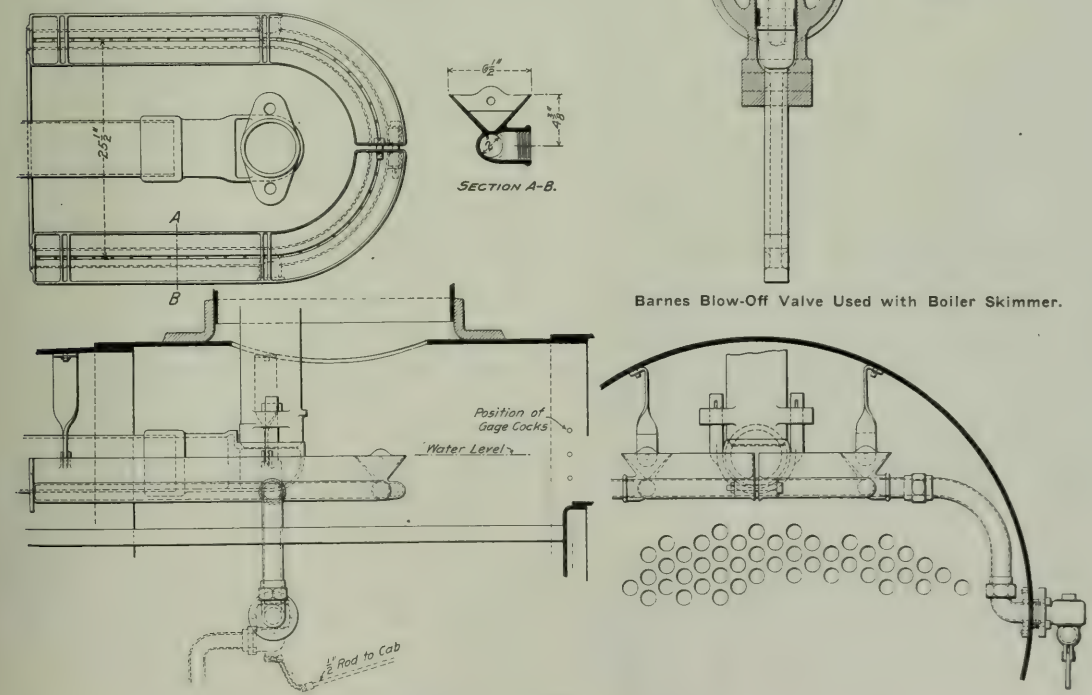
The Barnes skimmer that is used on the Wabash is exceedingly simple in construction and reports indicate that it is successful in operation. It consists of a pan U-shaped in plan extending down each side of the shell and with the legs coming together back of the throttle valve. In cross section it is V-shaped, ending in what is practically a 2-in. pipe, that has a large number of $^{5}/_{16}$-in. cored holes at the top and running into the bottom of the V. This is 6½ in. wide at the top and 4⅜ in. high, and is set with the top edge flush with the center of the middle water gage. The whole is formed of two castings that are bolted together at the center back of the throttle. It is carried by four hangers held to the shell by studs.

A 2-in. outlet is placed upon each side and connected with a blow-off valve, also designed by Mr. Barnes. This valve is of brass with the exception of the lever, which may be of either malleable iron or cast-steel. The valve itself is cast solid with the stem, the part above the seat having four wings which fit into a projection of the cap nut, that forms a guide, which with the stem passing through the valve body insures the proper seating of the valve. A spring above the valve makes it impossible for the valve to remain open when the lever is released. The passages are of large size and with a valve lift of ½ in. there is an ample allowance for a free outrush of water that will carry any sludge floating near the skimmer out with it.

The blow-off valve is manipulated by a rod extending back to the cab, where it is within easy reach of the engineer or fireman. The waters used, where this skimmer has been put in use, are impregnated with the carbonates and sulphates of lime and magnesia, with some chloride of sodium or common salt; just the combination to produce a sludge and foaming. It was first put upon an Atlantic engine with a 64¼-in. boiler in passenger service, and in a record of about a month from Oct. 26 to Nov. 23, 1906, it ran 1,000 miles without the skimmer and was washed out eight times; it then ran 8,173 miles with the skimmer and was washed once, thus effecting a saving of seven washings with a gain of 7,173 miles of service. As it costs $1.50 to wash a boiler, the saving in this item alone was $10.50. It is also estimated that about 1,000 lbs. of fuel are consumed for each washing which would have cost $4.80 more. Then there is the rental value of the engine which is placed at



Barnes Blow-Off Valve Used with Boiler Skimmer.



Application of Barnes Boiler Skimmer.

$15 a day, so that on the whole it appears that in one month the skimmer saved $15.30 in cash and something more than $30 in estimated rentals, which was considered a good dividend on the cost of application, $35.

At the end of the time for which the record was taken it was found that there was 1½ in. of mud in the bottom of the boiler and 8 in. in the leg of the firebox, with the crownsheet in first class condition.

The Hedjaz Railroad.

In 1900 the Turkish government began the building of a railroad from Damascus to the holy city of Mecca. Its total length will be about 1,120 miles, of which 440 had been built by the end of 1906, and the remaining 680 will be completed in course of time. Officially it is known as the Hedjaz Railroad, taking its name from that of the Arabian province through which it passes. For its construction no loans, foreign or domestic, have been raised. The labor for the grading is furnished by the army and the money necessary for bridge and masonry construction, superstructure, rolling stock and station building is obtained from the pious contributions of the faithful. It is an indication of the hold of the religion of Mohammed on the people, that these contributions are regularly bringing in $1,555,000 annually, and each year the road advances 60 to 100 miles. Not only does religious enthusiasm furnish funds and animate the troops employed, but it even deters the Bedouin from interfering with the work.

The road has a general southerly direction, and 300 miles south of Damascus enters the arid region. Here the difficulties of construction increase as the road advances due to the scarcity of water and the necessity of transporting everything required by man or beast either by train or caravan. These conditions continue till Medina is reached, 840 miles south of Damascus. The route follows quite closely that of the great Pilgrim road to Mecca. Indeed, the important points of the territory to be traversed were originally determined by engineers traveling as pilgrims with the holy caravan. The plan of operations is for a reconnaisance party to map out the country 90 miles ahead of the end of the road. This is followed by a locating party, whose notes are forwarded to a technical bureau with headquarters at the last large station of the already completed road, where the details of construction are worked out.

The distribution of the working parties is as follows: Three battalions of infantry, 3,000 men, are utilized for grading (earth and rock work), each man receiving an addition of 5 to 15 cents to his ordinary army pay. Contractors, mostly Italians or Austrians, construct the culverts, bridges, tunnels, buildings, etc., at stations, in short, carry out all work requiring mechanical ability. Two railroad battalions put in place a bedding of broken stone, place ties and lay rails. A company of pioneers brings up the rear, whose duty it is to finish up the roadway. For the telegraph line part of a telegraph company is detailed.

The gage of the track is 3 ft. 5½ in. At first wooden ties were used, but proving unsatisfactory in the dry and hot climate, their use was abandoned in favor of iron ties. Rails weigh 43½ lbs. and the superstructure (ties, rails and fittings) average 218 lbs. per running yard. The rolling stock consists of 43 locomotives, 522 freight and 31 passenger cars. Ordinarily it is nearly all employed for construction purposes, but at the time of the Great Pilgrimage to Mecca, it is all devoted to the transportation of pilgrims. At that season five large pilgrim trains leave daily, the large quantity of water, provisions, riding and pack animals required for the journey to Mecca having been accumulated in advance at the point of departure of the caravan.

The railroad employees, engine runners, firemen, station men and section hands are mostly natives, and they are not very satisfactory.

The engineer at the head of the enterprise is Meissner Pascha, a German officer who has had large experience in connection with railroad work in Turkey. While at first a large number of foreign engineers were employed, these have gradually been replaced by Turkish officers and young Turkish engineers who have been trained at technical schools, so that at the present time they form the greater part of the engineering staff.—*Zeit. d. v. Deutscher Eisenbahnverw'ng.*

Railroad Fire Extinguishers in Massachusetts.

The Massachusetts Railroad Commission recently examined various devices for extinguishing fires which had been presented for approval, according to law, by the railroads—There were five different types of apparatus. The New York, New Haven & Hartford, the Hoosac Tunnel & Wilmington and the Central Vermont presented liquid extinguishers; the Boston & Maine and the Boston & Albany, dry powder extinguishers. The types presented by the New Haven and the Hoosac Tunnel & Wilmington were approved, but that of the Central Vermont was not approved. In order to make a comparison between the dry and liquid types of extinguishers, the Boston & Maine and the Boston & Albany were ordered each to equip 100 cars with some form of liquid fire extinguishing apparatus, using dry extinguishers on other cars. The liquid apparatus prescribed by the board must have a capacity of at least three gallons. The different companies are to report at the end of a year the results of their experiences with the different extinguishers.

The Value of Good English to the Engineer.*

Technical men are peculiarly prone to offend in the use of their mother tongue, because they have not, as a rule, read deeply in classical literature or been instructed thoroughly in the construction of the language. Their higher education is generally almost entirely technical. Yet the character of the technical man's language is important in his social and business intercourse; in his business and professional correspondence; in the promulgation of orders, rules and regulations for the guidance of those under his direction; in the preparation of specifications, contracts and reports; in writing and delivering addresses and technical papers; and in writing technical books for the advancement of his profession. A technical man is, presumably, an educated man, and if he does not speak and write like one, suspicion is cast upon the entire range of his learning. When a man cannot spell correctly, or use ordinarily good grammar, it is difficult to convince others that he is professionally able. There are many vocations in which it is not essential that a man be cultured and intelligent; but the technical professions are not among them. Nothing so surely marks a man's secret habits of thought, his real character, as the little tricks of speech which are exhibited when his mind is on the matter rather than the manner of his speech.

In business correspondence the value of good usage is still more manifest than in conversation, since the written word is permanent, and correspondence greatly extends the field of one's intercourse. A letter often passes through many hands and multiplies the good or bad impressions it produces. If its import is not clear, it may cause disagreement or involve serious financial disadvantage. Even bad punctuation will often seriously alter the entire meaning of a sentence, and bad grammar in particular at once stamps a writer as being something of an ignoramus. The art of letter writing, like a knowledge of grammar, is commonly considered to be within the range of everyone; but anyone who has had large experience in business correspondence knows that few men write good letters. It is so rare to find a matter which is composed of more than one or two items, clearly, concisely and thoroughly discussed in a letter that favorable attention is immediately attracted to its writer. Not a few men owe the opportunity for advancement to their ability to write a good letter.

The detrimental results of bad English in conversation or in correspondence are by no means as great as in formal technical articles. Every normal, healthy-minded technical man desires to leave a permanent record of the results of his best thought and work to aid his co-workers and those that come after him. An ably written description of work performed, discoveries made, or methods developed accomplishes more for the advancement of science than many well designed and well executed works. In the preparation of articles for the technical press, and papers for the learned societies, there is time to study form and style and to eliminate errors due to haste; hence, when such matters are ill written, it is not unfairly argued that the writer is ignorant of the correct use of the language. Such an opinion is exceedingly detrimental to the writer. It weakens his arguments, causes him to be misunderstood, or so detracts from the interest of his readers that the matter is not read. The idea that a technical paper is dry at best, and that the English employed in it is of small consequence has long been proved incorrect. Certain of the better magazines print only carefully selected matter and reject everything but scholarly, well written articles. Their influence upon the language is quite as good as that of the better books of the day; but the well written article costs more money than the "pot-boiler," hence, the magazine is more expensive, its circulation is limited, and it influences a smaller number of readers than its cheap and less worthy competitor. Yet there is so much nowadays that is well written that no busy professional man is willing to spare the extra time and effort necessary to read and digest an ill written paper.

The style should be crisp and clear. An elegant, showy style is often a sign of lack of breeding. Short words of English origin are invariably stronger and more rugged than their longer and more elegant synonyms which are derived from the Latin or Greek; hence their use is nearly always to be preferred. Simplicity and force demand simple, direct language. The style should be so smooth and so unostentatious that the hearer's attention is not drawn to the language, but is left entirely free to follow the course of the thought.

*By John Lyle Harrington, Consulting Engineer. Abstract of a recent address to the Technological Society of Kansas City, the Engineering Society of the University of Missouri, and the Civil Engineering Society of the University of Kansas.

Track Deformations and Their Prevention.*†

BY G. CUENOT,
Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway.

XIII.

RECAPITULATION AND CONCLUSIONS.

In the first part of this study, I pointed out the principal deformations which track can undergo and which consist of: Creeping, the reduction of gage on tangents, or spreading of gage on curves, the compression of the tie at the supports, the tearing out of the screw spikes, the poor holding of the joint, which produces dislocation of the track and the vertical deformation of the rail.

I have shown that all these deformations, which when taken singly, have only a small influence, exercise, in the aggregate, a considerable effect, as much from the point of view of limiting traffic as from facility of maintenance, and that they prevent the increase of speed on all sections of lines where that increase is desirable. Two principal causes act to produce these deformations: the bending of the cross-tie and the longitudinal movement of the track.

Some eminent engineers, Mr. Coüard notably, who has been the most careful and patient observer, have only imperfectly seen this relation of cause and effect; Mr. Coüard concluded, after having summarized these observations in a series of articles in the *Revue des Chemins de Fer*, that there was occasion for increasing the moment of resistance of the tie, and substituting for the type actually in use a type with reinforced section much more rigid. This conclusion, set forth in 1897, was a logical one; it contradicted in some respects the interpretations of a group of engineers, notably represented by the Germans, who thought that the loaded cross-tie rested completely on its bed of ballast, and that consequently the pressure was transmitted integrally over this bed, here more, there less, according to the sinking of the ballast or the deformation of the cross-tie. I believe that I have shown experimentally the error in this theory. The non-loaded cross-tie placed under the best conditions of stability rests on its extremities; under the effect of the load, it is deformed and is moulded in the ballast. The ballast subsides little by little, and finally takes the form of the deformed cross-tie. The subsoil reacts more or less according to its nature, and that is what gives to it the illusion of that elasticity, which has been freely ascribed to the ballast.

But the cross-tie does not transmit to all points of its bed the pressure arising from the load which is applied to it. The zone of influence of the load is very limited, scarcely 13.78 in. to 15.75 in., from its point of application. This follows a general law, already partly defined, notably by Mr. Mesnager, Engineer of Bridges and Highways, in charge of the laboratory of the school, who has demonstrated that, in pugging, in connection with beams, the entire length of the pugging should not enter into the computation so as to reduce the section of the beam, as the zone of influence of the load is limited. It follows that on a movable bed, as that which is made up of the roadbed and the ballast, the application of the load is made over a very small length on each side of the rail; beyond that, not only is there no pressure, but a tendency to a sub-pressure. It is similar to that produced with a substance of small resistance, like turf, where the load causes the soil around the loaded and displaced zone to rise up. Here the phenomenon is clear, but in the case of track it is more hidden.

It is not then necessary to extend a cross-tie beyond a certain limit, and that limit corresponds precisely with the length which gives the minimum deformation of the piece. With that length the maximum of useful effect and the uniform distribution of the load on the ballast will be obtained. This is an appreciable result. If the tamped bed be maintained as originally established, there will be no more such frequent unwedging.

The question of the length to be given to tamping will be solved at the same time. It has not been up to the present time, because the problem, as was stated, did not admit of solution. It has been sought to discover what is the length to be given to the tamped bed under a cross-tie of whatever length, having no relation, on the one hand, with the load, and, on the other, with the gage of the rails. All the solutions were equally good, or rather bad. The problem is indeterminate, because it does not admit of a single solution. It is necessary, as I have pointed out, to reverse the position of the problem and seek the length to be given to the cross-tie, in order that it shall experience the minimum of flexure. The limit to be given to the tamped bed corresponded with this minimum of flexure.

Neither has sufficient attention been paid to the manner in which the tamping should be done; some trackmen do it on the right, while others do it on the left. There is no uniformity in their efforts, and the unequally tamped tie has a natural tendency to become unwedged. Mechanical tamping, which Mr. Albert Collet has rendered practicable, will give, we believe, excellent results, and its general use will be imposed, when it is desired to establish a very stable track always comparable with itself.

But this stability of the track will not yet be complete, if the joints are not redesigned, if we do not fix them firmly and avoid dislocation, which the best and most solid splicing only retards. All that has been attempted up to the present time is to render this splicing more rigid and to bridge it, so to speak, between the two cross-ties of the even joint. Some engineers have been logical; they have drawn the cross-ties of the even joint nearer together, and they have joined them as twins, but few have dared to go to the end, that is to say, to place the cross-tie under the joint in order to support it. They were afraid, doubtless, that they would be reproached for sacrificing elasticity, the vague term which comprehends everything, and for creating hard points. It is the contrary which is true; the hard point is found between two ties. Elasticity is given by the tie, by the sinking in the ballast and the roadbed. It is necessary then to approach the problem resolutely, as established by experience. It is necessary to support the joint by a rigid cross-tie, which will diminish the bending, and consequently the longitudinal movement, the cause of the dislocation of the splicing. It is necessary to draw together the two neighboring cross-ties, to reduce their separation from the joint cross-tie, to prevent the rocking movement which is necessarily produced by too great a spacing.

It remains to select the type of cross-tie corresponding to the general conditions which we have imposed. A rigid cross-tie is necessary, much more rigid than the actual wood cross-tie, which has a resisting moment of about 36, wherever it is desired to increase the speed. This necessity for reinforcing the cross-tie excludes, *ipso facto*, the steel cross-tie in the form of a trough, because its resisting moment can only be increased by adding to the thickness of the metal or to its depth. In the first case, a cross-tie too heavy would be beyond price; in the second case, being too deep, it would no longer be capable of being tamped.

It is possible, then, only to take the wood cross-tie with a stronger section, or else a composite cross-tie (wood and iron, cement and iron, etc.) of a type similar to that which has been experimented with. We can find fault with the high price of the skeleton of the latter, which, being constructed with a special iron, will be expensive to manufacture. The inventors have themselves stated this disadvantage. Mr. H. Michel invented a new model of cross-tie as rigid as the first, but of a more practicable application, because it is composed of commercial shapes of iron at the current price, and because it allows of the design of different types, according to the resistance which it is proposed to obtain. It is easily possible to adopt it in secondary tracks, and obtain a cross-tie whose stability is better and durability longer, without sensible increase in the cost price.

This cross-tie is composed of two pieces of channel iron, or T iron, held together by clamps, between which the wood blocks, which are required for fastenings and as a means for distributing the pressure on the ballast, are squeezed. It presents the same advantages as the experimental cross-tie, and has, besides, the following: easy tamping, exposure of the blocks, readjusted if desired with shims, easy renewal of the pieces. The compression of the elements (wood and iron) is greater than in the first system, because of the tension given to the clamps and to the compression of the wood. It is a beam of armored wood.

In resistance, this new type of cross-tie presents the same superiority as that pointed out above, and which depends on its greater rigidity. The blocks of wood, parallelopiped in form, will be easy to make from the butts of rejected cross-ties. If made of beech, they will be creosoted to refusal, which will render the piece of wood antiseptic. If, on the contrary, the heart of oak is employed, a superficial coat will be sufficient to protect the upper face of the block.

In this type the fastenings will be sufficiently solid, by reason of the compression of the wood, especially if the reinforced metallic plate is adopted, and if care is taken to make the entire width of the collar of the screw spike bear on the base of the rail. The employment of treenails can prolong the existence of cross-ties whose fastenings have become bad, but it will not increase their resistance permanently if the wood is not compressed or sustained by a metallic girth. In every case the metallic treenails seem preferable to the wooden treenails, and are equally good in all other ways.

But, if the employment of cross-ties of the determined length is imposed by reason of the stability of the tracks, and if this necessitates the placing of sustaining shoes at the extremities, it is necessary to guard against indiscriminately employing and mixing short cross-ties with long cross-ties. The disadvantages of simultaneously employing cross-ties of different lengths are many; the track becomes rough, and the deformations which are naturally produced are increased.

Mr. Coüard demonstrated that the greatest deformation is produced at the joint; it can attain 0.79 in., and is due to the allowance which must be made when receiving rails from the mill, an

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†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.

allowance which is 0.02 in. at each of its extremities. The rails present the form of an inclined plane, and the depression, which is 0.02 in. in the beginning, increases with time under the influence of shocks, to 0.55 in. With the variable flexure of 0.12 in. which is due to the same cause, and the compression of the ballast, the total deflection is 0.79 in. The support of the joint and the straightening up of the extremities of the rails, in order to avoid all unequal level from the beginning, are absolutely required.

We conclude, then, that, in order to have tracks in a condition for supporting a heavy and rapid traffic, there are necessary:

First.—Cross-ties extremely rigid, two to three times more than those actually in use, which excludes in every case the employment of cross-ties exclusively of steel in the form of a trough.

Second.—The laying of the track with a cross-tie under the joint, that cross-tie being followed and preceded at 11.81 in. with cross-ties equally rigid.

Third.—The use of reinforced plates.

I do not pretend to give definite solutions, but to point out those which appear to me the most logical, and which promise good results. I have outlined a programme which should be followed up, if only partially, in order to verify the truth of my deductions.

I will be glad to have the experiments which I have made repeated, to have them criticised, to have anyone go back to the foundation of things, not being limited, as is now the case, to simply proving by means of ingenious apparatus the deformations produced. It is without doubt excellent to know them; but is it possible to deduce anything from them if the whole cause which has produced them is not sought for first? To repair the track at each point, where these deformations have appeared, is very well for the moment, but, since one has not been to the foundation of things, since the cause has not been destroyed, but only the effect, all that is left is to recommence and always to recommence, which is the work of Penelope.

I intend to continue the studies which I have commenced, to verify still more the observations which I have made, to corroborate them and to enlarge upon them. I only request to be followed, and that such distinguished engineers as the railroad companies possess put themselves to the work, giving account of the many things yet to be done, and how the actual track should be reinforced, if it is desired to increase the speed of traffic, while maintaining the security which it ought to give.

The Cost of Locomotives, 1890-1907.

BY LAWFORD H. FRY.

A number of statements as to the present cost of locomotives have been given out recently in such a way as to convey the impression that modern developments in the art of locomotive building have so increased the cost of locomotives as to lay a serious burden on purchasers. To endeavor to ascertain the truth in this, the order books of a large locomotive works have been laid under contribution and the figures analyzed as described below.

An analysis of figures of this description is necessarily complex, as, while noting changes in price, consideration must be given to the continued growth in the size of locomotives, and to the developments and improvements in design which make for economy in operation and maintenance. Further, in any examination of comparative prices, attention must be given to the demand in which the commodity stands at the period for which the prices are taken.

In order to show the demand which existed for locomotives in the years taken into consideration, the diagram in Fig. 1 has been prepared. This shows the output of the locomotive works, of which the records are being examined, for the last 23 years. On the same diagram is plotted the total steel production of the United States for the same period. It will be seen that the output of steel and the output of locomotives follow a very similar curve, so that the diagram gives a fair measure of the condition of business throughout the country.

The present time is obviously a period of maximum activity. As a period of similarly vigorous demand about 15 years ago, the year 1890 has been chosen.

At the present time the output is nearly three times that in 1890, but this is attributable to a trebled numerical capacity, and not to a relatively greater demand. The increase in the weight of the locomotives makes the tonnage output nearly six times that of 1890. The diagram also shows the variations of prices for steel billets, gray forge pig iron, and for a general average of a number of commodities. The figures for the iron and steel production and prices are taken from the report of the American Iron and Steel Association, while the prices for the general commodities are from Bulletin 69 of the Department of Commerce and Labor. The position of these various curves indicates that at the present time the cost of materials is somewhat higher than in 1890.

The locomotives chosen for comparison are the heaviest freight and passenger locomotives shown by the records as built in the year 1890 and as ordered for the first six months of 1907. Between these two periods there has been a great increase in the size of locomotives, and considerable change in the type employed. The heaviest freight engines of 1890 are moguls with 19-in. cylinders and an average weight of 102,700 lbs., and consolidations with cylinders from 20 to 22 in. in diameter and an average weight of 119,000 lbs., At the present time the heavy freight locomotives are consolidations with cylinders from 22 to 24 in. in diameter, and an average weight of 202,000 lbs. Still larger engines, such as the Santa Fe type (2-10-2), weighing 280,000 lbs., and the Mallet type weighing 350,000 lbs., are also used.

For passenger service the development has been even more striking. The eight-wheel four-coupled American type has been almost entirely superseded for heavy main line passenger service by the Atlantic and Pacific types, the average weight increasing from 93,000 lbs. to 199,000 and 225,000 lbs.

Table 1 shows the number of locomotives taken as a basis of comparison, and gives also the number of railroads represented.

Table 2 gives the average price per pound for the freight locomotives mentioned above. The prices here, as elsewhere throughout the present article, are the actual selling prices of the complete locomotive and tender, divided by the weight of the locomotive in working order. This working order weight of the locomotive is chosen as a basis of reference, because, for engines of a given type

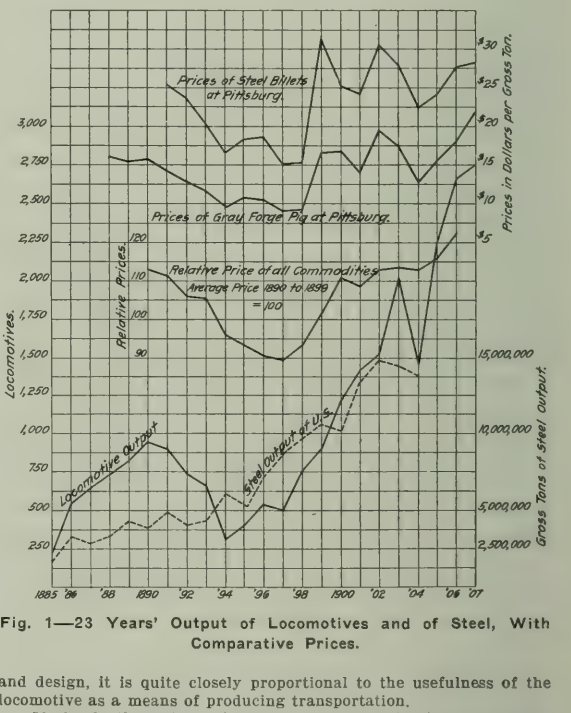


Fig. 1—23 Years' Output of Locomotives and of Steel, With Comparative Prices.

and design, it is quite closely proportional to the usefulness of the locomotive as a means of producing transportation.

If simply the weight of material employed in the construction is taken into consideration, the price of a modern consolidation locomotive and tender is found to be about 7.7 cents per pound of dead weight, while taken separately the locomotive costs about 8.3 cents and the tender about 5 cents a pound.

The relation between these prices per pound of dead weight, and the prices per pound of locomotive in service, will not show any great variation from one period to another, and the service-weight prices are therefore chosen for the purposes of the present article, as they represent more nearly the cost to the purchaser of the useful power of the machine.

It will be seen that table 2 shows a considerable reduction in the price of locomotives from 1890 to the present time. The mogul of 1890 cost 8.89 cents a pound, while the most powerful modern engines can be purchased for less than 8 cents a pound. The average price for consolidation locomotives in 1890 was 8.55, while to-day it is reduced to 8.26 cents a pound. This is merely a comparison of the prices as they stand, and takes no account of the improvements which have been introduced into design and construction. One of the most important changes is the increase in boiler pressure. In 1890 the pressures used were from 130 to 160 lbs. per sq. in. The pressures to-day are from 180 to 220 lbs. per sq. in. From this change results an increase of from 15 to 20 per cent. in the efficiency, per unit of weight. That is, with two locomotives

of the same weight, the modern high-pressure boiler by reason of its higher efficiency, would be capable of developing from 15 to 20 per cent. more power. Hence, if the price for 1890 is to be compared directly with that for 1907, it must be increased about 17½ per cent., so that taking the power into account the average price for 1890 stands at about 10 cents a pound, while the average price for 1897 is 8.26 cents a pound.

The diagram in Fig. 2 shows the variation of price in relation to weight for consolidation locomotives at the present time. The points plotted as circles show the actual prices per pound of total weight for 19 modern consolidations of weights ranging from 73,000 lbs. to 213,000 lbs. in total weight. The prices of these engines as plotted show considerable variation, but at the same time there is a well marked tendency for the price per pound to fall as the weight increases. The curve drawn may be taken as representing

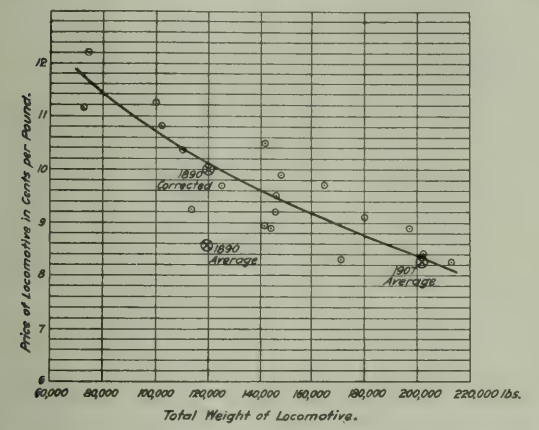


Fig. 2—Relation Between Weight and Price; Consolidation Locomotives.

with sufficient accuracy the relation between the price and the weight. On the same diagram are also plotted the average prices for heavy consolidations in 1890 and 1907, as given in table 2. It will be seen that the corrected price for 1890, and the present average for the heavy consolidations, both fall on the curve of mean prices obtained from locomotives of all weights.

If the cost of operation is taken into account, the economy gained by the development from 1890 to the present time becomes even more apparent. This is shown in table 3.

The average heavy consolidation in 1890 weighed 119,000 lbs., and at 8.55 cents a pound cost $10,175. The modern heavy consolidation averages 202,000 lbs. in weight, and at 8.26 cents a pound costs $16,685. The weight is increased 70 per cent., and since the efficiency is 15 per cent. greater, the power available is 95.5 per cent. higher. The power is practically doubled with an increase in price of only 64 per cent. These figures, as shown by table 3, give a reduction of 16.2 per cent. in the price per unit of power.

The cost of operation is calculated on the basis of the figures given by Mr. Berry, Chief Engineer of the Union Pacific.* For four years on this road the actual charge for locomotive operation amounted to 32.45 per cent. of the total cost of operation.

The details of the charge are shown below, as percentages of the total cost of operation and of the cost of locomotive operation.

	As per cent. of total cost of operation.	As per cent. of cost of locomotive operation.
Repairs and renewal of locomotives	10.19	31.4
Engine and roundhouse men	10.10	31.1
Fuel for locomotives	10.80	33.3
Water, oil, waste, etc., for locomotives	1.36	4.2
	32.45	100.0

*"The Cost of Locomotive Operation," by G. R. Henderson, p. 2.

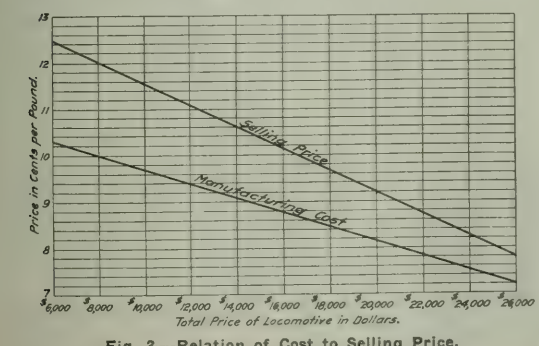


Fig. 3—Relation of Cost to Selling Price.

The change in these items when the small locomotive of 1890 is replaced by the modern machine with 70 per cent. more power and 15 per cent. greater efficiency is shown in table 3. The cost of repairs and renewals is practically proportional to the power developed. The number of men required for running and cleaning is practically independent of the size of the locomotive.

The cost of fuel is increased in proportion to the increase in size, the increase in efficiency giving the further increase in power without an increase in the fuel consumption. The cost of water, oil, etc., may be taken as proportional to the power developed.

From the above it follows that while the cost for the crew remains the same for the large as for the small locomotive, the costs for repairs and for oil and waste increase 95.5 per cent. in proportion to the increase in power, and the cost of fuel increases 70 per cent. in proportion to the increase in size. This results in an increase of 57.3 per cent. in the cost of operation, while the power developed is increased 95.5 per cent. Consequently, for the modern engine the cost of operation per unit of power is 19.5 per cent. less than for the small and older machine. As was shown above, the prime cost per unit of power is to-day 16.2 per cent. less than in 1890.

The comparisons instituted above have taken account only of consolidation locomotives for both periods. The advantage of the present day is still more strongly shown if account is taken of the mogul type, which was largely used for freight service in 1890, and which has been now practically superseded by heavier and more economical types.

Comparative prices for the passenger locomotives are given in table 4. It will be seen that as the figures stand, they show a slight increase in the price per pound for the single-expansion Atlantic type locomotives in 1906 and 1907, compared with the American type locomotives of 1890; while the balanced compound Atlantic type and the single-expansion Pacific type engines of 1907 show a reduction in cost, which is most marked in the case of the last mentioned type. Among the passenger locomotives the power is better measured by the heating surface than by the total weight, and the prices of these engines are therefore given per square foot of heating surface as well as per pound of weight. On this basis the economy of the modern locomotives is more strongly marked. The growth in size and efficiency will, as in the case of the freight engines, reduce the cost of operation, the percentage of economy being even greater than that shown by the freight engines. The reduction in the price per unit of power amounts to 13.5 per cent. for the single-expansion Atlantic type, 21.6 per cent. for the balanced compound Atlantic type, and 26.6 per cent. for the Pacific type. The reductions in the cost of operation are 21.5, 25.6 and 26.6 per cent. respectively for the three modern types.

The economies which the purchaser secures by the use of the large modern locomotives are due partly to their mechanical advantages, and partly to the commercial fact that it is impossible for the manufacturer to increase prices at a rate commensurate with the growth in the size of the locomotives and the increases in the cost of manufacture. The diagram in Fig. 3 illustrates the tendency of the selling price to approach the cost of manufacture as the total cost increases, thus reducing the percentage of profit.

The same principle operates in the case of increases in the cost of manufacture, by reason of a rise in the price of labor or of raw materials. The manufacturer, by reason of the exigencies of competition, cannot secure an increase of price of the same per cent. as the increase in cost, and he is consequently forced to accept a continually decreasing return on his invested capital.

In building locomotives or other heavy machinery, the cost of labor is the controlling factor. The locomotive builder's charges cover cost of materials, cost of labor, return on capital. The return obtainable on the capital, as seen above, has a constant tendency to decrease, and consequently any increases in the cost of the machine is brought about by an increase in the cost to the builder, of the materials or of the labor. On further analysis it will be seen that the cost of the materials is mainly dependent on the price which the manufacturer of them has to pay for the labor he employs. The cost of all material used in locomotive construction is mainly the following items:

a. Cost of labor.
b. Cost of transportation.
c. Royalties and return on capital.

Inasmuch as none of this material is the subject of a monopoly, the cost of royalties and the return on the capital invested, are held to a level by the force of competition. The cost of transportation tends to decrease rather than to increase, and the only item

of cost which is open to an uncontrolled rise is the remuneration demanded by labor. This is merely saying that the price of commodity is determined by the relation between supply and demand, and that in the production of engineering materials in this country, labor is the only factor of which the supply is sufficiently restricted to make possible an increase in the price with an increase in demand. Royalties on any material are obtainable by those controlling the processes of manufacture or the source of supply, but of the materials employed in locomotive building none are monopolized. There is always an alternative process of manufacture, or an article which may be substituted to avoid excessive patent royalties, and the sources of supply are varied enough to meet all demands. The return claimed by the invested capital is at all times held down by the very keen existing competition, and by the ease with which capital could be secured for further competition if the returns were at any time forced above the normal. The transportation charges are held down by competition and consideration of what the traffic can bear. There is, however, not an unlimited supply of engineering labor, and as prosperity in the country demands an increased output, labor is able to take advantage of this condition and increase the remuneration required.

TABLE 1. *Number of Locomotives and Railroads Compared.*

Year.	Locomotives. Class of	No. of.	Number of railroads.	Av'g total weight in lbs. of locomotive in working order.	Cylinder diam. & No. of locos. hav'g each diameter— Cyl'd'r diam.	No. of locos.
1890	Mogul	61	6	102,700	19	61
1890	Consolidation	159	14	119,000	20	3
					21	17
					22	3
1890	American T.	19	6	93,000	18	14
					19	2
					20	3
1907	Consolidation	185	14	202,000	24	3
'06-'07	Santa Fe.	..	..	280,000	Comp.	..
'06-'07	Mallet	..	..	350,000	Comp.	..
1907	Atlantic	30	3	199,000	Bal. Comp.	..
1907	Pacific.	128	4	225,000	22	128

TABLE 2.—*Prices of Heavy Freight Locomotives.*

Year.	Type of locomotive.	Average weight.	Price, per lb.
1890	Mogul single expansion	104,000 lbs.	8.89 cents.
1890	Consolidation single expansion	119,000 "	8.55 "
1907	Consolidation single expansion	202,000 "	8.26 "
1907	Mallet type compound	350,000 "	7.80 "
1907	Santa Fe type compound.	285,000 "	7.70 "

TABLE 3.—*Consolidation Freight Locomotives—Cost of Power and Operation.*

Year.	1890.	1907.
Total weight, in lbs.	119,000	202,000
Total price	$10,200	$16,685
Price in cents per lb.	8.55	8.26
Relative weight	100	170
Relative efficiency, per unit of weight	100	115
Relative power	100	195.5
Cost of operation:		
Repairs and renewals	31.4	61.4
Engine and roundhouse men	31.1	31.1
Fuel	33.3	56.6
Water, oil, waste, etc.	4.2	8.2
	100.0	157.3
Relative price per unit of power	100	83.8
Relative cost of operation per unit of power	100	80.5

TABLE 4.—*Prices of Passenger Locomotives.*

Year.	Type of locomotive	No. represented in comparison. Roads.	Locos.	Average weight, lbs.	Average heating surface, sq. ft.	Av'g price— Per lb.	Per sq.ft. of h.s.
1890	4-4-0 Sim. exp.	7	19	97,000	1,540	8.85c.	$5.65
1907	4-4-2 Comp.	3	30	199,000	3,190	8.82c.	5.50
1907	4-6-2 Sim. exp.	4	128	225,000	3,930	8.31c.	4.76
'06-'07	4-4-2 Sim. exp.	4	18	180,000	2,940	9.20c.	5.63

TABLE 5.—*Passenger Locomotives—Cost of Power and Operation.*

Type of locomotive	1890. Single-expansion. American.	1906-7. Atlantic.	1907. Bal. comp.	1907. Single-exp. Pacific.
Total weight	98,000 lbs.	180,000 lbs.	199,000 lbs.	225,000 lbs.
" heating surface	1,540 sq. ft.	2,940 sq. ft.	3,190 sq. ft.	3,930 sq. ft.
" price	$8,700	$16,550	$17,570	$18,700
Price, per lb.	8.86 cts.	9.20 cts.	8.82 cts.	8.31 cts.
" per sq. ft., htg. surf.	$5.65	$5.63	$5.50	$4.76
Relative weight	100	184	205	230
" heating surface	100	191	207	255
" effic. pr unit w't.	100	115	125	115
" power	100	220	259	293
Cost of operation:				
Repairs and renewals	31.4	69.0	81.4	92.0
Eng. and roundhouse men	31.1	31.1	31.1	31.1
Fuel	33.3	63.6	68.9	79.5
Water, oil, waste, &c.	4.2	8.2	10.9	12.3
Total	100.0	172.9	192.3	214.9
Per unit of power:				
Relative price	100.0	86.5	78.4	73.4
Relative cost of operation	100.0	78.5	74.4	73.4

A Berlin engineer has invented a process for aerating the water in the tank cars in which live fish are transported to market. To make such transportation profitable there must be many fish in a comparatively small quantity of water, and these exhaust the oxygen very much as a throng of animals exhausts the air in an air-tight room or car. The new method avoids this by putting receptacles containing compressed air on the floor of the tank, which discharge air slowly into the water and so make it fit for the consumption of the fishes even when pretty closely packed. Great fish merchants have used such a car between Berlin and the sea, and, it is said, with very satisfactory results. Of course the same method could be applied to tanks in vessels.

Recent Developments in Air Brake Control Apparatus.

BY F. H. PARKE AND S. W. DUDLEY.

The two most important factors in originating and directing the course of the recent rapid developments and fundamental changes in the control apparatus of the air brake have been, 1st, the broadening of the field of its application to include electrically operated railways, and, 2d, the enormous growth in rolling stock of all kinds, and consequent increase in the requirements of train operation.

As recently as three years ago the various standard types of air brakes, which had then for some time been in use, were deemed

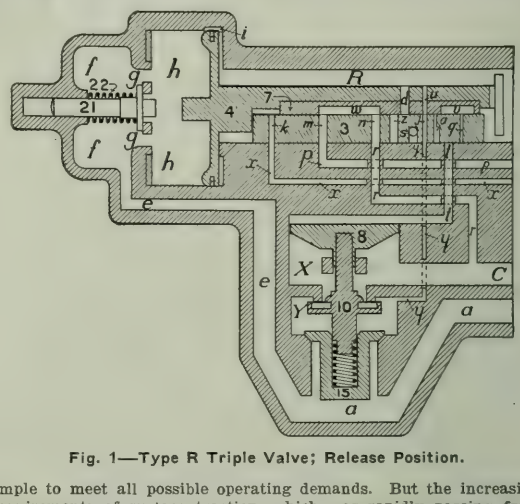


Fig. 1—Type R Triple Valve; Release Position.

ample to meet all possible operating demands. But the increasing requirements of surface traction, which was rapidly passing from almost universal single car operation to that of trains, made it desirable to substitute an automatic brake for the straight-air systems then in general use, which should combine to the highest possible degree the safety of the automatic brake and the flexibility of operation of the simple straight-air control.

THE AUTOMATIC AIR BRAKES.

Before proceeding further, it may be well to describe briefly the principle governing the automatic brake: Each vehicle has a

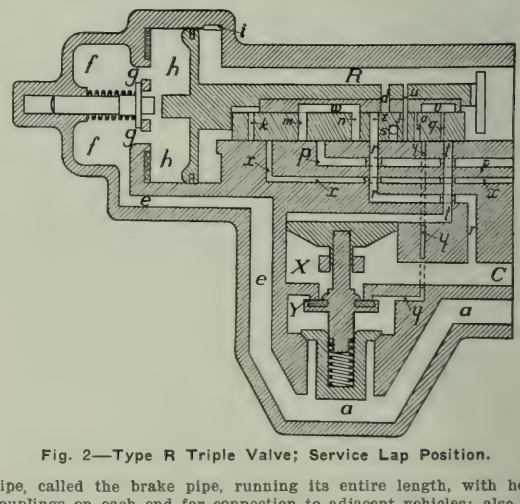


Fig. 2—Type R Triple Valve; Service Lap Position.

pipe, called the brake pipe, running its entire length, with hose couplings on each end for connection to adjacent vehicles; also an auxiliary reservoir, in which is stored the air supply for use in operating the brakes on that vehicle; a brake cylinder with piston and rod, the latter connected to the brake shoes through suitable rods, levers and brake beams; a triple valve which forms the connection between a branch from the brake pipe, the auxiliary reservoir, and the brake cylinder, in such a way as to (1) charge the auxiliary reservoir by connecting it to the brake pipe, (2) apply the brakes by connecting the auxiliary reservoir to the brake cylinder, and (3) release the brakes by connecting the brake cylinder

with the atmosphere. The principal element of the triple valve is a piston, the rod of which moves a controlling slide valve. Brake-pipe pressure is always present on one side of this piston and auxiliary-reservoir pressure on the other, so that the operation of this valve, and therefore of the brakes, depends on the difference between these two pressures. As the brake pipe extends through the entire train, a means is thus provided for operating the brakes on each car from the leading vehicle, namely, by altering the brake-pipe pressure. It is lowered to apply the brakes and increased to release them, thereby embodying the essential feature of an automatic brake, because, if any rupture occurs in the brake pipe or its hose connections, the pressure is at once reduced and the brakes are automatically applied.

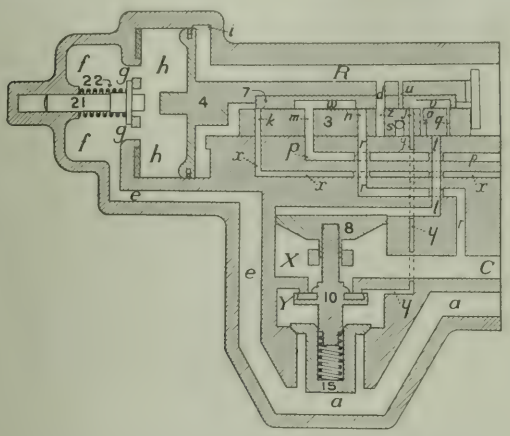


Fig. 3—Type R Triple Valve; Release Lap Position.

THE STRAIGHT-AIR BRAKE.

The straight-air brake, on the other hand, has no auxiliary reservoir nor triple valve. It has no supply stored on each car, nor any pressure in the brake pipe when the brakes are not applied. It depends on the supply stored in a single reservoir on the leading vehicle, which is admitted through the brake pipe directly to the brake cylinders to apply the brakes, and released from the pipe and cylinders to release the brakes. This, of course, means no braking power if any part of the piping system is ruptured even in single car operation, but a very accurate means of controlling the cylinder pressure (in short trains) both in applying and releasing, thereby constituting the feature of flexibility.

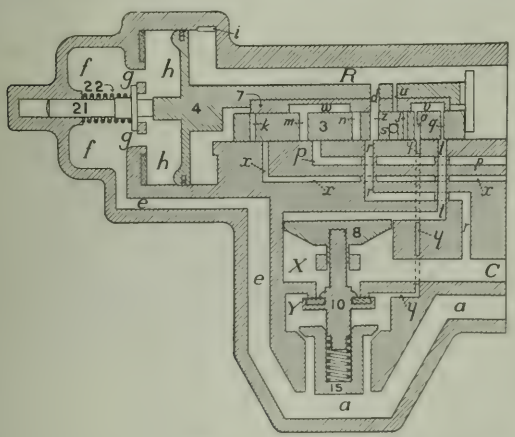
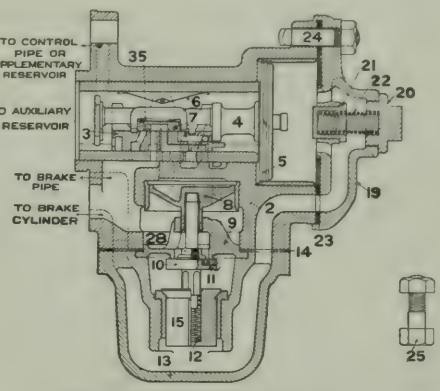


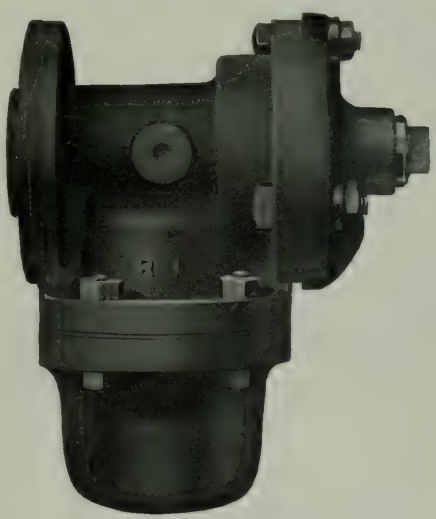
Fig. 8—Type R Triple Valve; Quick Service Position.

The prominent operating feature of the straight-air brake system, which contributes largely to its flexibility, and which until lately has been lacking in the automatic system, is the ability to release the brakes gradually. This enables the operator to approach the stopping point at a high rate of speed and apply the brakes with full power. Then, as the speed is reduced, he is able to accommodate the retarding force to the decreasing amount of energy to be overcome and the increasing coefficient of friction, by reducing the brake-cylinder pressure in a series of steps or graduations. Therefore, at all times, during the stop, there is being exerted a retarding effort which is the maximum permissible at that particular instant consistent with smooth handling and the absence of wheel sliding. Futhermore, this ability to control the release of the brake-cylinder pressure enables the stop to be made with the greatest possible accuracy. These features of operation are essential in a service where fast schedules and frequent stops are required. However, when train operation is introduced, not only is the flexibility of the straight-air system seriously interfered with, but the consideration of safety becomes of prime importance. Any parting of the train or rupture in the hose or piping connections would result in instant and total loss of braking power, and this would be most likely to occur just when full retarding power was most needed.



Section Through Type R Triple Valve.

As the automatic-brake system was primarily designed to meet this contingency and prevent the possibility of such a loss of braking power, it was evident that the time had come when it was necessary to evolve a system which would combine the flexibility of the straight-air with the safety of the automatic system. It was therefore manifest that such a new system must, whatever else was included, have as its fundamental characteristic, the automatic feature. This meant that the automatic brake as then known would have to be so modified as to include the principal features of flexibility characteristic of the straight-air systems, viz.: the graduated release, and the ability to make brake applications in rapid succession. This latter feature depends on the rapidity with which the auxiliary reservoirs can be recharged, after an application and release are made. Consequently the two necessary features to be incorporated in the old automatic brake were the graduated release and quick recharging of the auxiliary reservoirs. This meant a



Type R Triple Valve.

modification in the triple valve to include the points mentioned in addition to the functions which it already performed.

GRADUATED RELEASE.

Considering first the means adopted to secure a graduated release: The operation of the triple valve is governed by the difference in brake pipe and auxiliary reservoir pressures, acting on the opposite sides of the triple valve piston. To apply the brakes, a reduction in brake-pipe pressure is made, which leaves a higher pressure on the auxiliary reservoir side. The piston is consequently forced toward the lower pressure, carrying with it the attached slide valve which in its movement opens communication between the auxiliary reservoir and brake cylinder. This causes the pressure in the reservoir to be reduced, by the flow of air to the brake cylinder,

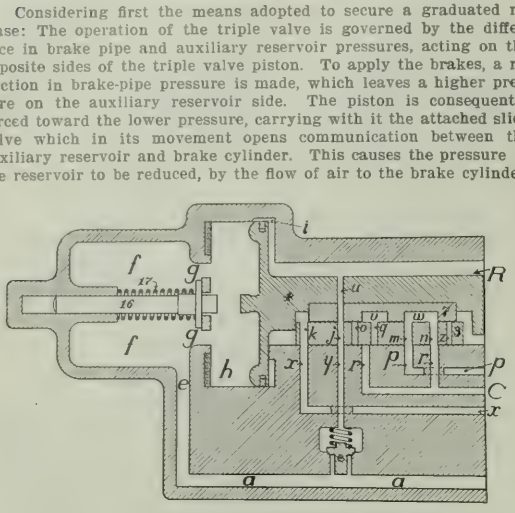


Fig. 4—Type T Triple Valve; Release Position.

until it has fallen to slightly below that remaining in the brake pipe. The pressure on the brake pipe side of the piston being now slightly in excess, the piston and slide valve are moved back sufficiently to prevent further change of pressure.

In order to release the brakes, when thus applied, an increase in brake pipe pressure is necessary. This will force the piston and slide valve back to its normal or release position, allowing the brake cylinder pressure to escape to the atmosphere, and at the same time recharging the auxiliary reservoir. This would continue until the brakes were wholly released, and the reservoirs fully recharged, unless in some way the triple valve piston could be moved back from the release position to cut off the exhaust of brake cylinder pressure, and the flow of air to the auxiliary reservoir. This was impossible with the old standard types of triple valves, as the pressure in the auxiliary reservoir was dependent upon the air supplied to it from the brake pipe only, and therefore manifestly it could never exceed the brake pipe pressure during the release or move the piston and slide valve from release position. But suppose that a reserve supply of air at maximum brake-pipe pressure

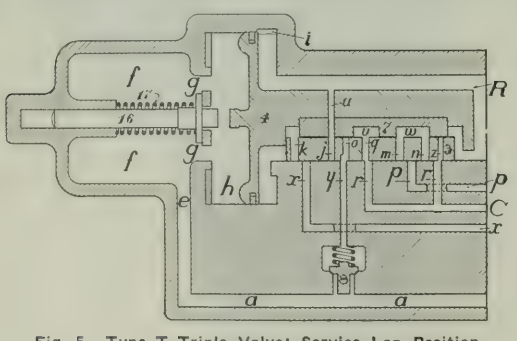


Fig. 5—Type T Triple Valve; Service Lap Position.

is so connected to the triple valve that it can flow to the auxiliary reservoir only when the triple valve piston is in release position, and suppose that after an application, only a part of the reduction is restored to the brake pipe. The triple-valve piston goes to release position, as before, but the connection then made with the reserve supply allows air to flow to the auxiliary reservoir, thus helping to recharge it. If allowed to continue, this would raise the auxiliary-reservoir pressure to that of the reserved supply. But this does not occur, since when the pressure in the auxiliary reservoir slightly exceeds that now in the brake pipe, the triple valve piston is caused to move back from the release position sufficient to cut off both the brake cylinder exhaust and the connection to the reserve supply. In this way partial releases may be made until the brake cylinder is entirely exhausted.

The method employed in working out the above in the actual triple valve is illustrated in Figs. 1 to 7. These views, it must be borne in mind, are purely diagrammatic, bearing no relation to the actual construction of the valve, but showing all the ports and passages in one plane and connected in the simplest possible manner. The different connections to the triple valve are as follows:

Brake pipe at *a*, brake cylinder at *c*, the reserve supply at *x*, while *p* is the exhaust connection to the atmosphere, and *R* is always in communication with the auxiliary reservoir.

It is clear from the illustrations that, as in the standard types of triple valves, the triple valve piston has brake pipe pressure on one side, namely, in chamber *h*, and auxiliary reservoir pressure on the other, namely, chamber *R*.

Suppose the brakes to have been applied by a 15-pound reduc-

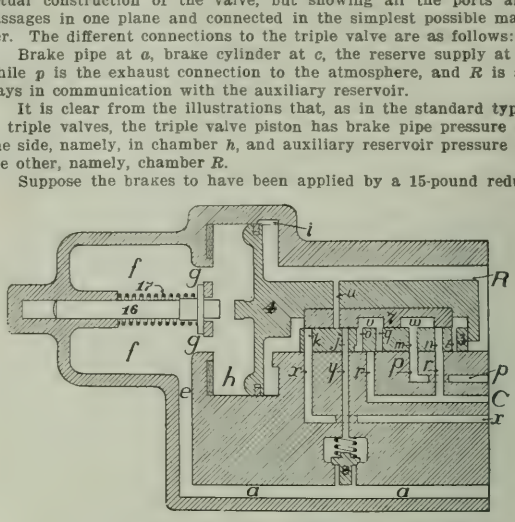


Fig. 6—Type T Triple Valve; Release Lap Position.

tion in brake-pipe pressure, and assume the initial pressure to have been 70 pounds. As soon as the pressure in the auxiliary reservoir has fallen slightly more than 15 pounds the valve will be returned to service lap position shown in Fig. 2. There is now 55 pounds in the brake pipe and auxiliary reservoir, while 70 pounds is still available in the reserve supply and port *x*. Suppose now the brake-pipe pressure be increased 5 pounds. The piston and slide valves will be returned to release position, as shown in Fig. 1, in which position the auxiliary reservoir is being recharged from two different sources, through three different channels. Air from the brake pipe passes through the feed groove *i*, as usual, and also, lifting the check valve, through passage *y*, in the valve body, *j*, in the main slide valve, and *u* in the graduating slide valve to the chamber *R*. At the same time air from the 70-pound reserve supply feeds into chamber *R* through ports *x* in the valve body and *k* in the main slide valve. By this means the auxiliary reservoir pressure is increased until it has reached slightly more than 60 pounds, when this increased pressure on the reservoir side of the piston over that on the brake-pipe side causes the piston and graduating

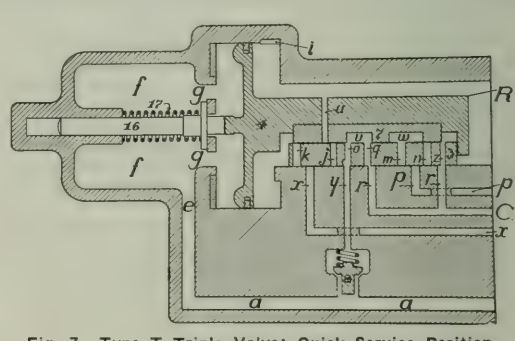


Fig. 7—Type T Triple Valve; Quick Service Position.

valve only to move to the left until the piston stem strikes against the slide valve. This movement closes ports *k*, *j*, and the brake cylinder exhaust port *r*, thus preventing further escape of air from the brake cylinder. This position, known as release lap, is illustrated in Fig. 3.

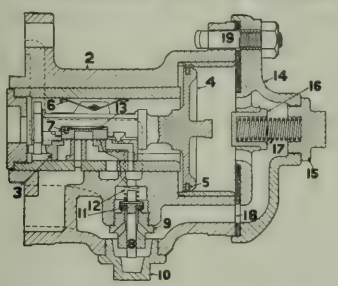
If the brake-pipe pressure is raised 5 pounds more (to 65 pounds), the operation described above will be repeated, allowing a further portion of the air remaining in the brake cylinder to escape. This operation may be repeated, thus exhausting the cylinder, and recharging the auxiliary reservoir in a series of steps until the brake is fully released and the auxiliary reservoir fully recharged. Thus a simple and adequate means is provided for graduating the release of the brakes, positive in its action and sensitive enough to meet all the requirements of service.

QUICK RECHARGING.

In the graduated release operation the auxiliary reservoir is being recharged through three different ports, instead of one (the feed groove *i*), as formerly, and in such a manner that the rise in auxiliary reservoir pressure is proportional to the fall in cylinder pressure, so that when the release of the brake is complete, the auxiliary reservoir is practically fully recharged and ready for an immediate reapplication if necessary. Having these features incorporated in the automatic system the flexibility of straight-air operation is closely approximated without in any way impairing the safety features of the automatic control. In fact, a distinct advantage from the standpoint of safety is gained by the quick recharge feature, which insures, at all times, the possibility of full braking power being developed, without regard to the length of time intervening after a release—a condition not even approximated by either the straight air or former automatic systems.

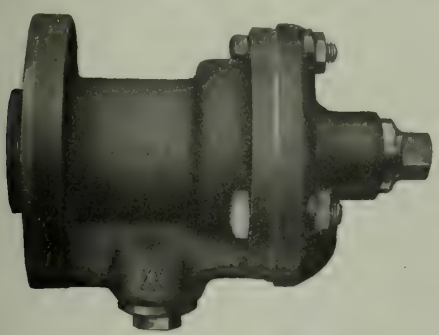
TRIPLE VALVES FOR SINGLE CARS.

The quick action features of a triple valve consist of the check valve 15, rubber-seated valve 10 and piston 8, shown



Section Through Type T Triple Valve.

in Figs. 1 to 7. In an emergency application, auxiliary-reservoir pressure is admitted above piston 8, which causes it to unseat valve 10, and allow air from the brake pipe to raise check valve 15 and flow rapidly to the brake cylinder through chambers *Y* and *X* until the brake cylinder and brake-pipe pressures become equalized. The check valve then seats and prevents cylinder pressure from flowing back to the brake pipe. This is the means employed for hastening the brake-pipe reduction throughout the train, as each triple valve vents a portion of the brake-pipe air to its cylinder, which similarly affects the triple valve on the next vehicle, and so on through the train. It also raises somewhat the cylinder pressure obtained, due to the air introduced from the brake pipe. If the brake-pipe reduction is considerably more rapid than the reduction in auxiliary reservoir pressure due to its flow of air to the brake cylinder, the triple-valve piston will assume



Type T Triple Valve.

the emergency position, which will result almost instantly in an application with maximum braking power.

Although the features of graduated release and quick recharging were originally developed in connection with the quick-action triple valve, they can just as readily be incorporated in the plain type of triple valve; that is, one without the quick-action features. This was the next step taken.

PLAIN TRIPLE VALVE WITH GRADUATED RELEASE AND QUICK RECHARGE.

The first form of plain triple valve to be designed to embody the features of graduated release and quick recharge of auxiliary reservoir was for train operation limited to two cars. With this valve the graduated release feature was obtained by piping the exhaust of the triple valve to the brake valve, where the air contained in the brake cylinder would either be retained or allowed to escape to the atmosphere at the will of the motorman. The quick recharging feature was obtained in this valve by means of a small check valve which allowed the brake pipe air to flow directly to the auxiliary reservoir when the triple piston was in release position. A further detailed description of this valve will be unnecessary, as all of its features are embodied in the plain triple valve which followed it, which was designed for use on cars to be operated singly or in trains up to five units. This valve, designated as the type T triple valve, is shown in Figs. 4, 5 and 6.

In Fig. 4, port *a* connects with the brake pipe, port *x* with the reserve supply, port *c* to the brake cylinder, and *p* to the exhaust through the brake valve, while *R* is in connection with the auxiliary reservoir.

Quick recharging is obtained partly through the small check valve shown, which connects *a* through ports *y*, *j* and *u* with the auxiliary reservoir, and partly through ports *x* and *k* from the reserve supply. The graduated release of the brakes is obtained in exactly the same way as previously described for the quick-action triple valve, as will be evident at once from Figs. 5 and 6, the ports being lettered identically. One feature in connection with this valve, however, deserves particular notice. The exhaust port *p* being connected by piping to the brake valve, combined with the use of the reserve supply as previously described, affords two means by which a graduated release of the brakes in the train may be made. The method of graduating the release by means of the reserve supply, in the manner already explained, gives a graduated release on all the cars in the train, while the second method enables the operator to govern the release of the brakes on the head car alone, directly at the brake valve. This latter method makes possible a very flexible control when operating as a single car, and is known as the straight-air release feature.

The application of these valves to trains up to five cars in a service in which frequent stops from a fast schedule were required, made clear the desirability of a more rapid service application of the brakes throughout the train. The modifications already made in the triple valves to obtain the quick recharge feature were easily adapted to produce a quicker service application of the brakes than had previously been possible where the brake-pipe reduction was dependent upon the air contained in the pipe flowing the whole length of the train to the brake valve before it could escape to the atmosphere.

In emergency a rapid serial application of the brakes is obtained by venting a portion of the brake-pipe air to the brake cylinder on each car. This affords a means of escape for the brake pipe air, without all of it having to flow the length of the train to the brake valve. This same method suggested itself for quickening the service application, the action being of the same character as that in emergency, but to a less degree. As there was already a port connecting the brake pipe to the slide valve seat, which in release position affords a means of securing a quick recharge, it was only necessary to add ports to the slide valve, which, in the movement to service position, connect the brake pipe through these ports to the brake cylinder. In this manner a slight reduction in brake-pipe pressure is effected during a service application by each triple valve in turn. By this means the time required to apply the brakes in service is materially reduced.

In Fig. 4, the additional ports just mentioned are marked *o*, *v* and *q*. In the quick service position, port *o* registers with port *y* (see Fig. 7), and cavity *v* in the graduating valve connects ports *o* and *q* in the main slide valve, the latter registering with port *r*, leading to the brake cylinder, thus establishing direct communication from the brake pipe through the check valve to the brake cylinder. When the piston returns to lap position, Fig. 5, the quick service ports *o* and *q* are blanked by the graduating valve. This feature proved to be so easily obtained and of such decided advantage that it was incorporated in all the triple valves designed for use in trains of more than two cars.

Referring to Fig. 8, showing in quick service position the quick-action triple valve already described, it will be observed that the port *q* connects with port *t*, which leads to the top of the emergency piston instead of directly to the brake cylinder, as in the preceding valve. This arrangement was simply a matter of convenience, as the port *t* was already conveniently located for the purpose, and the emergency piston is of sufficiently loose fit to allow the relatively small amount of air thus discharged to pass readily around it and to the brake cylinder without any danger of causing the quick action parts to move.

Referring to Fig. 8, it will be noted that when quick-service port *y* registers with port *o* in the slide valve, the service ports *d* and *r* only partially register; the air flowing through these ports from the auxiliary reservoir to the bake cylinder is thus restricted in amount, which limits the rate at which the auxiliary-reservoir pressure reduces. If the brake-pipe pressure reduces more rapidly than does the auxiliary-reservoir pressure, the predominance of pressure in chamber *R* will enable the piston to somewhat compress the graduating spring and move the slide valve to the "full service" position shown in Fig. 9. In this position port *y* is closed, prevent-

ing a flow of air from the brake pipe to the cylinder, while port r is fully open, allowing a more rapid flow from the auxiliary reservoir to the brake cylinder, so that the reduction in auxiliary-reservoir pressure may keep pace with that in the brake pipe. In this way the triple valve automatically cuts out the quick-service feature when it is not needed.

(To be concluded.)

The Use and Abuse of Fire Brick for Locomotive Fire-boxes.

BY J. E. BOND.

Fire brick arches have been used for so many years in locomotive fireboxes that the purchasing departments and motive power departments of the railroads, as well as the manufacturers of fire brick for this purpose, seem to have fallen into a rut, and apparently the subject is not receiving the attention it deserves. In the opinion of the writer there is room for improvement in both the manufacture and use of fire brick arches.

Cold air after extreme heat is the hardest test of a good fire brick. It is a regular occurrence, on most roads, to run an engine over the ash-pit at the end of a run, turn on the blower and knock out all the fire. The cold air striking the red-hot bricks cools the outside, and, unless properly made, the bricks crack and are destroyed. Experience has shown the writer that a fire brick can be made by any of the larger manufacturers that will increase the life of the arch an average of 100 per cent.; that is, while on most roads the fire brick arch lasts from ten days to two weeks, by giving proper attention to the design and mixture of the clay, the average life could be increased to from 20 days to a month.

Manufacturers generally have an idea that the vibration of the locomotive is a great factor in the destruction of the arch, and that a tile must be made of such a mixture as will give as great physical strength as possible. As a matter of fact, vibration is a small factor in the destruction of the arch. The writer realizes that each clay requires a peculiar treatment of its own to get the best results; that a method of handling the clay in a given district would not be successful with another clay, even a few miles distant. Therefore, it is impossible to have a specific rule that will apply to all clays, but there are certain general details that apply to the manufacture of all fire brick.

For the benefit of those not familiar with the subject, a brief description of the process will be given. Fire clay usually occurs under coal measures and is virtually a pure clay. The chemical analysis is of great importance in certain lines of work; it is of less importance in railroad work than the physical qualities, since the gases of coal do not cause much deterioration, unless there is a considerable percentage of iron in the clay, when the sulphur of the coal may unite with the iron pyrites and cause injury to the brick. Fire clay is mined about the same as coal. When it first comes from the mine it is as hard as stone and fractures of the clay will be so sharp that the pieces will cut the hands. The clay is of three general varieties: plastic, semi-plastic and flint. The first, when tempered, becomes like putty and is easily worked with the hand. The second, if exposed to the weather sufficiently, or if sufficiently tempered, will also become plastic. The flint clay will not become plastic when exposed to weather, but will break up into small crystals if exposed for some time. The chemical analysis of these three clays may be identical. The clays are ordinarily pulverized in a dry pan crusher, and mixed with calcine (burned fire clay) ready for tempering. The tempering is ordinarily done in a wet pan. The clay is taken from the wet pan to the moulders, where it is moulded into the desired shapes by hand. It is then placed on a hot floor, where it is dried, and afterwards burned in a kiln at a temperature of about 3,000 deg. F., after which it is allowed to cool down slowly for a number of days before opening the kiln.

Now it is the mixture of the clays that determines the character of the brick. For high grade, such as is used in blast furnaces, steel furnaces, etc., the mixture is largely flint and calcine, with just enough plastic clay to form a bond to unite the particles. It is made in as soft mud as will retain its shape after being moulded. When this is dry it is exceedingly porous and is not physically strong. It is nearly white in color after burning and when fractured can be pulled apart by the fingers in many cases. However, when this brick is subjected to high heat and sudden changes of temperature it does not crack or check because its porosity enables it to cool more uniformly throughout its mass. The expansion and contraction is also much less than in the more plastic kinds of brick. High grade bricks will not answer for all purposes, since they are too easily injured by abrasion. For instance, in the top of a blast furnace, where the charging of the furnace would destroy high grade brick, it is necessary to use more plastic clay and less flint.

A great deal of study has been given by iron and steel makers, as well as by manufacturers of fire brick, to get up a material exactly suited to each process connected with the art. It is not advisable to make locomotive tiles of the same mixture as high grade brick because they would not have sufficient strength to get them into the fireboxes; but the mixture should approach nearer to the high grade than that which is generally supplied to railroads. Now the higher the proportion of flint clays and calcined clay used up to the point that will be bound together, the greater the heat and the variations of temperature the brick will stand, but the more delicate the brick will be to handle cold. Conversely, the greater the proportion of plastic clays used in the mixture, the less change of temperature it will stand, but the stronger physically the brick will be while cold. It is not altogether the fault of the manufacturer that he makes his mixture too low a grade to stand the changes of temperature incident to the locomotive operation. It costs him no more, ordinarily, to make a high grade than a low grade brick, but the designs submitted will not stand up in the higher grade material. It is therefore up to the railroads to design a brick that will stand.

But it is impossible for a designer, who is not familiar with the processes of manufacture to design fire brick intelligently. It would be money well spent to send the designing engineer to the fire brick factories to spend as long a time as he needs to get an insight into the business, and that he may co-operate with the manufacturer in getting out designs that can be made. As a case in point, a manufacturer of fire brick in Missouri showed the writer a design from a prominent western road that called for iron bars in the tiles to strengthen them. They ran the entire length of the arch. This manufacturer simply made holes through the tiles, which were for wide firebox engines, and told the railroad people they could supply their own iron. For it is well known by all who are familiar with the art that iron heated to the temperature of the firebox has little or no strength, even if it is not melted, and had the iron been placed in the tiles before burning, it would have been melted long before the furnace attained the heat necessary to burn the brick, and would have ruined any other bricks in the kiln as well.

Most roads make tiles for wide firebox engines in two sections, butting the tiles together in the middle of the firebox. This the writer believes to be wrong in principle where arch tubes are used. There are usually four tubes to support the tiles. The joints should be made over the tubes in order that there be as little overhang or cantilever as possible. Now, because the tubes, containing water, keep the adjacent part of the tile cooler than the part which is away from the tube, this causes the material to expand on the top of the tile and remain contracted on the lower side, causing the tile to droop and gradually to fracture. Then when a rough place is produced by the drooping of the tile, the action of the gases and cinders becomes much greater at this point, causing more rapid abrasion. In narrower types of fireboxes containing two tubes it is better to make a joint over each tube, with a special tile supported on studs in the side sheets for the ends; or make the end tile longer so that the end resting on the tube is lower than the end resting against the side sheet. The studs can thus be dispensed with.

The writer has seen large quantities of fire brick arches stored in the open air on certain roads in the West and Northwest. Nothing could be worse for fire brick of a quality good enough to stand the changes of temperature than exposure to winter weather, for the reason that a good fire brick is exceedingly porous and absorbs a great deal of water. When the water freezes it expands and fractures, if it does not break, the brick. It is economy to erect good dry storage sheds for all fire brick. Even the moisture absorbed from the atmosphere makes a brick more delicate in cold weather. Summer rains are not so injurious as the winter rains.

Complaint came to the writer that a certain road was having heavy loss in its locomotive tile. It was high grade material and should have yielded good results. Investigation revealed the fact that the tiles were piled 20 to 25 ft. high in a shed. It was being handled by cheap help, and indeed the breakage was a serious item. Manufacturers seldom, if ever, pile fire brick to exceed 8 ft. high because it is not strong enough to withstand the pressure incident to higher piling, especially in the winter when frost weakens the material.

Another abuse often seen is to bring tiles covered with ice into the roundhouse, install them in a firebox and then build a fire under the arch with forced draft. The unequal expansion is sure to cause injury to any fire brick under such circumstances, and very often the arch will break down before the engine reaches her train.

The higher the grade of brick, the better it will stand this kind of abuse, since the greater porosity enables the steam to escape more readily, but it will be much better to store the bricks in a warm place for a few days before installing, in order that they may become as dry as possible. In starting up a new stove or blast furnace, steel manufacturers take several days to get their furnaces up to heat, but they expect to get months or even years of service out of a lining.

Intelligent study of the subject will, without doubt, reduce expense in the use of fire brick arches.

GENERAL NEWS SECTION

NOTES.

It is understood that the strike of machinists on the Erie is broken, and that 150 of the old men have returned to work.

It is announced that the Burlington has made salary increases averaging 10 per cent. to employees over the entire system.

The Illinois 2-cent passenger bill was approved by Governor Deneen May 28, and makes a straight 2-cent limit for all railroads in the state.

The United States Express Company is reported to have signed a contract with the Detroit United Railway whereby it will handle all package express over its lines.

It is reported that the United States customs officers will make the examination of baggage crossing the Mexican border into the United States much more rigid than heretofore.

The San Pedro, Los Angeles & Salt Lake has been fined $1,000 in the United States Court for failing to make the required stops while shipping cattle. The company pleaded guilty to the indictment.

The Wisconsin senate has advanced the Nye bill providing that upper berths in sleeping cars must stay up unless taken, for benefit of lower berth occupants. It is said that this insures the bill's passage.

It is said that the National Association of Car Service Managers will enact a new rule that receivers must unload freight within 48 hours of the time the car is delivered, or pay $1 a day demurrage.

In accordance with an order issued by the Mississippi Railroad Commission, the principal lines doing business in that state have placed on sale interchangeable mileage books of 2,000 miles at a flat rate of $40.

The Santa Fe through its Statistician recently gave facts to the Interstate Commerce Commission in its hearing at Chicago on rates on live stock shipments showing that the live stock traffic is unremunerative.

Governor Hughes has signed the bill providing that all plans for barge and canal work must be submitted by the State Engineer to the Barge Canal Advisory Engineers Board before they go to the State Canal Board.

A general strike of machinists on the Louisville & Nashville was ordered May 29. It is said to affect 600 men. The machinists asked recognition of their union and a uniform scale of wages in each shop. No increase in pay was asked.

F. C. Donald, commissioner of the Central Passenger Association, has announced that second-class fares will be abolished between Pittsburg and all points in the association's territory, as well as through connecting gateways, effective July 1.

A brakeman on the New Haven road was standing on a car at New Rochelle, signaling, when his hand struck the overhead trolley wire. He is reported dying from the shock, and is said to be the third employee hurt in this way at New Rochelle.

The Philadelphia & Reading on June 3 announced a partial recession from its recent increase of suburban and commutation rates. The price of monthly tickets is reduced about half the increase of ten days ago. The increase had aroused violent public agitation and boycott.

The Massachusetts' Senate has concurred without amendment in the resolution adopted by the House condemning the management of the Boston & Albany by the New York Central. Attempts were made to force the Senate to pass a more radical resolution, but without success.

The Public Utilities Bill, establishing two Public Service Commissions in New York State, on June 4 passed the Assembly by a vote of 116 to 11 over the veto of the Mayor of New York City. The Senate re-passed it on June 5 by a vote of 39 to 8 and the bill now goes to the Governor.

President Mellen, of the New York, New Haven & Hartford, in speaking of an increase of wages on that road of $800,000 for the coming year, says: "I regret to say, so far as the organized labor item is concerned, that I am meeting a constantly decreased efficiency with every increase granted in wages."

The minimum weights which may be loaded in a car in order to get carload rates have recently been raised in Trunk Line territory. The minimum loading of the lighter iron and steel manufacturers has been advanced from 24,000 to 36,000 lbs. The minimum load of floor was advanced from 35,000 to 40,000 lbs.

Transcontinental lines have been notified by the Trunk Line Passenger Committee that its members will not join in rates and arrangements made for the annual meeting in Los Angeles next month of the National Educational Association, nor make any reduced rates whatever from their territory for that occasion.

The Neptune Line of steamers, owned by the United States Transportation Company, of which Stephenson Taylor is President and Robert C. Scholz Traffic Manager, commenced operations between New York and Fall River June 1, with the steamers Connecticut and Rhode Island, formerly of the Providence Line.

A number of large stockholders of the Atlantic Coast Line Railroad Co. have applied for an injunction to prevent the railroad from putting into effect the 2¼ cents per mile rate recently enacted as law in North Carolina, under the plea that if such a law became operative it would be confiscatory in character and therefore unconstitutional.

The Baltimore & Ohio announced May 28 that it would abandon four passenger trains on June 1 on account of loss incident to the 2-cent fare enforced by the Ohio legislature during its last session. Sections between Lorain and Akron and Akron and Youngstown will be affected. It is reported that other roads out of Cleveland will follow the example.

James Bingham, Attorney-General of Indiana, has given the Indiana Railroad Commission an opinion that the 2-cent passenger fare law of that state does not apply to interurban and other electric lines. The Attorney-General holds that the steam and interurban lines were regarded by the Legislature as two distinct classes of transportation companies.

An agreement has been reached between the city of Springfield, Mass., the New York, New Haven & Hartford and the Boston & Albany by which the city will be able to lay out a park on the east bank of the Connecticut river where the tracks of the New Haven road now lie. These are to be transferred to the west bank of the river and a new bridge built to bring them into the city.

After a conference with President Roosevelt, Commissioner Lane, of the Interstate Commerce Commission, announced June 4 that before July 1 legal proceedings will be instituted to compel E. H. Harriman to answer certain questions propounded to him by members of the commission at the recent hearing in New York when the merger of the Harriman lines was under investigation.

The New Haven road has bought from William Waldorf Astor a tract of ten acres on the north side of West Farms road, extending from Morris Park avenue to Van Nest street, the Bronx. Part of the tract will be used in connecting the tracks of the New York, Westchester & Boston Railway and the Harlem branch of the New Haven railroad, but a large part will be used as freight and car yards.

The Chicago, Cincinnati & Louisville, which has only recently begun running trains into Chicago at the Illinois Central station, has given notice that beginning July 1 its passenger rate between Chicago and Cincinnati will be $5.00, or $2.00 less than the present standard rate; but it will be only $1.00 less than other lines on the date named, owing to reductions worked by the new laws in Indiana, Ohio and Illinois. The Chicago, Cincinnati & Louisville is the shortest line between Cincinnati and Chicago.

After maintaining for 15 years the rate of 10 cents per mile for the transportation of passengers over the ten miles of road between Lake Placid, N. Y., and Saranac Lake, the Delaware & Hudson on June 3 placed in effect a schedule reducing the price of tickets to 3 cents per mile and making the regular Delaware & Hudson mileage at 2 cents per mile also good. The new schedule also reduces freight rates about one-half. Under its charter the Saranac & Lake Placid

road, which is controlled by the Delaware & Hudson Company, was authorized to charge a fare of $1 for transportation each way between Lake Placid and Saranac Lake.

It is understood that the general advance in freight rates to be made in the Central Freight Association territory, to become effective August 1, will average 6 per cent. It was originally planned to have the new rates take effect June 15, but at a recent conference it was decided to hold them over for a month and a half, as it will be impossible to file all the tariffs with the Interstate Commerce Commission for some time.

Complaint has been made by a citizen of St. Paul, Minn., to the Interstate Commerce Commission demanding a reduction by the Pullman Company and the railroads in the rates charged for berths in sleeping cars, and that upper berths be charged for at half the rate charged for lower berths. The rates complained of are on the Great Northern, the Northern Pacific and the Chicago, St. Paul, Minneapolis & Omaha (North-Western Line).

Judge Holt in the United States District Court handed down a decision June 4 overruling the demurrer interposed by the Great Northern Railway Company to indictments for rebating. Judge Holt holds that although the contract for rebating was made prior to the passage of the Elkins act, it was not finally consummated until after that act went into effect, and for that reason if proven would be sufficient to put the company on its defense at a final hearing.

Three additional suits attacking the constitutionality of the 2-cent fare law were filed at Philadelphia June 2, by counsel representing the Lehigh Valley, the Northern Central, and the Philadelphia, Baltimore & Washington. As in a suit recently instituted by the Pennsylvania Railroad Company, the county of Philadelphia is made defendant in the three suits. It is expected the principal contention to be made will be that the two-cent law is in violation of the federal constitution.

The New York State legislature has passed a bill providing that three brakemen must be employed on all freight trains of over 20 cars on all roads in the state which operate more than four freight trains daily. According to the representatives of the railroads who appeared at a hearing before the Governor, the enactment of such a law would cost the New York Central $500,000 and the Lackawanna $120,000 a year. The chief supporters of the bill are the railroad labor organizations.

The Pennsylvania is reported to have decided to abolish, on October 1, all commutation, workmen's and trip ticket rates in the state of Pennsylvania. This action is a direct result of the 2-cent fare law, which goes into effect on that date. The road has already asked for an injunction restraining the county of Philadelphia from enforcing the penalty prescribed for violation of the act. The company believes that this will be granted and the law thus made inoperative. If so, it will not abolish the low rates referred to.

A petition has been filed for a receiver for the Chicago-New York Air Line Railroad Company. An injunction is asked restraining the continuation of alleged practices which a former employee of the company named Nemoyer recently brought suit to stop. Nemoyer charged that President Alexander G. Miller was drawing a salary of $25,000 annually, and that Miller and his associates took 600 shares of stock in a construction company as payment for obtaining for the construction company the contract to build the road. The suit was dismissed, Nemoyer not being a stockholder.

Eight so-called "friendly suits" were filed in the United States District Court at St. Paul, May 31, against the Great Northern, the Northern Pacific, the Chicago, Milwaukee & St. Paul, the Chicago & North-Western, the Chicago, St. Paul, Minneapolis & Omaha, the Minneapolis & St. Louis, the "Soo," and the Chicago Great Western, to enjoin them from putting into effect the commodity rate recently ordered reduced by the Minnesota Railroad and Warehouse Commission. The state of Minnesota is made a party in the suits. Similar action was taken by the Rock Island on June 3.

Losses on New York Municipal Ferry.

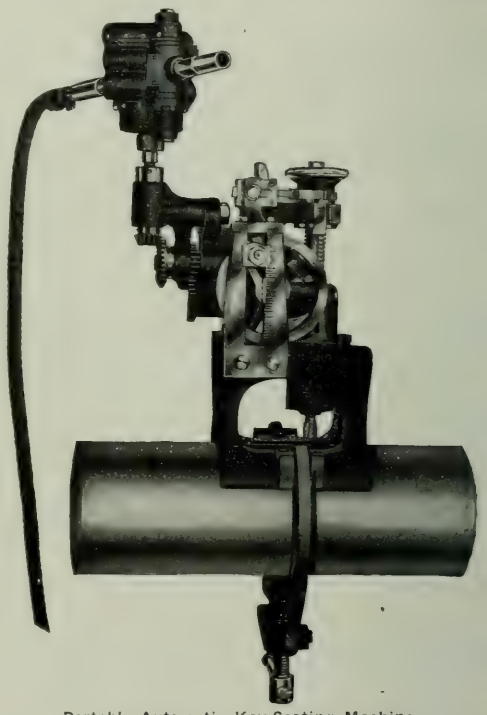
The Commissioner of the Department of Docks and Ferries of New York City estimates this year's loss on the municipal ferry between the Battery and Thirty-ninth street, Brooklyn, at $150,000, and the ferry from the Battery to Staten Island at $300,000. There is no fund from which to pay these losses, which must be met by the sale of bonds, yet, in the face of these facts, there has been a bill pending in the legislature to make the ferries free. As a commentary on the efficiency of municipal operation his further remarks are interesting:

> We cannot cut operating expenses. When the Staten Island ferry was taken over, we were told that New York City must have the finest boats on the bay. We have the finest in the world. We were told they must be speedy. We haven't the speed qualities of torpedo boats in these crafts, but we have cut the time down until we burn just four times as much fuel as any commercial body would in operating the boats the same number of trips. And then we have a matron on every boat and music.

The Ryerson Portable Automatic Key-Seating Machine.

A portable automatic key-seating machine—a new device just placed on the market—is shown in the accompanying illustration. The advantages of such a machine are evident to everyone acquainted with the difficulties in locating and cutting key-seats for eccentrics. Better and quicker work is done by the machine than is possible by other methods; it assures that eccentric and axle key-ways will correspond, a condition not always obtained when key-seats are cut before the wheels are pressed on. In repair work, where this condition exists and the old axle is retained, the portable key-seater can be used to recut the key-seat to agree with the eccentric, and thus avoid using an offset key.

The machine is designed to cut loose up to the driving box—working within 1 in. of it—and also its adjustment will permit any standard size key-way to be cut. The cutting is done within the base of the machine, producing a compact design and also permitting its use for eccentric cutting on axles where the distance between eccentrics is very limited. The base of the machine fitting over the axle is 8½ in. long. When used according to directions



Portable Automatic Key-Seating Machine.

it is claimed it will cut a 1 in. x ½ in. x 6 in. key-way in not more than 35 minutes.

The device may be driven by either air or electric motor, connection being made by a taper shank which is part of the machine. The speed should be between 300 and 450 r. p. m. Both the vertical and horizontal feed are entirely automatic, so that no attention is required after placing and starting the tool. The weight is approximately 100 lbs. Its use is not confined to driving axles, of course, serving equally well for key-seating shafting, etc. It is made by Joseph T. Ryerson & Son, Chicago.

Better Terminal Facilities at St. Louis.

Large plans are under way for improving the railroad terminal facilities at St. Louis. Already the bridge arbitraries have been abolished so that the rate to St. Louis is the same as to East St. Louis, Ill. The same rates apply on both sides of the Mississippi river. The Terminal Railroad Association of St. Louis has announced a general plan for improving the terminal facilities in the city at a cost of $7,000,000. The yard capacity will be increased from 1,600 cars to 8,000 cars. Three great freight centers are planned: one at Compton, Manchester, and Ranken avenues and Atlantic street, where there will be a 3,000-car yard; one on the site of the present roundhouse on 14th street in the Mill Creek valley, where there will be a yard with a capacity of 700 to 1,000

cars, and the other on the wharf between North Market and Ashley streets. Execution of the plans awaits the favorable action of the city council.

A Bureau for the Transportation of Explosives.

A "bureau for the safe transportation of explosives and other dangerous articles" has been formed under the auspices of the American Railway Association, with C. B. Dudley, Chemist of the Pennsylvania Railroad, as President; M. D. Maher, Vice-President in charge of operation of the Norfolk & Western, Vice-President, and W. F. Allen, Secretary of the American Railway Association, Secretary and Treasurer. The purpose of the organization is the proper and uniform enforcement of the regulations for transportation of explosives and other dangerous articles which may be placed under the jurisdiction of the bureau by the American Railway Association. Major Beverly W. Dunn, of the Ordnance Department, U. S. A., has been given leave of absence by the War Department and will on June 10 take charge of the bureau as Chief Inspector. The report, in the *Railroad Gazette* of May 31, that Major Dunn had been assigned to take part in preparing new rules for transportation of explosives was in error. The Chief Inspector will appoint local inspectors, who will be stationed in different parts of the country. Their duties will be to see that the regulations are complied with by manufacturers, shippers and railroads. The Chief Inspector shall also have authority to make examinations and tests of explosives, which shall be a necessary preliminary to the acceptance for transportation of any new explosives. There will be a testing laboratory at South Amboy, N. J. In case of a wreck caused by or resulting in an explosion on a railroad or in a manufacturer's establishment the local inspector will visit the scene as promptly as possible and make a report to the Chief Inspector of the facts in the case.



Traveling Boom Crane; Panama Railroad.

Union Pacific Free Passes in Nebraska.

Railroad companies in Nebraska now have to make a report showing the number of annual passes issued and outstanding in the state. The Union Pacific makes its return as 27, a tremendous reduction from the number in force before the passage of the Rate Law. This does not include employees' passes or "other passes issued under contract and not regarded as free transportation."

Cranes for the Panama Railroad.

The accompanying illustration shows one of a lot of eight cranes now being built by the Shaw Electric Crane Co., Muskegon, Mich., for the Panama Railroad. They are for use in handling miscellaneous freight at the Laboca wharf, which is the Pacific terminus of the railroad. The cranes were designed to meet the peculiar conditions existing at the wharf, among which may be mentioned a tidal variation of about 20 ft.

The boom, which is 80 ft. long, is shown in its working position, standing at an angle a little over 30 deg. from horizontal. It was required that the outer end should stand at sufficient height to carry loads over the decks of the largest vessels at high tide, while the other end must be low enough to project inside of the warehouse door. The boom may also be raised, carrying the outer end clear of all parts of vessels and withdrawing the inner end from the warehouse. With it in this position, vessels may be docked and the cranes placed opposite the hatchways in proper position for loading or discharging cargoes.

The main frame or tower is of steel construction, and stands 62 ft. above the track. There is a clear opening through it 10 ft. wide, in which the boom is suspended and through which the loads are carried. The base is so made that the crane can travel over freight piled to a height of 6 ft. between the tracks, so that goods may be trucked directly from under the crane to the warehouse. The space between the front of warehouse and edge of wharf was sufficient for a track of only 11 ft. gage. This, together with the necessary height and reach, made the question of stability a serious one. Although the weight of frame and machinery has been so disposed that the crane will be stable with a load 25 per cent. above normal capacity in the extreme position, clamps have been provided which are always in engagement with the rear rail, to prevent the crane from tipping if a load should become fouled on a hatchway or other part of the vessel.

The crane is mounted on six wheels, four under the front and two under the rear. Anticipating the possibility of uneven settling of the wooden wharf, the wheels are carried in equalizers, so arranged as to compensate for any probable irregularities of track without straining the structure. The machinery is placed in the base of the tower, adding to the stability of the crane, and giving easy access for inspection. For convenience in shipping and erecting, each set of machinery is mounted upon a separate frame, which is easily handled and put in place.

The crane has a regular working capacity of four tons, and a reach of 40 ft. from the center line between rails to the extreme outer position of load. The total height of hoist is 70 ft., and the speed hoisting with full load is 150 ft. per minute. The load can also be racked out and up at a speed of 150 ft. per minute. The other two movements, travel and boom hoist are relatively slow, being required only in setting the crane in position for service. The hoist is operated by a 65 h.p. motor, the rack motion by a 40 h.p., and the travel and boom hoist by 24 h.p. and 8 h.p. motors respectively. Automatic switches are provided to prevent overtravel in hoisting and racking out, also an overload switch for the hoist machinery. All movements are under the control of one operator, whose cab is so located as to give him the best view of his work. The crane weighs nearly 50 tons, and with the boom in the raised position it stands 90 ft. above the wharf.

The motors and controllers, as well as all structural work and machinery, are the product of the Shaw Electric Co.

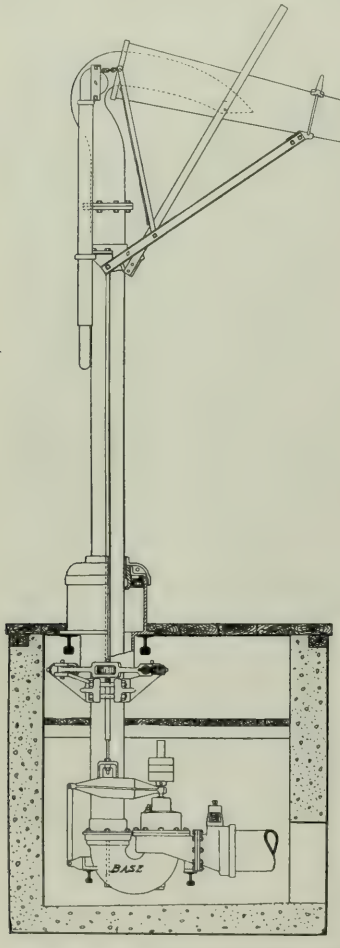
Switching Allowance Asked.

The Solvay Process Company at Solvay, N. Y., near Syracuse, has applied to the Interstate Commerce Commission to have the New York Central and the Lackawanna give it an allowance of $3 for each car handled by it in its own yards. The President of the company testified before Martin S. Decker, special examiner for the commission, that its shipments in and out in 1906 were 254,000 tons of soda products and 476,000 tons of coal and other shipments making up a total of about 865,000 tons. The company maintains its own yards and engines and does all of its own switch-

ing, having handled 64,000 cars last year. The company claims that the railroads should pay the expense of handling the cars in the yard. The railroads claim that their duty begins and ends with receiving and delivering the cars from and to the company.

The Johnson Water Column.

The details of the Johnson railroad water column are illustrated herewith. It is a full-circle, one-man column designed to fit any locomotive tank of either high or low design, locks itself parallel to the tracks when not in use, works without danger to the operator, and is easily kept in order, it is claimed. The spout has a vertical range of 5 ft. where the track centers are 16 ft. or more. It is pivoted at a point midway between the high and low positions of



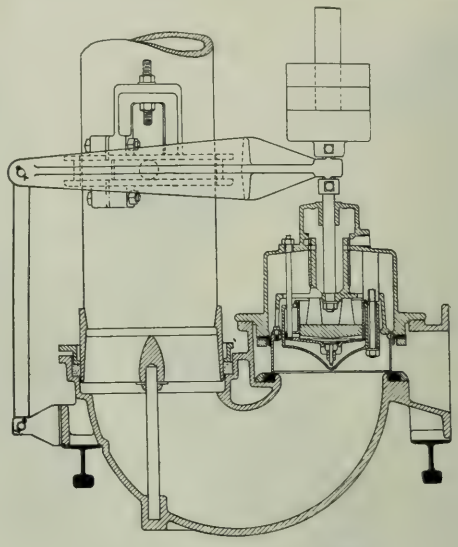
The Johnson Water Column.

the end of the spout, so that this end travels in an approximately vertical line, enabling it to enter the smaller manholes of locomotive tanks whether the tanks be of high or low design. The drip from the column will flow towards the end of the spout in any position, thereby avoiding the formation of ice in the spout. The flow of water from the goose-neck presses against the lower side of the spout, thus holding it in the manhole and overcoming any tendency of the spout to raise under high pressure.

The valve-controlling lever or bale is pivoted to the girder which supports the spout in such a manner that the lever moves with the spout without working the valve; this also brings the valve-controlling lever directly at the operator's hand when the spout has entered the manhole in either a high or a low tank. Forcing the valve-controlling lever down opens the valve and this force also operates to hold the spout down and in position.

The valve is designed to be always in balance. It is made of brass, works through a cup leather, and seats on a moulded rubber seat. It is opened manually by the operator and is closed by weights on the valve stem. The closing speed of the valve is governed by the escape of water from a brass dashpot, the size of the escape opening being varied by adjusting a screw from the outside of the bonnet. By removing the nuts which hold the bonnet to the base, the valve, dashpot and entire controlling mechanism can be lifted out vertically with the bonnet, making it easy to adjust and repair the valve outside of the pit and away from the wet and dirt.

The uptake pipe is standard wrought-iron pipe with threaded ends, and the side thrust is taken by roller bearings on finished surfaces. A pivot pin in the base carries the weight of the column, making the column self-contained and overcoming the necessity of adjusting the valve rods. The locking device is the usual spring, cam and roller mechanism, which is placed high in the pit where it is dry and open to inspection. The valve rods and connections



Valve for Johnson Water Column.

are outside the waterway where they can be inspected. The counterweights are of simple construction inclosed from the weather.

The Johnson column has been in use for about four years and 18 different roads have them in service. It is made and sold by Charles A. Stickney Co., St. Paul, Minn.

New Steamers for the International Mercantile Marine.

Nine new steamers to be built for the lines owned by the International Mercantile Marine Company are as follows:

(1) An express mail, passenger and cargo steamer for the North Atlantic trade which, the report states, in point of luxury and size will far surpass anything hitherto attempted.

(2) A passenger and cargo steamer, also for the North Atlantic trade.

(3) A passenger and cargo steamer for the Atlantic Transport Line, New York-London service.

(4 and 5) Two mail passenger and cargo steamers for the Dominion Line, Canadian service.

(6) A large passenger and cargo steamer for the London-Australian trade.

(7, 8 and 9) Three steamers for Leyland Line.

It is expected that these vessels, with the possible exception of the large fast steamer and the second steamer for the Canadian trade, will be in commission by the early part of 1909.

Owing to the disadvantage of operating under the American flag the company has sold two American-built steamers.

The earnings for the last three months of 1906 were seriously cut down by the congestion of the United States railroads, which in some instances resulted in absolute embargoes on all but perishable traffic to certain ports.

Supply Cars on the Canadian Pacific.

On the Canadian Pacific supply cars for distributing materials from the general storekeepers department have been in service for nearly 20 years. Early this year three new cars were put in commission on the lines east of the Great Lakes. These cars are 40 ft. 2 in. long, 8 ft. 2 in. wide and 8 ft. high, all inside measurements. Small supplies for stations and section houses are arranged on

shelves; oil tanks are provided with a capacity of 1,500 gallons of head light, 150 gallons of signal and 150 gallons of car oil. There is also sleeping accommodation for the man in charge of the car, who can when necessary get his own meals. The men in charge of the cars live in them from 22 to 26 days each month. The cars start out the first day of the month and run about 2,400 miles a month. The car which covers the Atlantic division handles 400 requisitions a month, the one on the Ontario division 600, and the one on the Lake Superior and Eastern divisions 550 each, so that on an average these three cars together handle about 1,500 requisitions a month.

A Chance for State Operation.

The Missouri Board of Equalization at a hearing in regard to the assessment of the Chester, Perryville & Ste. Genevieve, controlled by L. B. Hauck, received an offer from Mr. Hauck to have the state of Missouri operate the road for a year or two in order that the board might understand by practical experience the relation of taxation to expenses and profits. According to Mr. Hauck the state laws have removed every chance of making the road profitable. The Chester, Perryville & Ste. Genevieve runs from Cape Girardeau, Mo., on the Mississippi river, north to Westchester, which is opposite Chester, Ill., 63 miles, with a branch, the Saline Valley Railroad, from West Chester to Minith, 23 miles.

Rail Sales for 1908 Delivery.

Orders have been booked for 818,500 tons of rails for 1908 delivery, according to the *Wall Street Journal*. This total, which represents a gross business of over $23,000,000, compares with orders for about 1,000,000 tons booked a year ago for 1907 delivery. Of the current orders the United States Steel Corporation has about 350,000 tons and the Tennessee Coal & Iron Company 237,000 tons. The following table gives the rail orders for 1908 delivery placed since the books were opened:

	Tons.
Harriman lines to Tennessee Coal & Iron	157,500
Northern Pacific to United States Steel	65,000
Northern Pacific to Lackawanna Steel	*35,000
Rock Island to Tennessee Coal & Iron	10,000
Harriman lines to Bethlehem Steel	23,000
St. Paul to United States Steel	75,000
Southern Railway to Tennessee Coal & Iron	30,000
Burlington to United States Steel	45,000
Rock Island to United States Steel	25,000
Nickle Plate to United States Steel	5,00
Western road to United States Steel	10,000
Chicago & Eastern Illinois to United States Steel	5,000
Pennsylvania Railroad to various mills	147,000
Louisville & Nashville to Tennessee Coal & Iron	40,000
Savannah, Augusta & Northern to U. S. Steel	*46,000
Canadian roads	30,000
Miscellaneous	70,000
Total	818,500

*For this and next year's delivery.

Through Routes and Through Rates.

The Interstate Commerce Commission, in an opinion rendered June 5 by Commissioner Lane, announces a construction of the Rate Law which holds that most of the railroads in the United States are united as parts of through routes over which through rates exist even where no joint rate has been established. The decision deals with the movement of 10,000,000 lbs. of sugar held in storage at Omaha which was brought into that city from the West before the existing tariff out of Omaha and to the East went into effect. The question raised was whether or not the Chicago, Burlington & Quincy might allow sugar stored in Omaha to go forward under a tariff put in effect after the sugar had arrived at Omaha.

Commissioner Lane, dealing with this question, says:

Sugar which moved from Longmont, Sterling, Brush, Fort Morgan and Loveland prior to the going into effect of this tariff cannot be moved out of Omaha under its provisions and on the rate fixed therein. A proportional rate is a through rate, and can be applied only to traffic moving thereunder from point of origin to destination. At the time the sugar moved from the originating points named, this tariff was not in effect and the local rate paid into Omaha cannot be treated as an advance payment upon a proportional rate which was not in effect at the time of origin of movement.

There can be but one through rate in effect between any two points at a given time, and this rate may be a joint rate or a combination of rates applicable on through business. Where no joint through rate is in effect, combination through rate over a through route may be made up of any rates applicable on through transportation—the sum of the locals, or a poroportional rate in and a local rate out, or two or more proportionals, or any other lawfully established rates which may be joined together to make a rate over the through route; but such combination through rate must be treated as a unit from the date of original shipment to the date of arrival at destination and the rate applied must be the combination of rates which exists upon the date of original shipment. Tariffs cannot be given a retroactive effect; they cannot be made to apply to conditions other than those existing upon the date when such tariffs become effective. A combination through rate is as binding, definite, and absolute as a joint through rate; and all of the conditions, regulations, and privileges obtaining as to any factor in such combination rate for through shipment at the time of initial shipment upon such combination through rate must be adhered to and cannot be varied as to that shipment during the period of transportation of such shipment to its final destination. A local or proportional rate "in" cannot be absorbed, diminished, or affected by any "out" rate not in effect at the time when the traffic moved upon such local or poroportional rate.

A further question decided in the same case is as to the rate that should govern over a through route when a through rate charged is made up of the sum of the locals. Commissioner Lane holds that the rate that should be applied is a combination through rate made up of the sum of the locals or other lawfully established rates applicable on through business at the time when the shipment originates, as follows:

There may be through routes without joint rates. A joint rate is simply a through rate every part of which has been made by express agreement between the carriers making the through route. The joint rate is a rate over a through route; but it is not the only through rate recognized by the act and the decisions.

Among the important amendments made in 1906 to the interstate commerce act was that which makes it the duty of every carrier subject to the act "to establish through routes and just and reasonable rates applicable thereto" (Section 1.) It is not necessary here to attempt to discover the full force of these words. Their significance is not to be grasped without consideration of the latter portion of the act (section 6), which expressly recognizes the possibility of a through route without a joint rate, and which, after directing the publication and filing of local rates and of joint rates, provides for still other rates in the following language:

"If no joint rate over the through route has been established, the several carriers in such through route shall file; print, and keep open to public inspection, as aforesaid, the separately established rates, fares, and charges applied to the through transportation."

The reasons for this rule are at least two: (1) The policy of the law that every route and every service shall have a published rate equally known and equally available to all patrons of the carriers, and (2) the policy of the law that carriers not otherwise subject to the act shall be, when participating in interstate business, subject to the act to regulate commerce.

A through route is a continuous line of railroad formed by an arrangement, express or implied, between connecting carriers. It must have a rate for every service; and, as the route is a new unit—one line formed of two or more connecting lines—so its rate for every service is a unit, even though it be divided between the several carriers arranging themselves into the through route. Through carriage implies a through rate. This is equally true whether the through rate be published as a whole by the joint action of the connecting carriers, or, in the absence of a joint arrangement, be published in portions by the several carriers. The route being one, a contract for a service over it is a contract for a single service, all the terms of which must be fixed at one and the same time; that is, at the time of the making of the contract for the service. The rate is either a joint through rate made by arrangement by the parties to the through route, or it is a combination through rate consisting of the separately established rates, fares, and charges applied to the through transportation. This sum, however, is a single rate for a single service.

In answering the question as to the existence of a through route all the incidents and circumstances of the shipment must be taken into account. Carriers arranging for a through route, and also for a joint rate, must give notice to the world of such arrangement by publication. Carriers forming through routes without joint rates, however, may publish and file only the separately established rates, fares, and charges applied to the through transportation. As a matter of fact most, if not all, carriers subject to the act use their local rates as through rates where no joint rate is established. It is therefore evident that such incidents as the billing, the collection and division of charges, the use of a proportional rate to or from junction points or basing points, and other local incidents of the transaction may properly be depended upon for guidance as to the existence of a through route. A through bill of lading as to the carriers recognizing it has been held by the Supreme Court to be conclusive evidence of the existence of a through route.

Demands of Railroad Employees in Great Britain.

Resolutions recently passed by some 50,000 railroad employees assembled in London contain the following demands, compliance with which it is estimated would raise the expenses of English railroads by $37,500,000 and reduce the average dividend rate from 3 to 1.7 per cent. These resolutions are as follows:

1. An 8 or 10-hour day, according to class.
2. Minimum of 9 hours' rest before duty.
3. Overtime at a time and a quarter minimum.
4. Sunday duty to be regarded as distinct from the ordinary week's work, and to be paid for at a minimum of time and a half.
5. An immediate advance of 50 cents a week to all grades who do not receive 8-hour day.
6. All grades to be paid in London a minimum of 75 cents a week above the wages paid in the country.
7. Abolition of working only one man in motor cars on electric railways.

Joint Rail and Automobile Rates.

The traffic department of the Tonopah & Tidewater Railroad has issued a circular showing its present arrangements for freight transportation at the northern end of its line. On May 25 the company began operating regular automobile service between Zabriskie, now the last rail station, which is 91 miles north of Ludlow on the Santa Fe, to Greenwater, Cal., the center of a new copper district. The automobile trip takes about 2½ hours. One-way and round-trip tickets, covering railroad and automobile trips, are on sale at principal Santa Fe ticket offices. A commercial agency has

been established in Greenwater. Hand baggage only will be carried on the automobiles; other baggage must be handled by freight teams between Zabriskie and Greenwater.

Two-Cent Fares in Kansas.

Nebraska has passed a 2-cent fare law and through it the Kansas Railroad Commission hopes to obtain a reduction of passenger fares in Kansas to that level, although a 2-cent fare law was rejected at the recent session of the Legislature. If the railroads do not contest the Nebraska law the board will be asked to issue an order reducing rates to 2 cents a mile in Kansas on the ground that the railroads in Nebraska, by failing to contest the law, admit that a 2-cent rate is remunerative. On the other hand, if the railroads do contest the Nebraska law, and the law is upheld, a reduction will be ordered in Kansas on the ground that a 2-cent a mile rate has been held by the courts remunerative in Nebraska and, therefore, that it must be remunerative in Kansas.

Natural Snow Fences.

The Pennsylvania Railroad through its forestry bureau has begun planting low-growing shrubs a few feet apart along the sides of the tracks through the Allegheny mountains at points where snow drifts are accustomed to form on the track in winter. These will take the place of wooden rail fences.

Liquor Shipments in Texas.

A new Texas law fixes a tax of $5,000 on express companies for each office in the state through which c.o.d. shipments of liquor are handled. The Texas railroads have since refused to accept shipments of liquor where there were any charges to be collected at destination, fearing that they would be liable to the tax as doing an express business. The Attorney-General has now ruled that this traffic is permissible by the railroads, so that hereafter Texas lines will accept "shippers order notify" shipments of liquor. Agents, however, are strictly prohibited from collecting from the consignee or remitting to the shipper the price of any liquor.

Municipal Car Line in San Francisco.

The city of San Francisco is to take over the Geary Street Railway at a cost of $750,000. The road is to be converted from a cable to an underground trolley system.

One-Cent Rate for Legislators.

The New Hampshire legislature last winter proposed to pass a law providing that the Boston & Maine should carry about 1,000 state employees free. A substitute measure which was passed provided that the Governor should contract for the transportation of certain state officials. An arrangement has now been made with the Boston & Maine by which about 400 state officials will be carried for 1 cent a mile on mileage books, good only in the state of New Hampshire over the Boston & Maine and the Maine Central.

Broken Rails in Canada.

The Canadian Railway Commission, on account of the increasing number of wrecks directly due to broken rails, has begun an investigation of rail breakages. Since November 15 there have been six such wrecks resulting in loss of life. The Chief Engineer of the commission has called on the railroads to submit their specifications for rails now on order. The commission is considering a system of government inspection either of the manufacture of rails or of the finished product.

Opening of Brooklyn Subway Postponed.

The Counsel and the Chief Engineer of the Rapid Transit Commission have recommended that the construction company which is building the Manhattan-Brooklyn subway, including the tunnel from the Battery under the East river to Brooklyn, be allowed until May 1, 1908, to finish the line. The original contract called for completion of the road from the Battery to the borough hall in Brooklyn by September 1, 1907.

Railroad Commission for Pennsylvania.

The first railroad commission to be established in the state of Pennsylvania is created by a law which was signed by the Governor on May 31. There are to be three commissioners, appointed by the Governor, one of whom is to be a lawyer. They are to be paid $8,000 each. The commission has power over steam and electric railroads, express, telegraph and telephone companies, not only to summon and examine witnesses and investigate complaints, but to inspect all books, papers, leases and contracts. The law goes into effect January 1, 1908.

New York Central Reconstruction Contract Cancelled.

The contract of the O'Rourke Engineering-Construction Company for the excavation and construction of the Grand Central terminal, now a little more than one-third finished, has been cancelled, because the railroad found it impossible to allow the work to proceed as fast as was desired by the construction company. In consequence of the interruption of the work by the movement of trains the O'Rourke company lost heavily. The railroad company has bought the contractor's plant and will organize its own working staff and carry out the work as rapidly as possible.

A Secretary of Transportation.

President W. A. Garrett, of the Seaboard Air Line, in a despatch from Savannah, Ga., is quoted as follows:

President Roosevelt is badly in need of a Secretary of Transportation. The time has come for such a Cabinet office. This official should have great power over matters of transportation, should see that the roads give good service and point out to the public the real situation as to the ability of roads to perform service at given rates. He should be broad minded and one in whom the public has confidence. He could warn the railroads when they are exceeding their rights and should caution the public when it is pushing the roads too hard.

What the country needs now is service, and how is service to be maintained or improved? Certainly not by cutting down the revenues of the roads.

TRADE CATALOGUES.

Irrigated Lands in Montana.—The Chicago, Burlington & Quincy has issued a folder containing information about irrigated lands in the valley of the Yellowstone river near Billings, Mont., which is likely to persuade anyone who reads it and wishes to get close to the soil to move at once to this particular part of Burlington and Northern Pacific territory. The profits and cost of raising sugar beets, alfalfa and potatoes, the three principal crops of the district, as well as fruit, vegetables, poultry and cattle, are recited in some detail and the characteristics of the region and of Billings as a city described. The principal irrigated lands in this district are those owned by the Billings Land & Irrigation Company, the Columbus Land & Water Company and the Cove Ditch Company. Photographs of several of the farms and farmhouses are given and of vegetables raised on irrigated farms "six months from the sage brush."

"Around the Circle" in Colorado.—The Denver & Rio Grande has issued a remarkably attractive illustrated booklet under this title describing the "Circle" trip from Denver through Colorado Springs, the Royal Gorge, Marshall Pass and Montrose to Ridgway, thence via the Rio Grande Southern to Durango, through La Veta Pass and back to Denver, with an alternate stage trip over part of the route. This trip of 1,000 miles through the Rockies covers a succession of mountain scenery which is a revelation to anyone unfamiliar with Colorado and its attractions. The road crosses the continental divide at Marshall Pass at an elevation of 10,860 ft., and at Cumbres, Colo., in the Toltec gorge district near the southern boundary of the state, reaches nearly as great an elevation.

Electric Hoisting Machinery.—The Lidgerwood Manufacturing Co., New York, is distributing a pamphlet illustrating and describing several types of electric hoists driven by General Electric 250 to 500-volt direct-current motors. These hoists are built with single and double drums, and in sizes from 1½ to 50 h.p. The pamphlet gives sizes, diameters, weights and capacity. The electric mast hoist, which is a new type, has two drums, and is driven by a 20-h.p., 250-volt motor. It is mounted on the side of the derrick mast and is furnished with swinging gear.

Rail Specifications.—The American Bureau of Inspection and Tests, consulting and supervising engineers, Chicago, has published a pamphlet giving specifications for new and relaying rails of various grades, and other information interesting to buyers and railroad engineers. On the back of the pamphlet is printed a convenient table showing the material needed for one mile of single-track road. This table shows the number of cross ties needed for different lengths of rail, tons of rail of various weights, and splices, bolts and spikes of different sizes required.

Air Compressors.—Catalogue No. 58 of the Sullivan Machinery Co., Chicago, is entitled "Modern Practice in Air Compression." It has 112 pages and is well illustrated. It gives general data on the use of compressed air, and fully describes different types of compressors, including types of Sullivan straight-line air compressors,

Duplex air compressors, Corliss air compressors, and high-pressure air compressors, as well as air reservoirs, air reheaters, rock drills, etc., made by the company.

Dominion Atlantic Railway.—The passenger department of this road has issued a pamphlet entitled "Summer Homes in Nova Scotia." It is attractively illustrated and gives the names of places in Nova Scotia which can be reached via the Dominion Atlantic. The attractions of each town are listed, and hotels and boarding houses, with the rates they charge, are given.

Machine Tools.—Catalogue No. 4 of the Pratt & Whitney Co., Hartford, Conn., is a full catalogue of this company's products, which include taps and dies, bolt and pipe threaders, drills, lathe tools, boiler punchers etc. The catalogue illustrates, describes and gives sizes and price list of a great variety of these and similar tools.

Interurban Equipment.—Bulletin No. 1,058 of the Allis-Chalmers Co., Milwaukee, describes the Winona Interurban, the first section of which, from Warsaw, Ind., to Goshen was recently finished. All of the machinery and electrical equipment in the power-house sub-station and cars were furnished by the Allis-Chalmers Co.

Insulators.—A folder which is being distributed by the H. W. Johns-Manville Co., New York, is devoted to Keystone hair insulators. This material consists of cleansed and chemically treated cattle hair, packed between layers of building paper. It can be used for all purposes to which sheathing papers are applicable.

Bolt and Rod Heating Furnaces.—The Rockwell Engineering Co., New York, is distributing two folders describing furnaces for heating rods and for heating bolts. The folders give diameters and weights of a number of styles of each furnace. The fuel used is either oil or gas.

Staybolts.—The Falls Hollow Staybolt Co., Cuyahoga Falls, O., is distributing circulars calling attention to tests of staybolts made by a committee of the Master Mechanics' Association, and using these results as a text to point out advantages of the hollow staybolt.

Valves.—The Crane Co., Chicago, is distributing a pamphlet briefly describing and illustrating some of its more important valves, fittings and special appliances. It is designed to call attention to apparatus more fully described in the company's complete catalogue.

Michigan Central.—The passenger department is distributing a folder describing the attractions of Topinabee, Mich., a summer resort on the west shore of Mullet Lake. The photographs reproduced are charming and the literature is convincing.

Graphite.—The Joseph Dixon Crucible Co., Jersey City, N. J., has published a 43-page report made by Prof. W. F. M. Goss, of Purdue University, on the series of tests of graphite made by him several years ago.

Manufacturing and Business.

Dodge & Day, engineers and constructors, Philadelphia, have opened an office at 115 Broadway, New York, in charge of Robert T. Lozier.

D. J. Carson, who has been in charge of the New York office of the American Brake-Shoe & Foundry Company, Mahwah, N. J., for the past two years, has been appointed manager of the American Malleables Company.

The American File Sharpener Co., New York, will exhibit at Atlantic City, during the Master Car Builders' and Master Mechanics' conventions, a file sharpening machine, and will give daily demonstrations of its operation.

The Power Specialty Company, 111 Broadway, New York, reports recent sales of 120 Foster superheaters, aggregating 42,000 h.p. These superheaters are to be installed in B. & W., Stirling, Edge Moor, Heine, Franklin, Atlas and other boilers, including a number of return tubular boilers.

The Northern Engineering Works, Detroit, Mich., recently shipped to the Denver & Rio Grande a second three-motor, electric, traveling, 15-ton, Northern crane of special construction, for house use. The crane is operated by alternating current motors, and is designed to run on an overhead curved track.

A quarterly dividend of 1 per cent. on the $30,000,000 common stock of the American Car & Foundry Company has been declared, payable July 1. This declaration raises the annual rate from 2 per cent. to 4 per cent., quarterly dividends of one-half of 1 per cent. each having been paid in January and April, 1907. No dividends were paid in 1906 and 1905, and previous annual dividend rates were as follows: 1904, 1 per cent.; 1903, 4 per cent.; 1902, 2 per cent.; 1901, 2 per cent., and 1900, 1 per cent.

A. W. Wheatley, Assistant Superintendent of Motive Power and Machinery of the Union Pacific, has been appointed General Inspector of the American Locomotive Company, with office at Schenectady, N. Y. Mr. Wheatley is 35 years old; he came from England 15 years ago, and began railroad work on the Northern Pacific as a machinist. He worked his way up until he was made General Master Mechanic, and then went to the Chicago, Rock Island & Pacific as Superintendent of the East Moline shops. He was appointed Assistant Superintendent of Motive Power and Machinery of the Union Pacific in the spring of 1906. As General Inspector of the American Locomotive Company, Mr. Wheatley will report to the Vice-President in charge of manufacturing, and he will oversee shop practice at the different works.

Iron and Steel.

The Chicago & North-Western has ordered 4,000 tons of rails; the Wisconsin Central, 6,000 tons; the Pennsylvania, 3,000 tons, and the Rock Island, Arkansas & Louisiana, 7,000 tons. The Atchison, Topeka & Santa Fe is in the market for about 50,000 tons.

The Wisconsin Bridge Company has an order for 3,500 tons of steel for the Clinton (Iowa) bridge from the Chicago & North-Western. The Toledo-Massillon Bridge Company, Toledo, Ohio, has orders for 4,700 tons for two bascule bridges over the Chicago river. The Missouri Bridge & Iron Co., St. Louis, Mo., has a contract for 1,000 tons of steel for the Eighteenth street bridge, St. Louis. It is estimated that between 150,000 and 175,000 tons of structural steel has been ordered in May, which is the largest amount for any month since the first of the year.

The Seaboard Air Line, it is said, has ordered 11,000 tons of rails from an eastern mill, and the Northern Pacific 35,000 tons from the Lackawanna Steel Company for this year's delivery; the Southern has ordered 300,000 tons from the Tennessee Coal & Iron Company for delivery next year, and is also negotiating for 10,000 tons of Bessemer rails. The Chesapeake & Ohio is in the market for 11,000 tons. The Harriman inquiry for 25,000 tons of Bessemer rails has been withdrawn.

OBITUARY NOTICES.

Archibald MacArthur, President of MacArthur Bros. Co., contractors, died on June 2 at his home at Riverside, N. Y. Mr. MacArthur was 73 years old, and had been for many years at the head of the firm founded by his father.

Francis L. Clark, Consulting Engineer for the Westinghouse Air-Brake Company, died in Los Angeles on May 26 of paralysis and heart disease. Mr. Clark was 65 years old. He had been chief draftsman and engineer of the Westinghouse Air Brake Company until about six months ago, when he had an attack of paralysis and went to California; he was then made a Consulting Engineer.

P. J. McGovern, Chairman of the Southern Classification Committee, died at El Paso, Tex., on May 30 from pulmonary trouble. Mr. McGovern had gone to Texas several months ago on account of his illness. He was born in Cincinnati, Ohio, in 1856, and began railroad work as a clerk in a local freight office of the Louisville & Nashville in 1882. He worked his way up until appointed Assistant General Freight Agent in 1890, and two years later went to the Richmond & Danville, now part of the Southern, as clerk to the Traffic Manager. In the fall of that year he was made Assistant Commissioner of the Southern Railway & Steamship Association and the Southern States Freight Association. In 1896 he returned to the Southern Railway as chief clerk in the rate department of the general freight office, and after three years took the position he held at the time of his death.

John A. Walker, Vice-President and Treasurer of the Joseph Dixon Crucible Company, died recently at his home in Jersey City, N. J. Mr. Walker was born in New York in 1837. He prepared for college but went at once into business instead. He served in the Civil War and in 1867 went to Joseph Dixon & Co. The next year, when the present company was formed, he was made Secretary; later he assumed also many of the duties of Manager and was also made Treasurer. In 1891 he was elected to the office he held at the time of his death. For some years the general management of the company has been largely in his hands. Mr. Walker was of Scotch descent. He was keen and critical, and his business career shows his faculty for looking ahead and preparing for emergencies. His broad tastes and diverse interests are evidenced in the many offices he held outside of his main duties. He was Vice-President

of the Colonial Life Insurance Company, and a director of several trust companies; President of the Children's Friend Society, and a member of the Chamber of Commerce of New York and of the Board of Trade of Jersey City. He was a member of several Jersey City clubs, and also of the National Geographical Society, the Society for Psychical Research and an Associate Member of the American Institute of Mining Engineers. He was formerly on the Jersey City Board of Education and Trustee of the Jersey City Public Library and of other city institutions.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Buffalo & Susquehanna.—Charles W. Goodyear, who was recently elected President of the Buffalo & Susquehanna, was born on October 15, 1846, at Cortland, N. Y. He was educated at Cortland Academy. He studied law and was admitted to the bar in 1871, and later was made District Attorney of Erie County, N. Y. He practiced law until 1887, and then was elected Second Vice-President of the Buffalo & Susquehanna Railroad. When the present company, the Buffalo & Susquehanna Railway Company, was organized, he was made First Vice-President. He has also been Vice-President of the New Orleans Great Northern, which was organized last year, and he has now been elected President of this company also.



C. W. Goodyear.

Chicago & Alton.—James B. Forgan has resigned as a Director.

Delaware & Hudson.—W. H. Williams, who was recently appointed Assistant to the President, was born at Athens, Ohio, on June 25, 1874, and has been in railroad service since 1890. He began as assistant cashier in the local freight office at Toledo on the Pennsylvania Lines West, but resigned to take a business college course. In the fall of 1891 he went to the Pittsburg & Lake Erie, and in February, 1892, returned to the Pennsylvania Company, and became a stenographer in the office of the Superintendent of Telegraph at Pittsburg, later being appointed to a similar position in the office of the General Manager. In January, 1901, he became chief clerk to the Fourth Vice-President, and six months afterward was appointed Assistant Secretary of the Baltimore & Ohio. In September, 1902, he was appointed Assistant to the General Manager of the Baltimore & Ohio, and in 1904 was appointed Superintendent of Freight Transportation of the St. Louis & San Francisco. In July, 1905, he left railroad work to become Traffic Manager of the Merchants' and Manufacturers' Association of Pittsburg. He was later made Traffic Manager of the Pittsburg Chamber of Commerce, where he remained until his recent appointment to the Delaware & Hudson.



W. H. Williams.

See Napiersville Junction.

Napiersville Junction.—L. F. Loree, President of the Delaware & Hudson, has been elected also President of the Napiersville Junction, succeeding W. C. Witherbee, resigned. George F. Hartt has been elected Vice-President and Assistant Treasurer. C. A. Walker, Treasurer of the Delaware & Hudson, has been elected also Treasurer of the Napiersville Junction, and L. J. Beique has been elected Secretary. The road, which has just been opened, is an extension of the Delaware & Hudson from Rouse's Point, N. Y., northwest to St. Constant, Que.

New Orleans & North-Eastern.—D. E. Curran, Vice-President and General Manager, has been elected President of this road and of the Alabama & Vicksburg and the Vicksburg, Shreveport & Pacific, succeeding C. C. Harvey, resigned.

New Orleans Great Northern.—C. W. Goodyear, Vice-President, has been elected President, succeeding F. H. Goodyear, deceased. M. E. Olmstead, General Counsel, has been elected Second Vice-President.

Norfolk & Western.—W. G. MacDowell, Vice-President, has been elected First Vice-President. N. D. Maher, General Manager, has been elected also a Vice-President; T. S. Davant, Freight Traffic Manager, has been elected Vice-President and Traffic Manager. These elections are effective July 1.

Rock Island Company.—A. S. Greig, Assistant to the President of the St. Louis & San Francisco, has been appointed Assistant to the Chairman of the Executive Committee of the Rock Island Company.

St. Louis & San Francisco.—See Rock Island Company.

Southern Pacific.—Charles H. Reddington has been elected Assistant Treasurer, succeeding A. K. Vandeventer.

Traffic Officers.

Chicago, Burlington & Quincy.—E. H. Smith has been appointed General Agent at Cleveland, Ohio, succeeding M. F. McMillan, resigned on account of ill health.

Manistee & North-Eastern.—F. A. Mitchell, General Freight and Passenger Agent, has been appointed to the new office of Traffic Manager. Dennis Riely, commercial agent of the Ann Arbor at Toledo, Ohio, succeeds Mr. Mitchell, with office at Manistee, Mich.

St. Joseph & Grand Island.—F. O. Hatch, formerly General Agent of the Chicago Great Western at San Francisco, Cal., has been appointed General Agent of the St. Joseph & Grand Island at San Francisco.

Tehuantepec National.—See Vera Cruz & Pacific.

Vera Cruz & Pacific.—G. J. Dwan, Assistant General Freight and Passenger Agent, has resigned to go to the Tehuantepec National.

Operating Officers.

Denver & Rio Grande.—W. S. Martin, General Manager of the Mexican International, has been appointed Assistant General Manager of the Denver & Rio Grande.

Hidalgo & Northeastern.—See National Lines of Mexico.

Interoceanic of Mexico.—See National Lines of Mexico.

Lake Shore & Michigan Southern.—See Michigan Central.

Mexican International.—See National Lines of Mexico.

Michigan Central.—S. W. Brown, Assistant General Superintendent of the Lake Shore & Michigan Southern, has been appointed General Superintendent of the Michigan Central, succeeding H. C. Nutt, resigned to go to the Northern Pacific. Mr. Brown was born in Illinois in 1858; he began railroad work in 1872 as night operator on the Chicago, Burlington & Quincy. He was transferred to the general offices a few years later and, after serving as chief despatcher on the St. Louis division, resigned in 1886. He was out of railroad work until 1901, when he was made Trainmaster of the Western division of the Lake Shore & Michigan Southern. In 1903 he was appointed Assistant Superintendent of that division and also of the Indiana, Illinois & Iowa. In the spring of 1905 he was made Superintendent of the Western division, and in the fall of that year was transferred to the Eastern division. A year later he was appointed



S. W. Brown.

Assistant General Superintendent, which position he leaves to go to the Michigan Central.

Missouri, Kansas & Texas of Texas.—C. H. Scott, Acting Superintendent of the Shreveport and Mineola divisions and the McKinney branch, has been appointed Superintendent of the Fort Worth, Dallas, Denton and Henrietta divisions, and the Sherman, Bonham and Cleburne branches, with office at Denison, Tex., succeeding R. J. Sullivan, resigned.

Missouri Pacific.—A. J. Alexander, Superintendent of the Arkansas division, has been appointed Superintendent of the Eastern division, with office at Sedalia, Mo., succeeding H. G. Clark, promoted. J. Cannon, Superintendent of the Missouri division, succeeds Mr. Alexander, with office at Little Rock, Ark. J. W. Dean, Superintendent of the Central division, succeeds Mr. Cannon, with office at De Soto, Mo. J. M. Walsh, Superintendent of the Northern Kansas division, succeeds Mr. Dean, with office at Van Buren, Ark. W. E. Brooks, Inspector of Passenger Service, succeeds Mr. Walsh, with office at Atchison, Kan.

L. B. McGuire, Acting Trainmaster at Nevada, Mo., has been appointed Trainmaster at that place.

National Lines of Mexico.—The authority of A. Clark, General Manager of the National Railroad of Mexico and of the Mexican International, has been extended over the Interoceanic of Mexico and the Hidalgo & Northeastern. H. M. Taylor, General Manager of the Interoceanic of Mexico, has been appointed Assistant General Manager of the four roads.

National Railroad of Mexico.—See National Lines of Mexico.

New York Central & Hudson River.—C. L. Bardo has been appointed Superintendent of the Electric division, with office at New York.

Southern.—C. G. Walker, Agent at East St. Louis, Ill., has been appointed Superintendent of the Louisville division of the St. Louis-Louisville Lines, with office at Louisville, Ky., succeeding B. C. Milner, resigned to go into other business at Atlanta, Ga. J. F. Sheridan, Assistant Superintendent of the St. Louis division, has been appointed Superintendent of Terminals at East St. Louis, and his former office has been abolished.

Trinity & Brazos Valley.—John J. Flynn, Superintendent of the Memphis division of the Yazoo & Mississippi Valley, has been appointed Superintendent of the Trinity & Brazos Valley, with office at Teague, Tex., succeeding J. M. Lee, resigned. W. A. Allison, Trainmaster of the Memphis division of the Yazoo & Mississippi Valley, has been appointed Superintendent of Telegraph of the Trinity & Brazos Valley, with office at Teague, Tex.

Union Pacific.—A. W. Wheatley, Assistant Superintendent of Motive Power and Machinery, has resigned to go to the American Locomotive Company as General Inspector, with office at Schenectady, N. Y.

Yazoo & Mississippi Valley.—See Trinity & Brazos Valley.

Engineering and Rolling Stock Officers.

Erie.—William Schlafge, General Master Mechanic, has been appointed Assistant Mechanical Superintendent, and his former office has been abolished. George O. Hammond, Mechanical Superintendent, has been appointed Assistant to the Mechanical Superintendent. E. G. Chenoweth, draftsman, succeeds Mr. Hammond. The offices of all are at Meadville, Pa.

Missouri, Kansas & Texas.—H. J. Tierney has been appointed to the new office of Mechanical Engineer, with office at Parsons, Kan.

New York, New Haven & Hartford.—M. C. Hamilton has been appointed Engineer of Maintenance of Way, with office at New Haven, Conn., succeeding W. J. Black, transferred.

Northern Pacific.—A. C. Terrell, Division Engineer at Spokane, Wash., has, at his own request, been transferred to his former position of Assistant Engineer at Trout Creek, Wash.

Pennsylvania.—C. L. McIlvaine, Master Mechanic at Camden, N. J., has been appointed Assistant Engineer of Motive Power of the Buffalo & Allegheny Valley division, with office at Buffalo, N. Y., succeeding S. G. Thomson, transferred to the General Manager's office.

Western Maryland.—David Holtz, Master of Machinery, with office at Union Bridge, Md., has resigned after 30 years' service, and the office has been abolished.

Purchasing Agents.

Central New England.—See New York, New Haven & Hartford.

New York, New Haven & Hartford.—A. E. Mitchell, Expert and Engineer of Tests, has been appointed Manager of Purchases and Supplies of this company and of the Central New England. He will perform his former duties as well as those of Purchasing Agent heretofore performed by E. L. Pollock, resigned to go to the Rock Island. Mr. Mitchell graduated as Mechanical Engineer from the Maine State College in 1875. He served for ten months as an apprentice in the Baldwin Locomotive Works, and then, in 1877, began railroad work in the Altoona shops of the Pennsylvania. Two years later he was transferred to the test department, and in 1880 was made Assistant Engineer of Signals. After spending a year in the Yale & Towne Manufacturing Company, he went to the New York & New England, now part of the New York, New Haven & Hartford. In 1884 he again left railroad work and spent two years in mechanical engineering work for different companies. He then went to the motive power department of the New York, Lake Erie & Western, now the Erie, and in 1887 was made Engineer of Signals. He was appointed Engineer of Tests in 1889, and in 1890 Mechanical Engineer of the Erie and of the Chicago & Erie; he was made Superintendent of Motive Power in 1892. In 1901 he was appointed Assistant Superintendent of Motive Power of the Chicago, Milwaukee & St. Paul, and a year later went to the Northern Pacific as Superintendent of Motive Power. In 1904 he was appointed Superintendent of Motive Power of the Lehigh Valley, where he remained until last spring. He was later employed by the New York, New Haven & Hartford to inventory and appraise the value of the road's motive power and rolling stock; this work was followed by his appointment as Engineer of Tests.



A. E. Mitchell.

LOCOMOTIVE BUILDING.

Swift & Co., Chicago, have ordered three 30-ton saddle tank locomotives from the Davenport Locomotive Works.

Fantauzzi & Company, owners of the Lafayette sugar plantation, Porto Rico, have ordered a locomotive from the Baldwin Locomotive Works.

The Mexico, Santa Fe & Perry Traction Co., as reported in the *Railroad Gazette* of May 31, is in the market for one electric locomotive. S. L. Robison, President and General Manager, Mexico, Mo.

The Nevada Northern, as reported in the *Railroad Gazette* of May 24, has ordered two consolidation (2-8-0) locomotives from the American Locomotive Co., for August delivery. The specifications are as follows:

General Dimensions.

Type of locomotive	Consolidation
Weight, total	333,000 lbs.
Weight on drivers	168,000 "
Diameter of drivers	51 in.
Cylinders	21 in. x 30 in.
Boiler, type	Straight top
" working steam pressure	180 lbs.
" number of tubes	380
" material of tubes	Charcoal iron
" diameter of tubes	2 in.
" length of tubes	14 ft. 9 in.
Firebox, length	108 in.
" width	99 "
" material	Open hearth
" grate area	51.7 sq. ft.
Heating surface, total	3,084.0 "
Tank capacity	7,500 gals.
Coal capacity	12 tons

Special Equipment.

Air-brakes	Westinghouse-American
Couplers	Tower

The Colorado Midland, as reported in the *Railroad Gazette* of May 17, has ordered six simple consolidation (2-8-0) locomotives from the Baldwin Locomotive Works, for October delivery. The specifications are as follows:

General Dimensions.

Type of locomotive	Consolidation
Weight, total	193,000 lbs.
Weight on drivers	175,000 "
Diameter of drivers	52 in.
Cylinders	22 in. x 28 in.
Boiler, type	Straight top
" working steam pressure	200 lbs.
" number of tubes	413
" diameter of tubes	2 in.
" length of tubes	15 ft.
Firebox, length	108 in.
Firebox, width	66 "
Tank capacity	7,000 gals.
Coal capacity	About 15 tons

Special Equipment.

Air brakes	Westinghouse
Boiler lagging	Magnesia
Brake-beams	Marden
Brake-shoes	Perfecto
Couplers	Climax
Injector	Monitor
Journal bearings	Ajax
Piston rod packings	United States
Valve rod packings	United States
Safety valve	Crosby
Sanding devices	Leach
Sight-feed lubricators	Nathan
Tires, driving wheel	Midvale

CAR BUILDING.

Bond Brothers, Bond, Md., have ordered some passenger cars.

The Prescott & North-Western is said to have ordered 25 flat cars from the Danville Car Company.

The O. F. Jordan Company, Chicago, has ordered five flat cars from the Hicks Locomotive & Car Works.

The United Verde & Pacific has ordered one combination coach from the American Car & Foundry Co.

The Chicago, Lake Shore & Eastern has ordered 2,600 freight cars from the American Car & Foundry Co.

The Mexican Railway is in the market for six chair cars, six first-class coaches and six third-class coaches.

The American Car & Foundry Co. has recently booked orders for one beef car, 105 tank cars, 50 cane cars and 18 logging cars.

The La Croze Tramways Co., Buenos Ayres, has ordered some single and double truck cars from the J. G. Brill Company.

The Chicago, Burlington & Quincy has ordered 2,000 40-ft. wooden box cars of 80,000 lbs. capacity from the Pullman Co.

The Solvay Process Company has ordered 10 steel double bottom hopper coal cars of 50 tons capacity from the Standard Steel Car Company.

The Stewart Sugar Company (formerly the Silveria, Cuba, Sugar Company) has ordered fifty 100,000-lb. cars from the American Car & Foundry Co.

The J. M. Guffey Petroleum Company has ordered 100 steel-underframe tank cars of 80,000 lbs. capacity from the American Car & Foundry Company.

The Cedar Rapids & Iowa City Railway & Light Company is figuring on 25 stock cars, five flat cars and five box cars, all of 60,000 lbs. capacity.

The Arms Palace Car Company, Chicago, as reported in the *Railroad Gazette* of May 17, has ordered ten express horse cars from the Pullman Company.

The Bolivia Railway has ordered 10 passenger coaches from the American Car & Foundry Co., to be built at Wilmington, Del., as reported in the *Railroad Gazette* of March 1.

The Detroit & Toledo Construction Company, Harvey, Ill., successors to the Chicago & Southern Traction Co., has ordered three flat cars and one ballast car from the Hicks Locomotive & Car Works.

The Elgin, Joliet & Eastern, as reported in the *Railroad Gazette* of May 3, has ordered 1,350 steel underframe side dump gondola cars, 1,000 steel side dump coke cars and 250 steel drop bottom gondola cars from the American Car & Foundry Co.

The Aurora, Elgin & Chicago, as reported in the *Railroad Gazette* of May 24, has ordered two standard cars of 80,000 lbs. capacity from the Hicks Locomotive & Car Works. These cars will be 52 ft. 10½ in. long, 8 ft. 8 in. wide and 13 ft. 8 in. high, over all.

The Mexican National Sugar Refining Company has ordered a number of cars for its Cordoba, Vera Cruz, plantation railroad, as reported in the *Railroad Gazette* of March 15. The Eastwick Engineering Co., 32 Broadway, New York, represents the sugar company.

The Mexico, Santa Fe & Perry Traction Co., as reported in the *Railroad Gazette* of May 31, is in the market for six passenger cars, one party car, one express car, one work car and one line car. The passenger cars will be 52 ft. long from bumper to bumper, and weigh from 30 to 32 tons. S. L. Robison, President and General Manager, Mexico, Mo.

The Kanawha & West Virginia has ordered ten 36-ft. box cars of 60,000 lbs. capacity from the Hicks Locomotive & Car Works. The special equipment includes:

Couplers	Tower
Door fastenings	Security
Draft rigging	Miner
Roofs	Excelsior Car Roofing Co.

The Colorado Midland has ordered 100 coal cars of 80,000 lbs. capacity from the Western Steel Car & Foundry Co., instead of from the Pressed Steel Car Co., as reported in the *Railroad Gazette* of May 17. These cars are for July delivery, and will measure 36 ft. long, 9 ft. wide and 4 ft. high, inside measurements. The special equipment includes:

Brakes	Westinghouse
Couplers	Climax
Draft rigging	McCord
Journal boxes	McCord

The Nevada Northern, as reported in the *Railroad Gazette* of May 24, has ordered 50 side dump gondola cars of 100,000 lbs. capacity from the National Dump Car Co., for August delivery. These cars will weigh 36,000 lbs., and measure 22 ft. long, 10 ft. wide and 9 ft. 4½ in. high, inside measurements. The special equipment includes:

Brake-beams	Simplex
Brakes	Westinghouse
Couplers	Climax
Draft rigging	Republic.

The Tonopah & Goldfield, as reported in the *Railroad Gazette* of April 12, has ordered six cabooses of 30,000 lbs. capacity from the Pullman Company for June delivery. These cabooses will measure 18 ft. 4 in. long, 9 ft. wide and 6 ft. 3 in. high, inside measurements. The special equipment includes:

Axles	Pullman
Brake-beams	Pullman
Brake-shoes	Christie
Couplers	Climax
Door fastenings	Yale
Springs	Pittsburg Spring & Manufacturing Co.
Wheels	Griffin

The Atlanta, Birmingham & Atlantic has ordered 500 40-ft. box cars and 300 40-ft. flat cars, both of 60,000 lbs. capacity, from the American Car & Foundry Company, and 900 40-ft. coal cars of 80,000 lbs. capacity and 30 40-ft. cabooses from the South Atlantic Car & Manufacturing Company; deliveries are to be made at the rate of 10 to 15 a day, beginning August 1, 1907. The special equipment for all cars includes:

Bolsters	Bettendorf
Brakes	Westinghouse
Couplers	Major
Draft rigging	Miner
Journal boxes	Bettendorf (Integral)
Roofs, box cars and cabooses	Hutchins outside
Trucks, box and flat cars	Bettendorf frames
Trucks, coal cars and cabooses	Bettendorf

The Atchison, Topeka & Santa Fe, as reported in the *Railroad Gazette* of May 24, has ordered 250 tank cars of 10,000 gallons capacity from the Pressed Steel Car Company for August, 1907, delivery. The tanks will be built by the Hamler Boiler & Tanks Works. These cars will measure 35 ft. 7 in. long, inside measurements, and 38 ft. 1¾ in. long, 9 ft. 6 in. wide and 12 ft. 9 1/16 in. high, over all. The special equipment includes:

Bolsters	American Steel Foundries
Brake-beams	Kewanee
Brakes	Westinghouse
Brasses	Hewitt
Couplers	R. E. Janney
Draft rigging	Westinghouse
Journal boxes	Franklin
Springs	Simplex
Trucks	Barber
Wheels	Griffin

RAILROAD STRUCTURES.

Evansville, Ind.—The Evansville & Terre Haute has given a contract for its new passenger station to cost $95,000.

Kansas City, Kan.—The Chicago, Rock Island & Pacific, it is said, will put up 12 shop buildings here as soon as an ordinance is passed by the city vacating certain streets.

Madison, Ohio.—Local reports state that the Lake Shore & Michigan Southern will put up a new freight and passenger station here to cost $50,000.

New Orleans, La.—The Louisville & Nashville, it is said, will enlarge its freight yards at Gentilly at a cost of $150,000.

Toronto, Ont.—Dickson Bros. has the contract for a steel bridge over Spanish river, to cost $20,000.

The Grand Trunk, it is said, has decided to build an overhead bridge across its tracks at Sunnyside Park.

Vera Cruz, Mex.—Excavation work for the new union terminal buildings at this place has been started under the direction of Rodolfo Wiessner. The main work will not be started until the fall. The project calls for an expenditure of $8,000,000, and the construction of larger terminals than any now in existence in Mexico. The proposed passenger station and office building is to cost $1,000,000 Mexican currency.

Wilkesbarre, Pa.—It is expected that work will soon be started on the new East End bridge. The structure is to cost about $100,000, of which $25,000 is to be paid by the city and $20,000 each by the Central of New Jersey, the Delaware & Hudson and the Lehigh Valley Railroads.

Winnipeg, Man.—Contract for the additions to the Canadian Pacific shops here has been let to McDiarmid Bros., at $150,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BOSTWICK.—An officer writes that this company has finished its road and it is now in operation from Bostwick, Ga., southeast to Apalachee, on the Central of Georgia, six miles. John Bostwick, President, and W. B. Thomas, Chief Engineer, Bostwick, Ga.

CHICAGO, OTTAWA & PEORIA.—Incorporated in Illinois, with $50,000 capital, to build from Chicago, southwest to Peoria, 150 miles, with a branch from Ottawa west to Princeton, 35 miles. The incorporators include: H. E. Chubbock, of Ottawa, and W. A. Carnahan, C. Zilly, C. A. Wright and G. Mattis, of Champaign.

DELAWARE & HUDSON.—The Napierville Junction has been opened for traffic from Rouse's Point, N. Y., via Lacombe and Napiersville to St. Constant, Que., where connection is made with the Grand Trunk and the Canadian Pacific. (March 15, p. 383.)

DUE WEST.—An officer writes that a grading contract has been given to W. O. Willard, also to Gilliam Bros., and to O. Sullivan for ties. The line is building from Donalds, S. C., in Abbeville county on the Southern, south to Due West, 4½ miles. Track laying is to be started shortly. R. S. Galloway, President, and T. C. Anderson, Chief Engineer, Due West, S. C.

GLENFIELD & WESTERN.—An officer writes that this company, which now operates a line from Glenfield, N. Y., where connection is made with the Rome, Watertown & Ogdensburg division of the New York Central & Hudson River, to Page, 16½ miles, has finished grading on an extension of 2½ miles to Monteola. The work is being done by the company's forces.

GRAND TRUNK PACIFIC.—Construction work on the line from Winnipeg to Edmonton is being pushed with all possible speed. Owing to the late winter, work has been delayed for nearly two months and extra forces of men will be put on to make up for lost time. The section of 275 miles from Portage la Prairie, Man., west to Touchwood Hills is being built by the Macdonald-McMillan Construction Co., of Winnipeg; the next section of 150 miles from Touchwood Hills to Saskatoon, Sask., by the Canadian White Co., and the section from Saskatoon to Edmonton, 315 miles, is being built by Foley Bros., Larsen & Co. These contractors are experiencing considerable difficulty in securing labor and are offering unusual inducements to workingmen. The line west from Edmonton to the Pacific is being surveyed, the route having been located through the mountains. There will not be any construction work done on this section for some time.

GULF LINE.—This company, recently incorporated in Georgia, with office at Atlanta, is planning to build an extension of the Flint River & Gulf from Hawkinsville, Ga., to Bainbridge, 130 miles, and eventually to a gulf port about 100 miles additional.

HORNELL & DANSVILLE.—The New York State Board of Railroad Commissioners has granted a certificate of necessity to this company to build a line from Burns, in Allegheny County, N. Y., north to Danville, Livingston County, 10 miles. Connection is to be made with the Erie at Burns and with the Dansville & Mount Morris at Dansville. The company has a capital of $100,000.

ITHACA-OWEGO TRACTION.—Incorporated in New York with $200,000 capital to build an electric line from Ithaca, N. Y., southeast to Owego, 50 miles. C. W. Munson and J. F. Delaney, of Chicago, are directors.

LAKE ERIE, FREMONT & SOUTHERN (ELECTRIC).—Incorporated in Ohio to build a line from the Toledo, Port Clinton & Lakeside, three miles southwest of Oak Harbor, south through Ottawa, Sandusky and Seneca counties to Tiffin, about 30 miles. A franchise has been secured by the company for a belt line at Fremont, in Sandusky County. H. F. Shunk, T. Schmitt, A. E. Klauser and G. W. Luckey, of Toledo, are incorporators.

LONG ISLAND.—This company is planning to shortly start work on the elimination of grade crossings at North highway, Claypit road and at St. Andrews road in the Shinnecock Hills. The highways are to pass under the tracks at these points. Plans are also under way to eliminate grade crossings at Old West road, Westbury and New York avenue in Huntington.

NAPIERVILLE JUNCTION.—See Delaware & Hudson.

NEW YORK ROADS.—The Salisbury Steel & Iron Company will build a five-mile line to connect its works with the terminus of a spur of the New York Central at Dolgeville, N. Y.

NEW YORK SUBWAYS.—The Rapid Transit Board of New York City has voted to build the Fourth avenue subway in Brooklyn. The projected route is from Chrystie street, in the Borough of Manhattan over the new Manhattan bridge, thence by a four-track subway through the Flatbush extension and Flatbush avenue to Fourth avenue, from which point a two-track subway will run to Coney Island; also one to Fort Hamilton. The plans have also been passed by the Board of Estimates and bids are to be asked for the work in about two weeks. On July 1, when the Rapid Transit Board goes out of existence, the Public Utilities Commission will take charge of the work.

NORTHERN EMPIRE.—Application has been made by a company under this name for incorporation to build a line from a point on the international boundary east of Cardeston, Alb., north through Lethbridge and Fort McMurray, thence northwest passing through Fort Vermillion to a point on the boundary line between British Columbia and Yukon, thence northwest through that territory to the Alaska boundary. Also to build a branch following the north bank of the North Saskatchewan river to Edmonton, Alb.

OHIO & PACIFIC BELT.—An officer writes that this company has been organized to build a belt line from Lowellville, Ohio, northeast to Struthers, to connect the works of the Ohio Iron & Steel Company with the works of the Youngstown Sheet & Tube Company. No work on the line is to be done this summer. Robert Bentley, President, and C. L. Mackey, Engineer, Youngstown.

OKLAHOMA EMPIRE.—Incorporated in Oklahoma with $15,000,000 capital to build a line from a point in Osage reservation, Ind. T., southwest to the western boundary of Greer County, Okla. The incorporators include: T. Eggleston, P. F. Slaton, H. S. Christian and R. F. Pascholl, of Granite.

PENN EASTERN.—Incorporated in Pennsylvania with $150,000 capital to build a line from a point in Pike County, Pa., near Matamoras, on the Delaware river, southwest paralleling that river via Dingman's Ferry, 14 miles. The directors include: William B. Hilliard, of Milford, Pa.; F. W. Cross, C. G. Wood, F. H. Baker and J. W. Stickney.

QUICKSAND-HYDEN.—Organized to build a line from Quicksand, Ky., south through rich coal and timber fields in Lewis County to Hyden, 13 miles. J. W. Gilley, R. C. Lewis and Gilmer Lewis, Quicksand, Ky., are interested. Surveys are to be made at once.

RIO GRANDE, SIERRA MADRE & PACIFIC.—At a recent meeting, it is reported, this company decided to at once spend $15,000,000 building an extension under the name of the Sierra Madre & Pacific from its southern terminus south 100 miles; also a branch from its line at Guzman west to Cananea. (March 15, p. 396.)

ROCKWOOD & BAKERSVILLE.—Incorporated in Pennsylvania with $90,000 capital to build a line from Rockwood, Somerset County, Pa., north to Bakersville, nine miles. C. F. Hood, President, Connellsville; J. S. Braddock, F. L. Brown, S. F. Hood, J. L. Schiek and E. H. Werner, are directors.

ST. LOUIS, BROWNSVILLE & MEXICO.—Arrangements, it is said, are being made by this company to start work on its proposed extension from Algoa, Tex., north to Houston. The extension from Algoa east to Galveston will probably not be built, and trackage rights between these two points may be secured over the Gulf, Colorado & Santa Fe.

ST. LOUIS SOUTHWESTERN.—Local reports state that this company is making surveys for a branch from a point on the main line near Illmo, Mo., north to Cape Girardeau, Mo., seven miles.

ST. MARYS & KINGLAND.—This company, building a line from St. Marys, Ga., northwest to Kingland, 10 miles, has grading finished, and will start track-laying about June 15. S. T. Hanks, Colesburg, is the contractor. L. Johnson, President and General Manager, St. Marys.

SIERRA MADRE & PACIFIC.—See Rio Grande, Sierra Madre & Pacific.

SOUTHERN PACIFIC.—Grading has been finished on the extension of Morgan's Louisiana & Texas from Lafayette, La., which is 145 miles west of New Orleans, east to the west bank of the Mississippi river opposite Baton Rouge, 53 miles. The work includes 12 miles of trestles to be filled in with earth over the Atchafalaya swamp. There is also to be a bridge over the Atchafalaya river 450 ft. long. A ferry service will be put in use from the west bank of the Mississippi to Baton Rouge.

SPRINGFIELD, BEARDSTOWN & QUINCY (ELECTRIC).—Incorporated in Illinois with $25,000 capital and office at Springfield. The company proposes to build an electric line from Springfield, Ill., northwest to Petersburg, thence west via Chandlerville and Beardstown to Quincy, about 100 miles.

SUSQUEHANNA & NEW YORK.—A contract is reported let to Edward Whalen, of Towanda, and work has been started at Marsh Hill, Pa., on a branch south via Newberry Junction to Williamsport, about 18 miles. Yards are to be added at Newberry Junction and at Marsh Hill.

UNION PACIFIC.—The second main track construction on this road this year in addition to the 175 miles in operation between Omaha and Green River, Wyoming, will include about 200 miles

additional. The Lane Cut-Off between South Omaha and Lane, Nebraska, necessitates 3,000,000 cu. yds. of excavation. The cuts include one a mile long with an extreme depth of 87 ft. Two-thirds of the grading is finished, and all the work is to be finished this year. The cut-off saves nearly nine miles over the old main line by way of South Omaha and Gilmore. From Lane to Valley double tracking was finished late last year. About 50 miles more, from Valley to Benton, is to be finished this year. The next sections to be double tracked are between Silver Creek and Lockwood, 38 miles; Alda to Buda, Neb., 29 miles, and Rawlins to Wamsutter, Wyo., 41 miles.

Vandalia.—This company is laying a second track from Knightsville, Ind., west to East Yard at Terre Haute, about 14 miles, and the grades along the line are being reduced to a maximum of 0.04 per cent. Nine reinforced concrete subways will carry highways under the tracks and two roads will be carried over the tracks on reinforced concrete bridges, eliminating 11 grade crossings. There will also be eight reinforced concrete culverts. This work entails about 700,000 yards of earthwork and 15,000 yards of masonry. It is expected that the line will be in operation this month. About a mile of second track is also being constructed between the west end of the Wabash river bridge, Terre Haute, to Macksville. On this improvement no masonry is needed. The earthwork will aggregate approximately 200,000 cubic yards, all embankment, and will be finished within a few weeks. A new double-track line is being built from Brazil to Seelyville, eight miles. The line now in use will be maintained as a third track when the new line is finished. In the old line there are nine curves aggregating 2.77 miles in length, and 208 deg. of central angle. On the new line there will be three curves, aggregating 0.66 miles in length, and a total angle of only 29 deg.

Woodville.—An officer writes that this company is building with its own men a line from Woodville, Fla., on the Seaboard Air Line, west to Spring Hill, on the Georgia, Florida & Alabama, 10 miles. Track laid for six miles. Thomas M. Hall, Chief Engineer, Woodville.

RAILROAD CORPORATION NEWS.

Boston & Maine.—Governor Guild of Massachusetts on June 4 wrote to President Mellen of the New York, New Haven & Hartford, asking that the facts of the reported merger be given to the responsible representatives of the Commonwealth. On the same date President Mellen replied that interests identified with the New Haven have acquired a large stock interest in the Boston & Maine and have agreed to acquire the rest of the stock in exchange for New Haven stock, share for share. The Boston & Maine stock is not to be held by the New York, New Haven & Hartford directly. The purchase was made to prevent the sale of the Boston & Maine to another company. If the consolidation is carried out, through service is to be established through the Connecticut valley and via Worcester through the Merrimac valley, and the terminals of the two roads in Boston are to be unified. The letter closes with a statement that the power of the Commonwealth to control and regulate is unquestionable, and the New Haven hopes to be recognized as Massachusetts' most efficient public servant. Governor Guild, in a message to the legislature on June 5, recommends that at the present session it reaffirm by statute the determination of the Commonwealth to control the operation of her railroads. It is understood that the Boston & Maine stock will be held by the New England Steamship Company, a new company recently organized to take over the operation of the steamship properties of the New Haven. The purchaser referred to in Mr. Mellen's letter is probably either the Grand Trunk or the Canadian Pacific.

Chicago & Alton.—The Directors, on June 4, declared the regular semi-annual dividend of 2 per cent on the $19,544,000 preferred stock. It is understood that this decision was reached only after prolonged discussion, the Harriman interests favoring the payment but the Rock Island interests preferring to apply the surplus to improvements. The Comptroller estimates that the road will earn during the current fiscal year 4.11 per cent. on the $19,542,800 common stock, after the payment of the dividend on the preferred.

Chicago Junction Railway.—See Indiana Harbor Railroad.

Connecticut Railway & Lighting Company.—F. J. Lisman & Co., New York, are offering $75 a share for $200,000 4 per cent. guaranteed common stock of this company. The property is leased to the Consolidated Railway for 999 years from December 19, 1906, and the lease is guaranteed by the New York, New Haven & Hartford. The rental and a cash fund deposited with the Colonial Trust Company is enough to pay perpetual dividends on the stock. (Dec. 28, 1906, p. 184.)

Consolidated Railway (N. Y., N. H. & H. Electric Lines).—See New York, New Haven & Hartford; also Connecticut Railway & Lighting Company.

Erie.—Gross earnings for April were $4,671,405, an increase of $1,154,143; net earnings, $1,451,024, an increase of $559,202.

Erie & Jersey.—This company has borrowed $3,000,000 for 3½ years, at 6 per cent., secured by $4,000,000 Erie & Jersey bonds as collateral. The company is building the Guymard cut-off for the Erie from Mount Hope, N. Y., to Highland Mills, 42 miles.

Illinois Central.—L. C. Fritch, Assistant to the President, is quoted as saying that the Illinois 2-cent fare law will reduce the Illinois Central passenger earnings $800,000 a year, and that the state will accordingly lose $50,000 a year of the tax it levies on earnings.

Indiana Harbor (Belt).—It is reported that New York Central interests have bought control of the Chicago Junction Railway and that it is intended to merge the company with the Indiana Harbor. The Chicago Junction operates a belt line around Chicago from Whiting, Ind., to Franklin Park, Ill., with branches to the Union Stock Yards and other industries.

Louisville & Nashville.—The syndicate headed by J. P. Morgan & Co., which in February, 1906, bought $10,000,000 4 per cent. Atlanta, Knoxville & Cincinnati division, 50-year bonds of 1905, has been dissolved. The syndicate bought the bonds at from 98 to 98½, and only 16 per cent. has been sold to the public. They were quoted on June 4 at 89⅞ bid and 91 asked.

Louisville Railway Company.—This company, which owns all the street railways in Louisville, Ky., and nearly all of whose $6,000,000 common and $2,500,000 preferred stock is owned by the Louisville Traction Company, has issued $500,000 collateral trust, 6 per cent. notes redeemable at any time from 1908 to 1910. The proceeds are to pay for rolling stock and extensions.

Mobile & Ohio.—Gross earnings for April were $976,360, an increase of $178,409; net earnings $253,220, an increase of $49,359. Net earnings for the first ten months of the present fiscal year were $2,789,884, an increase of $266,157.

New England Navigation Company.—See New York, New Haven & Hartford.

New England Steamship Company.—See Boston & Maine.

New York, New Haven & Hartford.—The stockholders on May 31 approved the merger with this company of the Consolidated Railway. It is understood that the Consolidated recently bought the New England Navigation Company for $20,000,000 and issued in this connection $20,000,000 additional stock, making the total outstanding stock of the Consolidated Railway Company $30,000,000. This stock has all been owned by the New York, New Haven & Hartford, which recently increased its capital stock from $100,000,000 to $130,000,000. The new stock was exchanged for the Consolidated Railway stock, and, though technically outstanding, is now held in the treasury of the railroad company, and if sold to the public the proceeds can be used for some other purpose. See Connecticut Railway & Lighting Company; also Boston & Maine.

New York, Ontario & Western.—This company has borrowed about $1,000,000 on one-year notes.

This company's statement of April earnings shows a striking contrast with the earnings of April, 1906, when the coal strike was tying up its coal traffic. The earnings in the current year are also largely increased over those of the same period of the normal year of 1905. Gross earnings for April, 1907, were $707,503, as compared with $343,017 in 1906, and $590,554 in 1905; net earnings, $200,922, as compared with a deficit of $29,710 in 1906, and earnings of $190,412 in 1905.

Philadelphia & Reading.—This company has made an equipment trust agreement covering $5,000,000 4½ per cent. equipment trust notes. They will be issued in blocks as the equipment is delivered.

Southern.—Gross earnings for April were $4,768,457, an increase of $412,395; net earnings $718,202, an increase of $125,222, the operating ratio having been reduced from 86.4 per cent. to 84.9 per cent. The net earnings for the period since July 1 still show a decrease. The net earnings for the ten months of the current fiscal year were $9,912,155, a decrease of $2,208,622.

Toledo Railway & Terminal.—This property was sold under foreclosure for $2,000,000, the upset price, on May 28, to the protective committee representing the holders of the $3,500,000 first mortgage, 4½ per cent. bonds. The company went into receivership in January, 1906, as a result of the C., H. & D. and Pere Marquette receiverships.

Union Pacific.—Gross earnings for April were $6,287,988, an increase of $948,182; net earnings, $2,261,323, an increase of $119,440.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Increase in Price of Car Repairs..... 821
- Comparative Summary of Freight Cars.. 821
- Where to Find I. C. C. Rulings..... 821
- Pooling Freight Cars..... 821
- Comparative Cost of Repairing Steel and Wooden Cars on the Harriman Lines.. 822
- Steel Passenger Cars..... 822
- Cast Iron Car Wheels..... 823
- One Cause of Derailments..... 823

ILLUSTRATED:
- New York Central Locomotive Terminals at Croton and North White Plains... 824
- Development of the Marine Steam Turbine 830
- Hudson Companies' New Steel Cars..... 831
- Heating and Ventilating Equipment for Paint Shops..... 835
- Page Single-Leaf, Double-Track Bascule Railroad Bridge over the Chicago River 836
- Low Side, Steel Underframe Gondola, Philadelphia & Reading..... 841
- Recent Shop Construction..... 842
- Electric Baggage Trucks..... 845
- Steel Passenger Cars Pennsylvania R. R. 846
- Steel Postal Cars for the Harriman Lines 852
- Master Mechanics' Reports..... 853
- The Northwestern Pacific Railroad..... 861
- Recent Developments in Air Brake Control Apparatus..... 862
- Reinforced Cast Iron Wheels for the Norfolk & Western..... 868

CONTRIBUTIONS:
- Thickness of the Steel Side Plates in the Union Pacific Steel Box Car..... 824

MISCELLANEOUS:
- Rest Houses on the Baltimore & Ohio... 840
- Program of the M. C. B. Convention.... 841
- The Cost of Freight Car Repairs..... 841
- School of Railway Engineering and Administration, University of Illinois... 842
- Proposed Rules to Prevent Diversion of Cars..... 845
- Exhibits at the Atlantic City Conventions 858
- An Adding Machine Attachment..... 860
- President Mellen on B. & M. Purchase.. 861
- Electric Train Lighting..... 866
- Foreign Railroad Notes..... 852

GENERAL NEWS SECTION:
- Notes..... 869
- Interstate Commerce Commission Rulings 874
- Obituary..... 875
- Meetings and Announcements..... 875
- Elections and Appointments..... 875
- Locomotive Building..... 877
- Car Building..... 877
- Railroad Structures..... 878
- Railroad Construction..... 878
- Railroad Corporation News..... 879

VOL. XLII., No. 24. FRIDAY, JUNE 14, 1907.

The Pittsburg, Western and Southwestern Railway Clubs have all suggested an increase in the price of labor and materials as laid down in Rules of Interchange. Unlike the suggestions of previous years the increase proposed is general, covering broadly car bodies, miscellaneous castings, wheels, axles, lumber, couplers, journal bearings, etc., and labor, rather than specific charges for parts or repairs which are covered in the detailed list of prices. It is generally recognized that for the last two or three years many of the prices allowed were below the market value of equipment and material and the proposed changes are good evidence of the increase in cost of supplies throughout the country. The Pittsburg Railway Club suggests for example an increase from 1¾ cents per pound to 2 cents for iron castings, 3¼ cents to 3½ cents for lumber, increases from $0.50 to $1.00 in the price of couplers, and most important of all an increase of 25 per cent. in the price for labor from 20 cents an hour to 25 cents. The M. C. B. Association can hardly fail to recognize the justice of their unanimous demands and revise the existing prices to an equitable basis.

Our attention has been called to an error in the table of the "Comparative Summary of Freight Cars in Service in the Railroads of the United States" printed in *Railroad Gazette*, May 17, page 683, which, while not affecting the value of the table as a whole or the accuracy of the individual figures for any one road, is misleading. The summarized figures under each group and for all roads are mean values of the individual figures in the columns above and are not true or weighted averages for the entire group. In using the table, therefore, care should be taken not to make comparisons of individual figures with the mean values. Comparisons between individual figures will, of course, be correct. It is the intention to revise the table and bring it up to date each year and next year the true averages will be computed for 1906 as well as 1907.

Interstate Commerce Commission Rulings is the heading of a new department in the General News Section of the *Railroad Gazette* which appears for the first time this week. There are so many cases and complaints being decided by the Interstate Commerce Commission that there appears to be good reason for establishing a definite place in the paper where they may be found, both as a matter of convenience in current issues and in looking up cases which have been decided in the past. While this column will not necessarily contain every case decided by the Commission, it is intended to have it include all of any general importance, either because of the effect on particular rates or charges, or as indicating the general trend of the Commission's opinions. It will also be possible from this column to form an estimate of the work of the different commissioners. Many of the cases are now being heard before a single commissioner acting for the whole Commission and opinions are written by a single individual. The name of the commissioner who hands down an opinion will be included in the cases mentioned, so that it will be possible to form an estimate of the work and views of each member of the board.

The pooling of freight cars is now receiving the careful consideration of at least one railroad association. The Car Service Committee of the Association of Transportation & Car Accounting Officers in a recent circular makes a report on this question, prefacing its statements with the remark that it has not yet been able to arrive at final conclusions. It describes a general plan for a freight car pool. Pooling centers should be established in the different traffic zones, the country being divided as much as possible according to the various commodities handled, particularly those requiring special classes of cars. The reason for this is that as a large percentage of the traffic originating in a certain zone is finally disposed of within that zone, a mutual pool composed of the roads operating in this territory would be of much greater benefit than a general pool with uniform rules for every district. To provide, however, for the centralization necessary to a successful carrying out of the plan, there would be a chief commissioner at some central point with whom the district commissioners in charge of the pools in the different traffic zones would constantly keep in close touch. The chief commissioner would thus know the shortage or surplus in each district and could help one or another district as conditions required. For example, there should be a district pool in the eastern field with a district commissioner located at New York, Philadelphia, Buffalo or Pittsburg; another in the Southeast with a district commissioner at Atlanta, Nashville or some other available point; another at Chicago, another at Memphis, Little Rock, Fort Worth or Dallas, and perhaps another at Denver, Omaha or some other similar point in the West. Roads which interchange a certain class of equipment, box cars, for instance, would come together and organize the district pools by electing an executive committee, a committee of master car builders and a committee of auditors or car accountants from their number. The executive committee would determine the number of cars each road should sup-

ply to the pool, basing this number on the number of its cars ordinarily on the tracks of the other pool roads in joint traffic; this is in order to prevent a given road from putting more cars in the pool than its proper quota. The executive committee would also determine the rate to be paid to the pool for use of pool cars, raising or lowering the rate as conditions in their judgment justified, that is, it would be possible to have payments for cars vary according to the value of cars. The executive committee would have the power to restrict the loading or delivery of empty pool cars to any particular non-member road found guilty of misuse of equipment and to require a member road making such deliveries to a restricted road to pay additional per diem on cars detained on the tracks of the restricted road. The commissioner for the pool would be elected annually by the executive committee. It would be his duty to keep a complete record of the movement of pool cars and a historical record showing the dimensions, capacity and original value of cars, and to make regular reports at short intervals to each member road of the number of pool cars charged to, as compared with the number of pool cars owned by it. The commissioner would not be authorized to arbitrarily order cars from one road to another, but would notify all members of the total number of cars on each road as compared with the number to which the road is entitled. On these facts the executive committee would determine whether a change in per diem rates should be made in order to bring about a more even distribution of equipment. The commissioner would prepare a monthly statement of all pool cars on each member road and the number of days charged against each road, and would collect per diem for the use of cars while on non-member roads. He would report to the executive committee cases of misuse and diversion occurring on non-member roads from which the committee could form a judgment as to the necessity of restricting delivery of pool cars to such roads. Pool cars would be lettered, Pool "A," Pool "B," or Zone "A," Zone "B," or Interstate "A" or Interstate "B," as desired, with the initials of the owner placed on the car in an inconspicuous position. It is recommended that for the present no pools should be undertaken with more than $100,000 cars. A smaller number would be preferable.

COMPARATIVE COST OF REPAIRING STEEL AND WOODEN CARS ON THE HARRIMAN LINES.

The record of comparative cost of repairs to steel and wooden cars which is being kept on the Harriman Lines has been given twice previously in these columns (July 21, 1905, and June 8, 1906). This record was begun in September, 1904. It embraces all the cars of steel or part-steel construction on the one hand, as against an approximately equal number of wooden cars of about the same age and capacity, affording an equitable comparison. The record to February, 1907, inclusive, is given below, through the courtesy of Mr. Kruttschnitt, and represents a period of two years and a half. The statement gives the average number of cars of each class for the period, the total cost of repairs to same and the average cost per car per month:

Steel Cars.

Kind of car.	Average No. of cars.	Total cost of repairs.	Average cost, repairs, car pr mo.
Ballast	460	$71,291.81	$5.17
Box	2,304	108,323.29	1.57
Coal	1,594	165,959.57	3.47
Dump	300	39,322.92	4.37
Flat	2,289	72,024.30	1.05
Furniture	297	32,198.04	3.61
Gondola or ore	1,419	134,019.10	3.16
Oil	871	261,613.43	10.01
Stock	1,693	55,908.34	1.10
Total	11,227	$940,660.90	$2.79

Wooden Cars.

Ballast	457	$65,560.89	$4.78
Box	6,247	735,405.53	3.92
Coal	127	14,329.81	3.76
Flat	512	15,699.75	1.02
Furniture	278	61,999.51	7.44
Oil	247	96,910.90	13 05
Stock	2,700	291,940.19	3.61
Total	10,568	$1,281,846.58	$4.04

The average total number of cars of both kinds show decreases from last year's statement. This is particularly the case with the steel cars, there being a difference of 477. This, however, is not due to destruction of equipment, but to the fact that the previous statement was incorrect to the extent of having had included in it some new cars bought some time after the record was begun, the error not having been discovered until after the publication of the statement. The wooden equipment shows a decrease of 73 cars from the previous statement.

It will be observed that the oil cars show an unusually high figure. This is due to the fact that all these cars were new equipment to begin with and when they were first received it was deemed advisable to make a number of alterations, which were charged to repair account, producing the abnormal figure given. Current repairs on these cars are not expected to average any higher than other equipment. The gradual increase in the figure for average cost of repairs per car per month over the period covered by the record was commented on in connection with the previous statement; the increases during the year since the publication of the first statement being 22 and 17 per cent. respectively for the steel and wood equipment. A further increase is shown in the present statement of from $2.42 to $2.79 for the steel and $3.74 to $4.04 for the wooden cars, the percentages being respectively 15 and 8 per cent. When the record is a little older it will be interesting to show this condition graphically.

STEEL PASSENGER CARS

The Pennsylvania's recent order for 200 steel passenger cars of various types, which are illustrated elsewhere in this issue, marks the beginning of a period of standardization in the evolution of passenger car construction for regular road service from wood to steel. The New York Subway, the Philadelphia Rapid Transit Company, the Long Island, the New York Central and the West Jersey & Sea Shore have a large number of steel motor cars in use. The Harriman lines have built a few sample postal cars; the Pressed Steel Car Company, the Pullman Company, the American Car & Foundry Company and the Standard Steel Car Company have each built a few experimental cars of various types, but no railroad or contract builder up to this time has built a sufficient number of road-service cars to term the design standard. There is little likelihood that in the future the Pennsylvania will depart widely from the designs now proposed. They are the result of nearly four years of experiment and analysis by the largest and best equipped mechanical department of any railroad in the United States. The fact that 200 cars have been ordered is sufficient proof that the railroad company is satisfied with its careful and painstaking work.

In steel passenger-car design there is a temptation to substitute rather than originate, but, on the other hand, there is great opportunity for employing new and original shapes and types of construction to excellent advantage. Nearly every designer has departed in some details from the old wooden construction which, after a period of more than 25 years, has become practically standard throughout the United States. The Harriman lines have abandoned the upper-deck and have gone back to the turtle back or arched roof of 30 years ago because it simplifies and cheapens the roof framing. The Pennsylvania has abandoned bolsters and substituted a method of symmetrically loading the center sills to give uniform deflection. The Hudson Companies have developed an economical truss side-frame which permits the use of side doors without using abnormally heavy center sills to carry the vertical load. Similar departures from wooden construction could be noted in almost every car which has so far been built. It is not alone in these essential elements, however, that the ingenuity of the individual designers is apparent. No two designs employ the same intricate construction in the window and door posts, in the platform, framing or in the application of sheathing and roofs. The ingenuity of the designers of these cars appears to be limited only by the scarcity of suitable commercial shapes in structural steel. Some have even gone so far as to have special shapes rolled, notably the special bulb angles used as belt rails under the windows of the Subway and Long Island cars. Pressed steel has been employed in many places where rolled shapes apparently did not satisfy the ideas of the designer.

All these variations in detail go far toward increasing the expense of manufacture of steel cars and, for the time being at least, almost limit their adoption as standard equipment to roads like the Pennsylvania, which can afford to order them in large numbers. The wood passenger-car builders have long since standardized nearly every detail of such cars and they are built, so to speak, by the foot. It is a fact that one large building company lays out all the timbers for the body and underframing of its cars with notched sticks and templates. So uniform is the output that it is able to make up ahead a large stock of finished parts and cars can be turned out at the minimum expenditure of time and money. The same thing is true to a great extent in freight-car construction, although the types and individual designs sometimes vary considerably. This similarity of output is not confined to any one builder, but the output of all the builders is substantially standard. In passenger-car construction, the framing perfected after many years by the Pullman

Company has been found to be the most satisfactory and is used almost exclusively.

If steel passenger cars are to come into general use, the same conditions of manufacture must soon begin to prevail, otherwise the output of the car building plants will be greatly reduced and the cost to the railroads increased. We will not attempt to say how this should be brought about. It is hardly within the province of the Master Car Builders' Association to arbitrarily adopt specific details of construction either as standards of the association or as recommended practice, but the Association could do much good through committees in collecting and analyzing the different designs proposed and encouraging the closest co-operation on the part of the railroads and the contract builders in preparing and adopting designs which, in the future, might be capable of being more or less closely standardized. Encouragement should be given to individual effort, but such effort should be guided toward one objective point.

CAST IRON CAR WHEELS.

Last Year the Master Car Builders' Association recommended an increase of ⅛ in. in the thickness of the flange on cast iron wheels, believing that the additional metal thus provided at the weakest point in the wheel would go far toward reducing the large number of flange breakages under high capacity cars. This recommendation was acted on by letter ballot and was not formally authorized until September. The time, therefore, has been too short to definitely determine the beneficial effects of the change. There is some difference of opinion among wheel makers as to the effect on the chill in the throat, some claiming that the increased thickness would reduce the chill and decrease the life of the wheel. Long continued service only will determine this question.

While such modifications in the form of the wheel will undoubtedly be of some benefit, the real truth in the matter has been for years and still is openly disregarded and put to one side while minor technical points are discussed with great seriousness and gravity. The vital trouble is that the prices paid for cast iron wheels do not admit of the use of a proper quality of metal or a proper order of practice in the manufacture of such wheels. For years, experienced wheelmakers have tried to emphasize this fact and for years the railroads have generally ignored it. Specifications and tests have been made more rigid and guarantees have been extended to cover nearly all the causes for which wheels are removed regardless of whether the defect was attributable to conditions of manufacture or not. Some roads have agreed to discontinue claims made on account of worn flanges when sufficient chill is found and on account of shelling out, due to severe applications of brakes, and a few other roads have consented to reduce the number of years for which guarantees are required, but while there is some small encouragement for the wheelmaker in this, the situation, as regards the railroads in general, is growing steadily worse from month to month. There are about 20,000 wheels made every day in the United States to go under new cars and for replacements, and a large proportion of these wheels are made by manufacturers who turn them out in connection with the manufacture of cars, operating a wheel foundry as they would any other department of their business. They are content to accept orders at competitive prices and turn out wheels of any quality that will admit of a margin of profit. It is perhaps not too much to say that 20 per cent. of the wheels made every day are totally unfit for service under heavy equipment. One car-wheel maker who has always maintained a reputation for turning out only the best quality wheels, during the year just passed, refused orders for nearly 200,000 wheels which were to be used under 50-ton cars, for the reason that the prices offered were totally inadequate to provide wheels of even ordinary quality, yet these orders were filled at the prices offered by other makers and the wheels are in service under cars.

The car-wheel situation is not exactly comparable with the steel-rail situation. The railroads have every reason to demand better rails for the same price, because they have only to cite such a case as the price of $18 a ton paid by the Japanese Government for steel rails for export and made to rigid specifications, as against the price of $28 a ton which the rail pool demands for rails rolled to the so-called commercial specification. The responsibility for defective rails lies largely with the rail maker, but the responsibility for defective wheels cannot be laid directly at the door of the wheelmaker. The railroads demand that the wheelmakers turn out wheels which will stand double the load imposed five or ten years ago under guarantees for as many years' service as was required for wheels used under the much lighter equipment and to furnish these wheels at prices lower than they pay for the commonest kind of iron castings. The Master Car Builders' Association allows 1¾ cents per pound for rough iron castings, but it allows only $8.50 for a cast-iron wheel weighing 700 lbs., or at the rate of less than 1¼ cents per lb. At such a price the wheel makers, in order to realize any profit at all, must resort to the most inexpensive and inefficient foundry practice possible and can use only the cheapest kind of scrap and gray forge iron. At the present prices of labor and melting stock and under the rigid guarantee required, it is impossible for wheel makers to turn out anything but scrap at the prices offered.

If the sole object of the present practice is to maintain a contest between the buyer and the seller as to which can get the best of the other regardless of results, the only remedy is to bring home the responsibility for the results to those who carry it on. The successful purchasing agent buys at the lowest possible price and he is concerned only with the price. If he is not advised by the officers in other departments that the material which he furnishes on requisition is not satisfactory and is dangerous to use then his responsibility ceases. Why should the officers in the car building and motive power departments be afraid to meet the issue fairly and squarely; why should they hesitate to say to the purchasing agent that they will not take the responsibility of placing the wheels he furnishes under cars? They know good wheels from bad wheels —at least they should know them if they are competent—and it is their duty to themselves and to the railroad they serve to prevent if possible the use of any material, whether it be boiler plate or axles or car wheels which they know to be unsafe. The situation is complicated, of course, by the fact that no one railroad can afford to take such a stand without the co-operation of all the other railroads, because the wheels bought by one railroad run over the lines of other roads. If a road buys wheels of good quality they may be replaced by wheels of poor quality as soon as the car leaves the home road. The necessity, therefore, is for concerted action and recognition by the most influential body of American railroad officers of the fact that their duty is, not to avoid in every possible way reference to prices and other commercial considerations, but to make their recommendations as to what they want and must have regardless of prices. If they make their requirements severe enough to be met only by wheels of first-class quality and insist firmly enough on having only such wheels furnished them, the situation will begin to clear up at once and the responsibility will be put where it belongs.

ONE CAUSE OF DERAILMENTS.

The proper location of the side bearings—that is, the distance from center to center—together with the amount of vertical clearance between them, undoubtedly has much to do with the safe movement of cars or locomotive tenders of different types and dimensions when moving over track of varying physical conditions, and particularly so when rounding curves at different rates of speed. Some inquiries recently made of leading mechanical department officers show that the distance between side bearings of the cars of these companies varies from 42½ in. to 65 in., while on some locomotive tenders the distance is as great as 88 in. The amount of clearance between side bearings varies from ⅛ in. to about ½ in. on each side. From 12 important railroads and one private car line the following dimensions are reported as the practice followed on their respective lines: 42½ in., 48 in., 51 in., 56 in., 57 in., 59 in., 60 in., 62 in., 63 in. and 65 in., and for tenders, 88 in. On some roads the practice or standard is the same for all kinds of cars and locomotive tenders, no distinction being made between gondola or hopper cars used in ore or coal traffic, and furniture and refrigerator cars, or tenders.

The views held by the ablest mechanical officers in the country are in many cases directly opposite, and while it would appear that there are more cars at present with the side bearings 60 in. between centers than of any other dimension, yet there are many only 48 in. between centers, and the officers who have adopted this small dimension as the best practice to follow support their position with a record of extensive experiments with side bearings at different locations which seemed to justify their conclusions and practice.

Certain known conditions of track superstructure must exist, of course, in order to insure the safe movement of trains both on tangents and curves. Likewise the equipment must be designed and built with a view to its safe movement, it being quite as essential that the cars and locomotives should be free from defective design,

construction or physical condition as the superstructure which supports them. Of the numerous dimensions for locating side bearings observed by different roads, some certainly are not as well adapted to the safe movement of cars at different speeds as others, and it, therefore, appears to be a question that not only justifies, but seems to require, immediate attention; in fact, it seems of sufficient importance to warrant some process of analysis that involves determining by exhaustive experiments such a combination of dimensions, types, location, clearance, etc., as is best adapted to different types of cars and engine tenders at different rates of speed on a superstructure of known conditions. Derailments of refrigerator, carriage and furniture cars on curves, because of their high center of gravity under load, are good subjects on which to base investigation and inquiry and with which to conduct experiments in an effort to arrive at some uniformity of standard.

Recent articles in the technical journals have brought into prominence the fact that there are among engineering and maintenance of way officers distinct differences of opinion in reference to superelevation and other track conditions that exert more or less influence on the safe movement of trains. That track elevation on curves is based on correct principles no one with the slightest knowledge of the laws of moving bodies will question. There may be, and doubtless are, some differences of opinion as to just the desirable amount. Track that is designed for the safe movement of trains at a speed of 30 or 40 miles an hour around curves of 10 to 16 deg., has such elevation of the outer rail as is necessary to counteract the centrifugal force at that speed. An entirely different proposition is presented when these same trains traverse the curve at 8 or 10 miles an hour. The car which would safely and easily round the curve at the higher rate of speed would at the lower rate of speed, in the absence of centrifugal force, bear heavily on the inside side bearing and the rear wheel of the truck would hug closely the inside rail. The distance of the side bearing from the center plate is the measure of, or governs the proportion of, the total weight of the car resting upon the inside bearing under these conditions. The closer the bearings are located to the center plate, the greater this weight; the greater the distance, the less the weight. It is also true that the greater the amount of weight supported, the greater the friction or the resistance to the swiveling of the truck. If the sum of the forces opposing the swiveling of the truck exceeds the pressure of the flange on the leading outside wheel against the railhead, then the wheel climbs the rail and a derailment follows.

It is therefore evident that under fixed or known conditions of track and equipment, considering the distance between the side bearing and the center plate and the center plate and the outside leading wheel as lever arms, the matter is susceptible of mathematical demonstration, both as to the cause of the derailment and the proper remedy therefor. But operating conditions are so varied that any result thus obtained theoretically, based on a given set of conditions, would, of course, require modification to meet different conditions; therefore it would seem that the "happy medium" which would prove the best for all conditions could best be found through a series of practical experiments under proper engineering supervision. The subject is of sufficient importance to warrant the expenditure of considerable money to the end that the best known types of center plates and side bearings be determined, together with their proper location and the amount of clearance for different kinds and types of cars, locomotive tenders and trucks; special care being taken, for example, to differentiate between trucks with springs located centrally over the arch bars and those having short truck bolsters with springs located inside of the truck frames; also to observe the difference in the action of steel car frames as compared with wooden frames. The former, on account of their greater rigidity, do not yield to undulating track and curve elevations as do cars of wooden construction, and this may be a factor to be taken into consideration in an experimental study of the problem.

Interstate Commerce Commission reports show that during the past year 381 persons were killed and 4,362 injured by derailments in the United States, a total of 4,743 which met with accident from this one cause. In addition to these there are doubtless many hundreds of derailments which are never reported, such, for instance, as cars in freight trains getting off of the track and being derailed without serious delay or injury. All such derailments together with those which have had more serious consequences, evidence the need of some combined effective effort to minimize their number.

This is a problem which cannot be solved by any one person or any one department, but it is too important to be iguored as it evidently is now by many companies. It is worthy of careful study, theoretical and experimental, by a committee of competent men representing the mechanical, operating and maintenance of way departments, which should determine some standards for future guidance.

CONTRIBUTIONS

Thickness of the Steel Side Plates in the Union Pacific Steel Box Car.

Omaha, Neb., June 5, 1907.

To the Editor of the Railroad Gazette:

Referring to your editorial on the light-weight, all-steel box car in the *Railroad Gazette* of February 22d: Your observations on the thickness of the steel side plates are well made. The thickness of this siding is a very difficult dimension to determine; practical experience is absolutely necessary before definite conclusions can be obtained. However, the enormous strength in the sides of these cars, showing a deflection of only $^3/_{16}$ in. with 50 per cent. overload, is highly indicative that the No. 11 B. W. G. steel is of a desirable and practical thickness for siding, affording resistance to puncture from load shifting. In the end these steel plates, I believe, will figure about six to seven times the strength of an ordinary wooden car and the distribution of stresses in a unit steel-structure car is entirely different from that in a wooden car and the subject must be viewed from an entirely different outlook. For example, the corner post of a wooden car is extended into the sill and is further supported, somewhat, by the superstructure at the top, but the ease with which a large oak corner post is broken in everyday service shows the weakness of this form of wooden construction. Compare the corner of a wooden car with an angle-iron corner post of the steel car. This corner post is supported in its entire height, from top to bottom, by the steel car side to which it is riveted. The steel of this car siding is secured and riveted to all the other members of the car side, as well as to the side sill and other end of the car, and the full tensile strength of this material can be utilized in offering resistance to the knocking out or bending of this corner post.

A limited bulging of a steel box car end is to be expected. However, this bulging will not in any way interfere with the strength of the end and cannot be considered a detriment; the steel end being so much stronger than any wooden structure, it will take practical experience to show the necessity of a heavy grade of steel for this service. Certainly, it will be more expensive to replace a steel plate than it would a few end boards on a wooden car, but on account of the strength of the steel it will not be necessary to repair same with the frequency which is now experienced in wooden cars.

Observations of the remarkable success with which the $^3/_{16}$ in. steel plates have met in gondola and hopper-bottom car work, as compared with the $^1/_4$ in. and $^5/_{16}$ in. sheet, led the Union Pacific to try the No. 11 B. W. G. sheet in the all-steel box car, especially as the duty of the box cars is entirely different and not half so severe as that of the gondola or hopper cars. The handling of stresses in an all-steel box car is entirely different from that of a gondola car, and the side of an all-steel box car is a combination of trusses and plate girders with a special design of underframing. The duty on this box car steel side is nothing like the duty imposed on an ordinary gondola car side.

W. R. M'Keen, Jr.,
Supt. M. P. & M., Union Pacific.

Steam and Electric Locomotive Terminals of the New York Central at Croton and North White Plains.

The northern limits of the Electric Zone of the New York Central are to be at Croton on the Hudson River Division and at North White Plains on the Harlem Division. At these places the change from steam to electric locomotives will be made on all through trains incoming and outgoing and they will also be the terminals for the electric motor car local trains running to New York. Extensive engine terminal facilities are being built at both places to care for steam and electric equipment. The terminal of the Hudson Division is at South Croton or Harmon, as the new town is to be called, one mile south of Croton and 34 miles from the Grand Central station. North White Plains is 24 miles north of New York.

North White Plains Terminal.

The general layout of the engine terminal at North White Plains is shown in Fig. 1. The roundhouse, turntable and other buildings on the east side of the tracks are the old facilities used for steam service before the electrification was begun (North White Plains has been the northern terminal of the suburban service on the Harlem Division for a number of years). The new shop and inspection buildings for electric equipment are to the west of the railroad, which bisects the yard, and about 1,000 ft. north of the present North White Plains station. The only new building erected

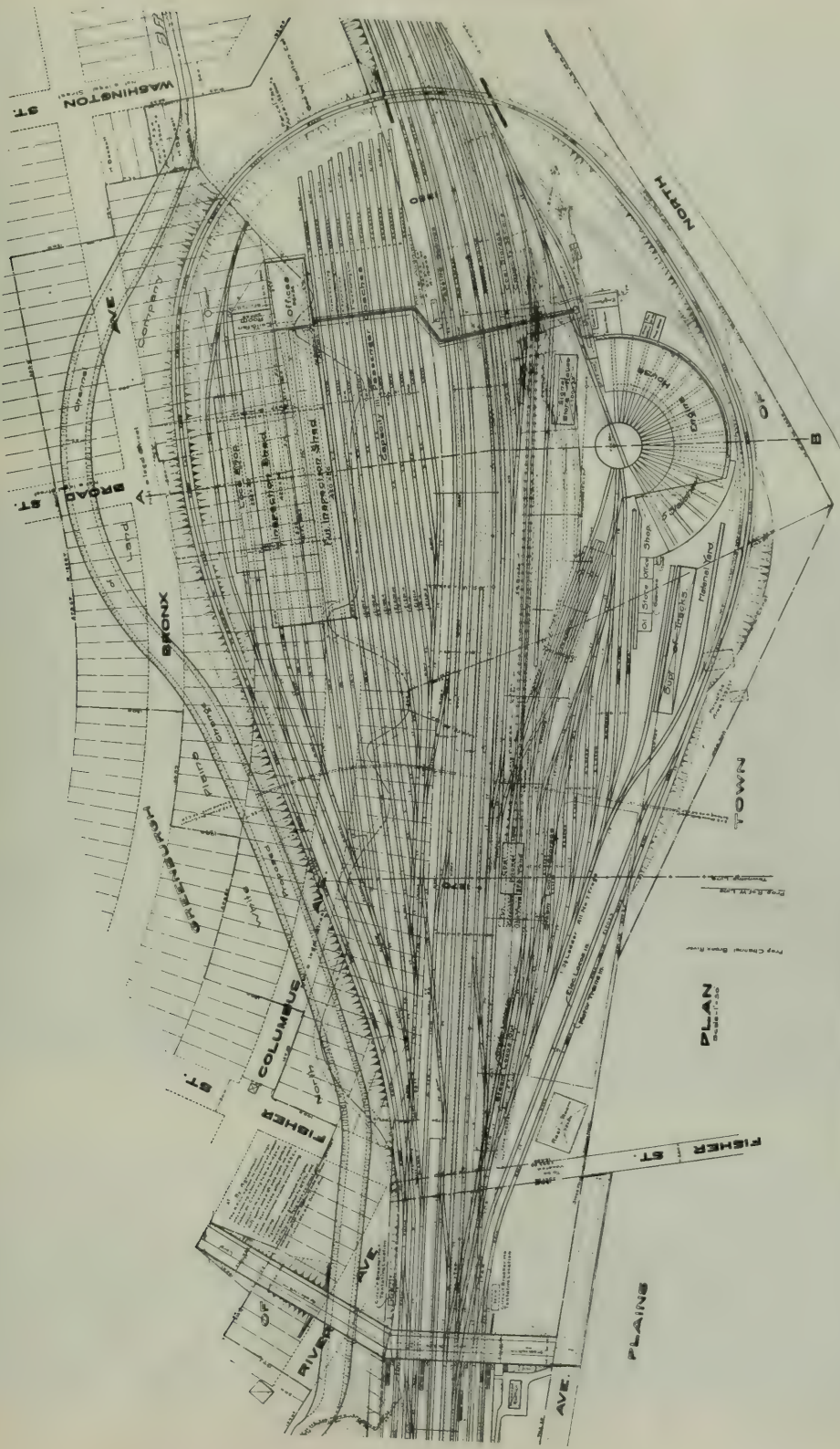

WASHINGTON ST.
BROADWAY
BRONX
PARK AVE.
COLUMBUS
FISHER ST.
RIVER AVE.
PLAINS AVE.
NORTH
TOWN
PLAN
Locomotive Shop
Machine Shop
Boiler Shop
Erecting Shop
Paint Shop
Material Yard
Coal Trestle
Inspection Shed
Car Shop
Office
Engine House
Turntable
Water Tank
Coaling Station
Sand House
Oil House
Scale House
Power House
Gas Plant
Transformer House
Pump House
Freight House
Passenger Station
Express Building
Baggage Room
Waiting Room
Ticket Office
Platform
Tracks
Yard
Switch
Signal
Crossing
Bridge
Culvert
Fence
Wall
Road
Walk
Steps
Entrance
Exit
Gate
Lamp
Post
Sign
Mail Box
Hydrant
Hose
Pipe
Wire
Cable
Conduit
Duct
Manhole
Handhole
Switch Box
Relay
Battery
Charger
Rectifier
Motor
Generator
Transformer
Meter
Gauge
Valve
Cock
Drain
Sump
Pump
Tank
Reservoir
Well
Boiler
Stack
Chimney
Flue
Duct
Fan
Blower
Compressor
Air Line
Steam Line
Water Line
Oil Line
Gas Line
Return
Supply
Feed
Blow Off
Safety Valve
Pressure Gauge
Thermometer
Level
Float
Indicator
Recorder
Alarm
Bell
Whistle
Horn
Light
Lamp
Switch
Fuse
Circuit Breaker
Relay
Contactor
Resistance
Rheostat
Controller
Motor
Generator
Transformer
Rectifier
Converter
Inverter
Battery
Charger



Fig. 2—North White Plains Shops, Looking North.



Fig. 3—Interior of Car Inspection Shops at North White Plains.

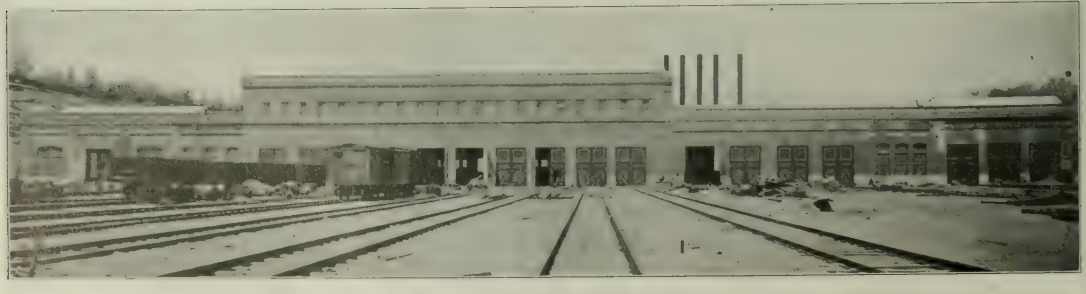


Fig. 4—Croton Shops, Looking North.

is a car inspection shed, but ample provision has been made for car storage tracks, for a future enlargement of the inspection shed to increase its capacity 100 per cent. and for an electric locomotive repair shed and shop large enough to accommodate 12 locomotives.

The site of the new shops was bottom land about 8 ft. below the grade of the proposed yard. Through it the Bronx river, a small and comparatively unimportant stream, flowed in a torturous course. The first work done was to divert the course of this stream through a channel 25 ft. wide dug along the west boundary of the yard. The yard was then filled in to the established grade with sand and gravel taken from a borrow pit in the immediate vicinity. The work of grading has been completed with the exception of the loop shown on the drawing, which will swing around the entire yard, crossing the railroad at the north end on an overhead bridge. This loop will be used for handling motor car suburban trains, but as the electrification has not yet been extended north of Mt. Vernon, work on the loop has not been rushed.

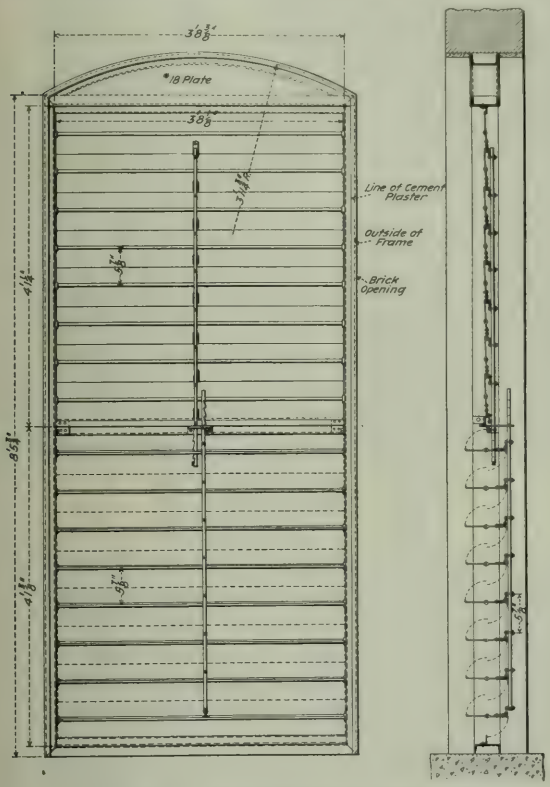


Fig. 5—Return Air Shutter in Fan Room Wall.

The car inspection shed is 450 ft. x 56 ft. with an extension 98 ft. x 56 ft. containing the machine and blacksmith shops, storeroom and offices. The building is brick with concrete foundations reinforced in the footings and with steel framed saw-tooth roof construction. The car inspection shed occupies 420 ft. of the length of the main building and has three tracks each holding a 5-car train. Ample light is provided in the side walls in addition to the lighting from the sash in the roof. The entrance to the shed is at the south end, which is closed with three wooden double-hinged doors. The north end of the building 30 ft. x 56 ft. is used for housing the steam coils and blowers used in the system of forced ventilation employed. The partition wall between this room and the inspection shed has three return air openings 4 ft. x 8 ft. 6 in. which are closed with Venetian blind iron shutters. The construction of these shutters is shown in Figs. 5 and 6. They are arranged to give any desired opening by locking the vertical rods on any one of the four shoulders shown on the rear elevation.

The inspection pits, three in number, extend the entire length of the shed. They are 4 ft. 2 in. wide and 3 ft. 8 in. deep at the center and ends, the floor sloping to points midway where they are 4 ft. 2 in. deep. This provides for perfect drainage. Fig. 7 shows a cross-section of the pits, which are of concrete throughout, mixed in the proportion of 1:3:6. A double grillage of ¾-in. reinforcing rods is laid in the bottom to prevent breaking of the monolith which rests on made ground. Anchor bolts ¾ in. in diameter and spaced 5 ft. apart are bedded in the side walls to hold the 10-in. x 10-in. stringers on which the rails are laid. Back of these stringers three 4-in. x 8-in. yellow pine planks are laid flush with the concrete floor to be used as bearing pieces for box jacks and other heavy work. The pits are entered by concrete steps at each end. A novel feature are the recesses and chases provided in the walls for receiving the pit lights and compressed air cocks.

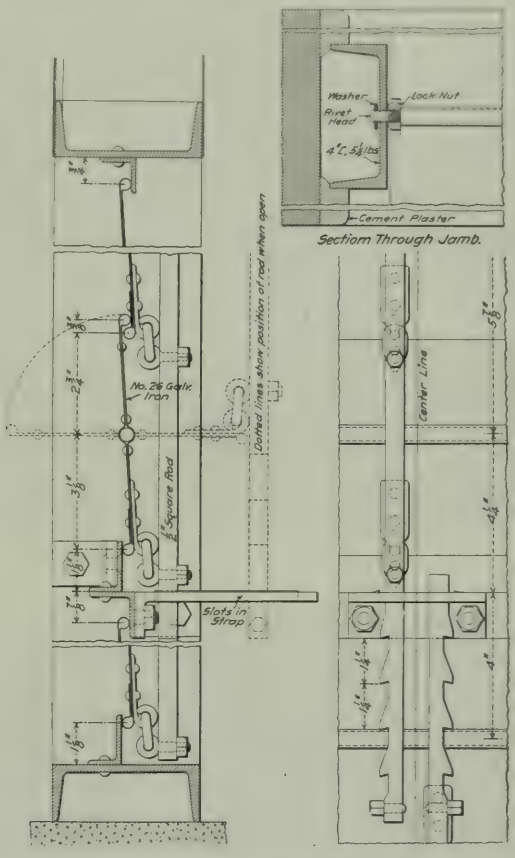


Fig. 6—Details of Return Air Shutter in Fan Room Wall.

The storeroom and smithshop occupy the north end of the extension or office building. The smithshop is 18 ft. 6 in. square and is partitioned off from one corner of the storeroom adjoining the

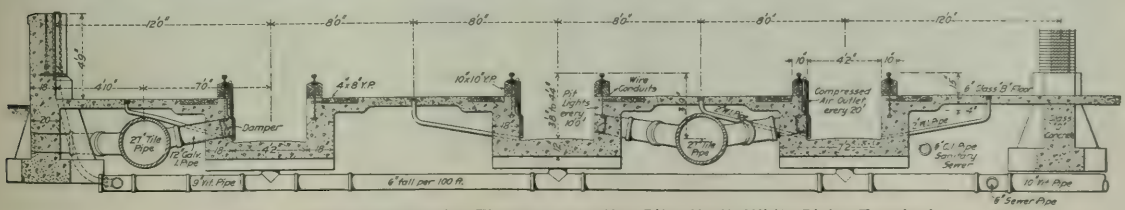


Fig. 7—Typical Cross-Section Through Inspection Pits; North White Plains Terminal.

machine shop. This partition is of wood lined with corrugated iron. The floor is 10 in. of cinders. The machine shop is along the east side of the building and is 18 ft. 6 in. x 79 ft. 6 in. It is connected with the inspection shed by a wide corridor along the south wall. The wash and locker room is in the center of the building. It is 51 ft. x 20 ft. and is enclosed by a wooden partition 13 ft. high. It contains at present 6 waterclosets, 5 urinals, 8 wash basins and 72 lockers. The offices on the west side of the building are separated from the wash room by a passageway. They occupy a space 38 ft. 4 in. x 10 ft. 9 in. and include a general office and private offices for the master mechanic and storekeeper.

The volume of the buildings to be heated is approximately 820,000 cu. ft. and provision was made for three changes or 2,460,000 cu. ft. per hour; the temperature to be maintained at 65 deg. The main hot air duct has been designed for an increase of 100 per cent. in the future and space was provided in the fanroom for a duplicate set of apparatus. The fan blower is the Buffalo Forge Co.'s type with a wheel 9 ft. in diameter and 4½ ft. wide. It has a normal capacity at 180 to 190 r.p.m. of 57,000 cu. ft. per min. at 1 oz. pressure. The fan is driven by a belt from a 30 h.p. direct current Westinghouse motor running at a speed of 1,025 r.p.m. on 220 volts. Current is supplied from the lighting circuit.

Steam for supplying the heater coils is brought from the power plant near the old roundhouse, about 400 ft. to the east and across the railroad. It is carried in a 10-in. cast iron pipe, which together with a 4-in. exhaust return, a 3½-in. air and a 3-in. live steam line are buried in a wooden conduit 3 ft. 10 in. x 4 ft. 2 in. All steam piping is covered with asbestos insulation and the conduit is thoroughly waterproofed.

The hot air duct system is entirely underground. The main duct, built under the north end of the inspection shed, is of concrete 4 ft. 6 in. wide x 5 ft. deep. It is connected by bruching to the fan already installed and is built with another opening to connect with the second fan when it is installed. This opening is temporarily closed with an 8-in. brick wall. Leading off from the main duct one next to the west wall and one between the inspection pits are two other circular concrete ducts about 150 ft. long terminating in vitrified tile pipe which decreases in size from 36 in. to 12 in. These ducts have Y branches of 12-in tile pipe leading into the inspection pits at intervals of from 40 to 45 ft. In addition to these main lines a 33-in. tile pipe duct leads to the office building. The outlets in the pits are provided with dampers. The concrete ducts are made of concrete mixed in the proportion of 1:3:6, reinforced with wire cloth.

The compressed air supply line for blowing out motors, testing brakes, etc., which leads from the power house terminates in a large storage reservoir outside the building. From this tank a 3½-in. header is carried across the north end of the building at a height of 17 ft. above the floor. From this header three 1½-in. pipe lines are dropped down under the floor and carried along the sides of the inspection pits for their entire length. These lines are provided with ½-in. outlets at intervals of 20 ft., the air cocks being set in the recesses in the pit walls.

Cars standing in the storage yard east of the inspection shed are heated by connections provided every 300 ft. with steam pipes connected with the power house. The yard is lighted by eleven 3-ampere 220-volt arc lamps equipped with reflectors and mounted on poles about 30 ft. above the yard level. The lighting of the buildings is all by means of incandescent lamps placed to give the best illumination.

SOUTH CROTON TERMINAL.

The South Croton terminal is on a much larger scale than that at North White Plains and is entirely new. Provision here has also been made for an increase of 100 per cent. in the present facilities. The general layout of the yard and buildings is shown in Fig. 8. It occupies a large tract of land between the railroad and the Hudson river which was originally a sandbank considerably higher than the present grade. This hill was leveled off with steam shovels and the material removed, which consisted of fine sharp sand, was used throughout the Electric Zone for filling and for concrete work. The greater part of the yard has been built and the remainder, including the loop at the north end, will be finished shortly.

The shops consist of a series of adjoining buildings contained under a common roof, the space occupied being L shaped and covering about 98,500 sq. ft. In addition to the existing buildings there will be built a 30-stall roundhouse and an electric locomotive inspection shed. The buildings are the same general type of construction as those at North White Plains, previously described.

The car inspection shed is 448 ft. x 56 ft. and contains three tracks with a total storage capacity of 21 cars. It may be entered from either the north or south end. The coil and fan is along the west wall instead of at the end and occupies a space 30 ft. x 84 ft. Similar shutters to those shown in Figs. 5 and 6 are used to close the return air openings. Adjoining the fan room to the north and south are two buildings each 25 ft. x 84 ft., which have mezzanine floors. The rooms on the lower floor adjoining the inspection shed are used for storerooms, locker-rooms and bench work. The rooms

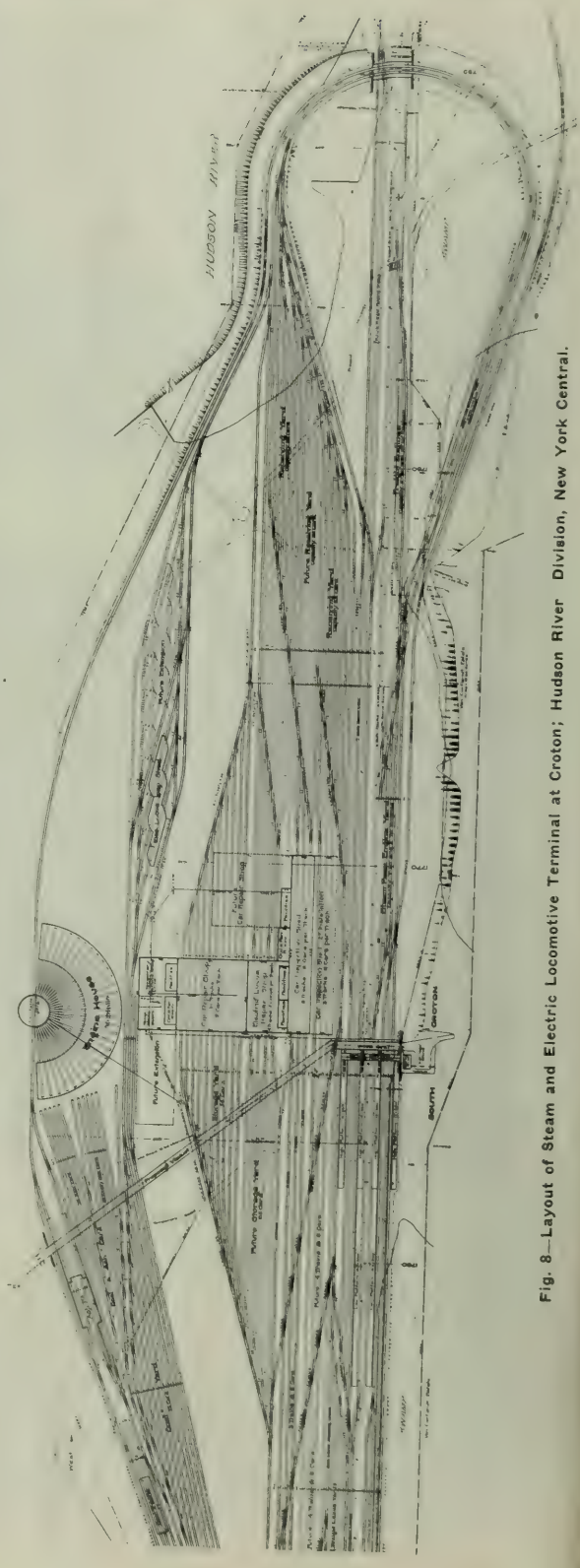

HUDSON RIVER
Power House
Main Tracks
Main Storage Yard
Main Street at Grade
Main Street at Grade
Coal Pockets
Sand Bins
Sand Bins
Coal Pockets
Oil House
Oil House
Oil House



Fig. 9—Interior of Car Repair Shop at Croton.

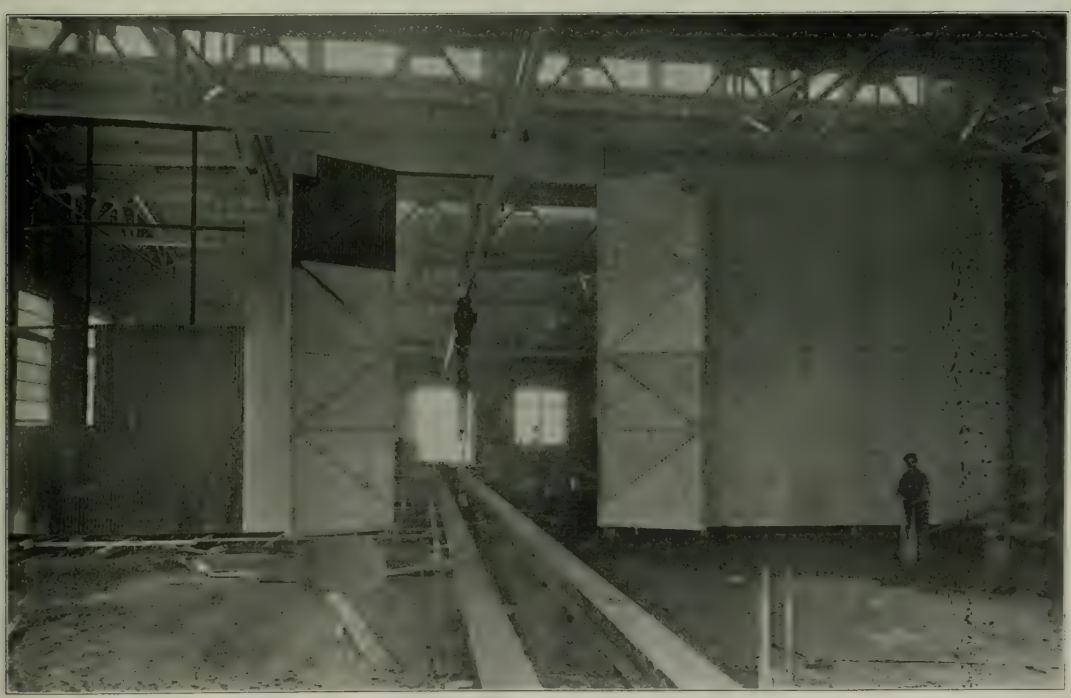


Fig. 10—Interior of Machine Shop at Croton Showing Trolley Hoist.

on the mezzanine floor are used for offices. The inspection pits are similar to those already described, except that no reinforcement was required in the concrete at the bottom.

Adjoining the building now used as a temporary power plant and which will later be used as a locomotive repair shop, is the car repair shop 176 ft. x 182 ft. This shop contains ten tracks and is provided with openings on both the north and south ends for admitting cars to all ten tracks. These openings are closed with double folding doors similar to those used in the inspection shed. Pits like those in the inspection shed are also provided under each track. This building and the machine shop are carried up to a greater height than the rest of the buildings in order to provide room for the traveling crane girders under the roof trusses. Separate locker rooms, offices, fan room and a smith shop adjoin the car repair shop on the west and occupy a space 30 ft. x 154 ft.

The machine shop 182 ft. x 55 ft. is in the extreme west end of the building. A space 48 in. long is partitioned off in the south end to provide a temporary storeroom. A standard gage track runs along the north wall of the repair shop connecting with all the pit tracks and continues through a corridor past the offices into the machine shop where it intersects another track running the length of the machine shop. This provides means for moving trucks, wheels or other heavy parts from the cars to the machines.

All the tools in the machine shop are supported on heavy concrete foundations. The floor consists of a 6-in. bed of tar concrete overlaid with 2¾ in. hemlock planks with a top floor of 1⅛ in. maple. Many of the machines are individually driven by motors, the others being belted to line shafting driven by a 35 h.p. motor. The following is a list of the equipment installed:

Machine.	Maker.	Size.	Drive.
Driving wheel lathe	.....	.....	24 h.p. motor.
Tire lathe	Pond.	42-in.	25 " "
Radial drill	Bickford.	60-in.	4 " "
Upright drill	Cincinnati.	28-in.	Belted.
Drill grinder	Sellers.	.....	Belted.
Tool grinder	Cincinnati.	No. 2.	1½ h.p. motor.
Milling machine	Cincinnati.	No. 4.	Belted.
Engine lathe	Schumacher & Boye.	36 in. x 14 in.	15 h.p. motor.
Plate rolls	.....	.....	7½ h.p. motor.
Circular saw	Kip.	.....	15 " "
Band saw	.....	.....	5 " "
Punch and shear	Hilles & Jones.	No. 2; 25-in.	7½ " "
Centering machine	Pratt & Whitney.	.....	Belted.
Pipe threading machine	.....	.....	Belted.
Planer	Pond.	30-in.	7½ h.p. motor.
Cutting off machine	.....	.....	.....
Bolt cutter	Acme.	.....	Belted.
Slotter	Dill.	18-in.	7½ h.p. motor.
Grinder	Northern.	.....	10 h.p. motor.
Drill	Rochester Davis.	20-in.	Belted.
Shaper	Gould & Eberhardt.	24-in.	3 h.p. motor.
Sensitive drill	Fenn.	4-in.	Belted.
Speed lathe	Reed.	11 in. x 5 in.	Belted.
Arbor press	Greenard.	No. 5.	.....
Lathe	Hendey & Norton.	14-in.	Belted.
Lathe	Lodge & Shipley.	16-in.	5 h.p. motor.
Lathe	Lodge & Shipley.	24-in.	7½ h.p. motor.
Axle lathe	Niles.	No. 3.	25 h.p. motor.
Engine lathe	Lodge & Shipley.	30-in.	10 h.p. motor.
Boring mill	Bullard.	62-in.	15 " "
Wheel borer	Putnam.	No. 2.	10 " "
Wheel press	Niles.	48-in., 500-ton.	7½ " "

A temporary power plant has been installed in the space intended for a future locomotive repair shop. The boiler room 44 ft. x 60 ft. 6 in. contains five locomotive type boilers rated at 150 h.p. each under a working pressure of 125 lbs. Under the fireboxes suitable connections have been made for dumping the ashes into the sewer built underneath. Each boiler has an individual steel stack 60 ft. high and 34 in. in diameter. Feed water is supplied by a 6-in. x 4-in. x 6-in. duplex pump, but each boiler is provided with an injector for emergencies.

The engine room is 42 ft. x 60 ft. 6 in. and is separated from the boiler room by a corrugated iron partition. There have been installed here two 150 K.W. and one 100 K.W. direct connected vertical generator sets, one 8-in. x 12-in. x 12-in. vacuum pump and return tank, air compressor, fire pump and a 750 h.p. feed water heater. All surplus steam not taken up by the feed water heater can be delivered to the heating coils of the ventilating fans.

The two large generator sets supply current at 220 volts for light and power around the shops and the 100 K.W. set supplies current at 440 volts to the trolleys for moving cars in and out of the buildings. The air compressor is of the Franklin type and has a capacity of 500 cu. ft. of free air per minute at 110 r.p.m.

The heating and ventilating plant for the shops is divided into two groups, one serving the car inspection shed and the other the car repair shop and machine shop. Except for the larger size the apparatus installed is identical with that already described in connection with the North White Plains terminal. The volume of the buildings to be heated at present is approximately 3,000,000 cu. ft. and the ultimate volume provided for in the future is 5,300,000 cu. ft. The fans are designed to give three changes of air per hour. At present only three of the four fans have been installed. Each fan has a wheel 10 ft. in diameter and 60 in. wide and at 160 r.p.m. has a capacity of 72,000 cu. ft. of air per minute. Each fan is driven by a 35 h.p. Westinghouse motor.

Six of the ten tracks in the car repair shop are spanned by electric traveling cranes and the runway girders have been put up over the other four tracks to be used when a complete crane service is needed over all tracks. The cranes were built by the Alfred Box Co. and have a capacity of 18 tons with spans varying from 29 ft. 8 in. to 37 ft. 3½ in. The length of the runways is 175 ft. and the total lift is 30 ft. The hoist has a maximum speed of 25 ft. per minute, the trolley 250 ft. per minute and the bridge 150 ft. per minute. All operations are controlled from the floor.

In addition to the cranes in the repair shop a 5-ton electric traveling hoist, running on an overhead track of 15-in. 42-lb. I-beams, is provided. This runway is suspended from the roof trusses and is 536 ft. long, extending down the center of the machine shop, through a passageway and into the inspection shed. The carriage has four wheels running on the lower flanges of the I-beam track, 21 ft. above the floor. Both the hoist and trolley travel are operated by electric motors controlled from the floor.

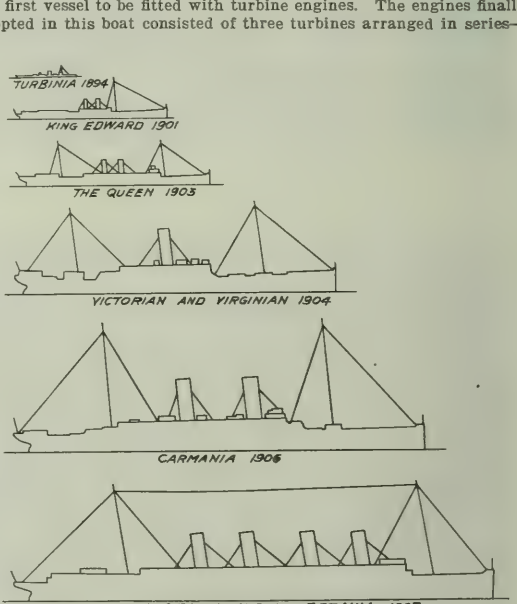
Both at Croton and at North White Plains great precautions have been taken against fire. All the buildings are piped with water mains with frequent outlets and there is a complete system of fire hydrants outside and around the yard. These are all connected to the fire pumps in the engineroom.

The interior of the shop buildings is painted white. The brick walls are given two coats of cold water paint above a wainscoting 6 ft. high which is painted dark green. The steel work, roofs, etc., are all painted white, giving the interior a clean and light appearance.

We are indebted to W. J. Wilgus, Vice-President of the New York Central for the information and illustrations from which this article was prepared.

Development of the Marine Steam Turbine.*

In the year 1894 the idea of propelling a vessel by a steam turbine was first put into practical form. The "Turbinia" was the first vessel to be fitted with turbine engines. The engines finally adopted in this boat consisted of three turbines arranged in series—high-pressure, intermediate-pressure and low-pressure—each driving a separate shaft with three propellers on each shaft. Following the success of the "Turbinia" the torpedo boat destroyers "Viper" and the "Cobra" were built and fitted with turbine marines for the British navy. The "Viper" held the record of being the fastest vessel in the world after attaining the phenomenal speed of 36.86 knots. Unfortunately, however, she ran aground in a fog and ultimately became a total wreck. The "Cobra" foundered in a storm. Thus, after two or three years of experimenting the "Turbinia" was the only vessel afloat fitted with turbine engines. The marine turbine was first adopted commercially in the Clyde steamer "King Edward," built in the summer of 1901. This vessel was successful and a second vessel, "Queen Alexandra," was built. There are now 31 turbine vessels in commercial service, representing a total of about 105,000 gross tons and 235,000 i.h.p. The following table



Development of the Turbine Steamer.

*From a paper read before the Institute of Marine Engineers in London, by the Hon. C. A. Parsons, and R. J. Walker.

shows the various steps in the adoption of the turbine engine for commercial purposes:

Name of vessel.	Owner.	Dimensions.	Gross tons.	Approx. I. H.P.	Year built.
King Edward.	Turbine Steamers, Ltd.	250x30x17¾	562	3,500	1901
The Queen	S. E. & Chatham Ry. Co.	310x40x25	1,676	7,500	1903
Virginian and Victorian	Messrs. J. & A. Allan	520x60x41	10,754	12,000	1904
Carmania	Cunard Steamship Co.,Ltd.	678x72x52	19,524	21,000	1905
Lusitania and Mauretania	Cunard Steamship Co.,Ltd.	785x88x60½	33,000	70,000	....*

*Now building.

The accompanying diagrams show the various steps in the development of the steam turbine for marine propulsion. The profiles of the vessels shown are drawn to the same scale, beginning with the "Turbinia" of 100-ft. length, 44-tons displacement, and 2,000 i.h.p., to the express Cunarders "Lusitania" and "Mauretania" of 785-ft. length, 45,000-tons displacement and 70,000 i.h.p.

The New Steel Cars of the Hudson Companies.

BY HUGH HAZELTON.*

The Hudson Companies are building a double set of tunnels from Cortlandt street, New York, through Jersey City and Hoboken to Christopher street, and thence by Sixth avenue to Thirty-fourth street, New York, and in designing the cars for this service the engineers have had three requirements constantly in mind:

First—The car must be absolutely fireproof.

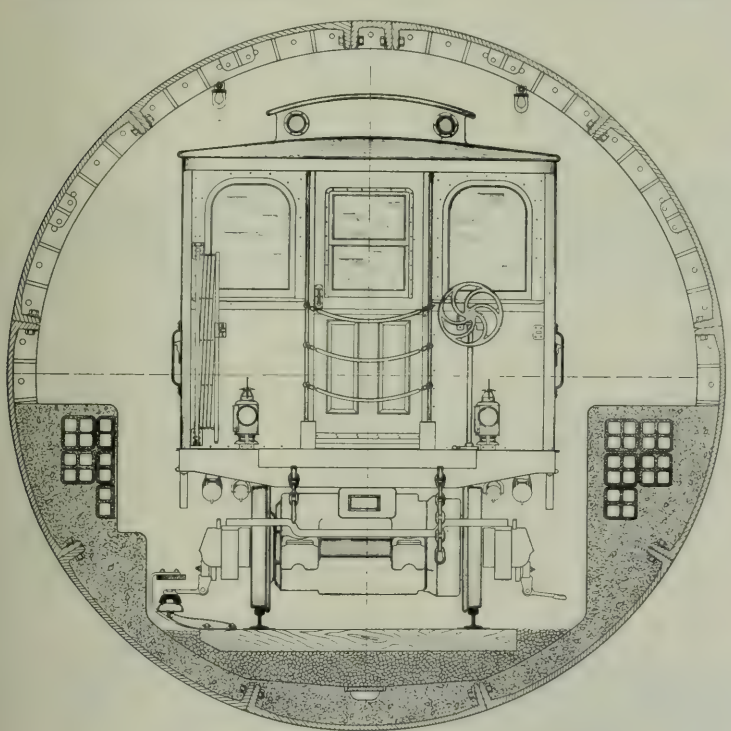


Fig. 1—Cross Section of Tunnels Showing End Elevation of Steel Car; Hudson Companies.

Second—Doors must be arranged so that passengers may enter and leave with least delay.

Third—The weight must be kept as low as is consistent with safety.

In order to make the car absolutely fireproof unusual precautions have been taken. The entire car body is made of steel, including doors, roof and headlining. The floor is made of "monolith" cement laid on steel, with ¼-in. finish of carborundum cement, which is used as a substitute for maple strips. The seat cushions and backs are covered with a metal fabric instead of with rattan. All insulated wires are covered with an asbestos braid and are placed in iron conduit pipes. The magnet coils of the control equipment are insulated with mica and asbestos in place of the usual covering of cotton tape.

In order to facilitate rapid movement of passengers, the car is designed as indicated in Fig. 2, with wide center doors, side seats, and an unobstructed passageway between the car platforms and the interior of the car. This arrangement minimizes the time of station stops without sacrifice of carrying capacity. At the terminals the cars will discharge passengers on one side to an incoming platform and will receive passengers on the opposite side from a special outgoing platform. These provisions are necessary owing to the density of traffic and the close headway of trains during the rush hours.

In a local service like that of the Hudson Companies the stations are from one-third to one-half a mile apart, and a large percentage of the power for operating the cars is required for their acceleration. For this kind of service it is desirable to minimize the weight of the cars as much as considerations of safety will permit. The problem which presented itself to the engineers of the Hudson Companies was to design a steel car with center doors and of the least possible weight.

The type of construction used on Interborough subway steel cars was at first considered, but was not found applicable on account of the decision to use center doors. The unbroken side of the Interborough car below the window sill forms a plate girder about 3 ft. deep. To introduce a center door in a car of this type would have made it necessary to cut the girder in two, and no satisfactory way was found to frame around the door without adding materially to the weight.

The use of drop frame girders at each side of the car below the floor line was also considered, but as such girders are limited in depth by clearance requirements to 16 in. or 18 in., it would have been necessary to make them of heavy sections which would have added materially to the weight of the car.

The truss frame illustrated in Fig. 3 was finally designed as the best solution of the problem. This truss frame is arranged in five panels, the center door occupying the middle panel. As the depth of this truss is about 7 ft., it follows that its weight, for a given strength, is much less than that of any girder or truss construction which can be placed below the car floor. The bottom chord of the truss is a 6-in. channel carried below the door sills and extending from end to end of the car. The top chord is a similar channel placed above the doors and extending the length of the car. The vertical members of the truss frame are 8-in. channel posts spaced at uniform distances, and placed between pairs of windows. Below the window sills these posts are braced by diagonal members to the bottom chord. Above the window sill the posts are reinforced by angle irons and plates, which arch over the pairs of windows and are riveted to the top chord. At the center door the top and bottom chords are reinforced by bulb angles, and similar bulb angles are riveted to the bottom chord below the end doors to furnish additional support for the car platforms. The truss frame is designed to carry the entire weight of the car with full passenger load with a fiber stress not to exceed 12,000 lbs. per sq. in. in any member.

The underframe of the car is shown in Fig. 4. The side sills are made of the 6 in. channels already described as a part of the truss frame. The center sills are 6-in. I-beams, which run from end to end of the car. The needle beams are composed of angles with truss rods and turn buckles. The attachment of the needle beams to the side sills is made by means of bent plates which serve also to stiffen the posts against side pressure.

The end sills have been made unusually strong in order to distribute the strains due to impact to the center and side sills. A shelf angle is secured to the end sill for the support of the drawbar. This shelf angle furnishes a stronger support than the sector bar usually employed for the purpose.

To prevent the telescoping of car platforms in the event of a collision, two heavy steel castings, shown in Fig. 5, have been riveted to the ends of the center sills. These castings extend about 8 in. above the top of the buffer timbers, and if the buffer timber of one car is forced up over that of the adjacent car, it will be stopped by the steel castings before damage is done to the end of the car.

The sheathing of the ends and sides of the car consists of steel plates $^1/_{16}$ in. thick. These plates are riveted to the truss frame after the latter is in place, and none of the rivets which hold the

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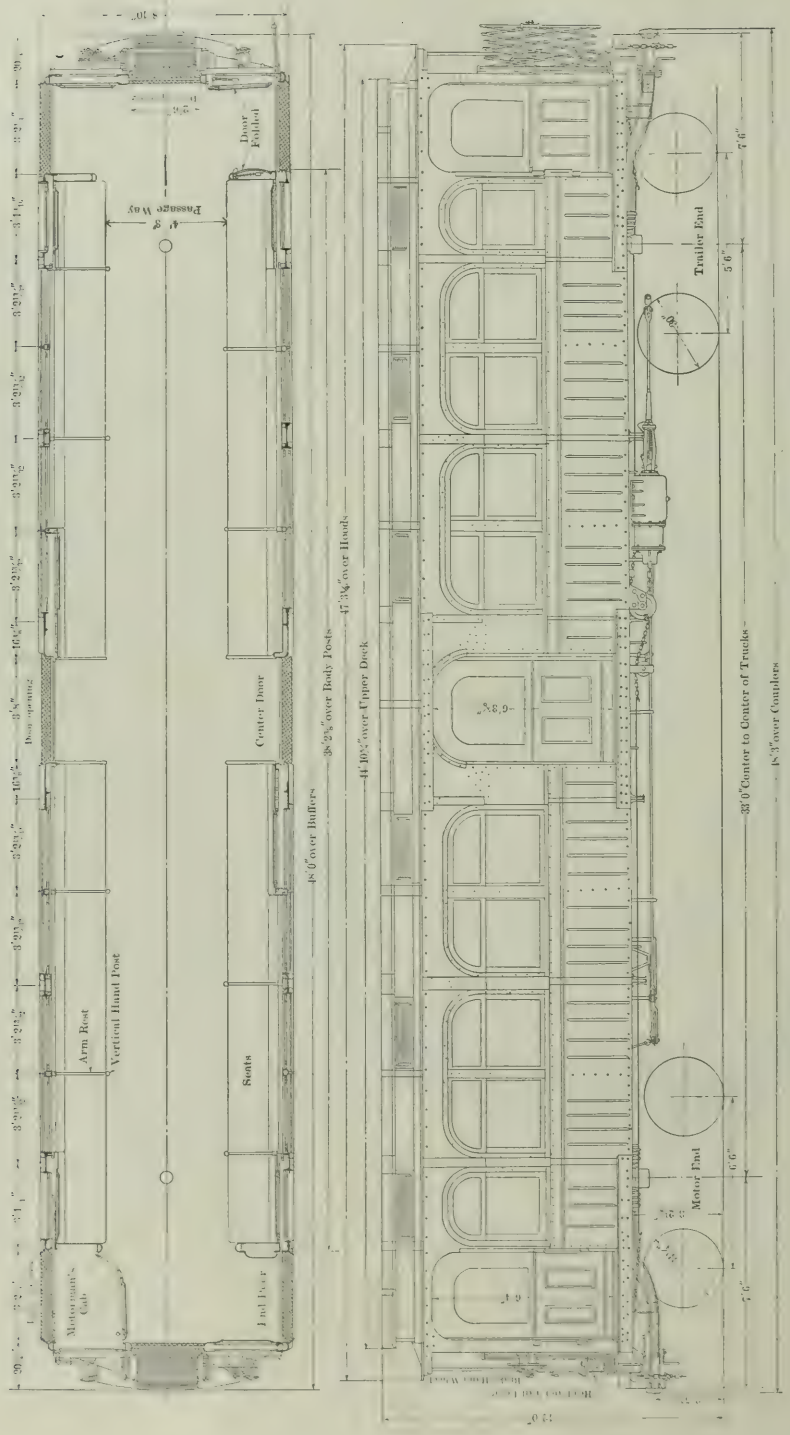


Fig. 2—Floor Plan and Side Elevation of Steel Passenger Car; Hudson Companies.



Fig. 3—Truss Side Frame of Hudson Companies' Steel Cars.

truss frame together pass through the sheathing. Therefore, the plates may be removed for repairs without disturbing the truss frame. The roof is made of $^1/_{16}$-in. steel plates coated on both sides with lead. The roof plates are supported by angle irons bent to conform to the shape of the roof and spaced about 14 in. apart. The plates are secured in place by ¼-in. rivets with heads soldered, and all seams between plates are lapped and soldered.

The headlining and side panels on the interior of the car are of steel $^1/_{32}$ in. thick, and all window guides and post covers are made of steel plates pressed to the required shapes. The floor is made of "monolith" cement laid on galvanized "Keystone" iron, which securely holds the cement down to the metal. The top surface is coated with a layer of cement containing about 30 per cent. of carborundum. This forms a hard wearing surface, and the sharp particles of carborundum prevent slipping.

The longitudinal seats are provided with partitions, as shown in Fig. 6. These partitions consist of steel plates which extend from the seat cushion to a height a little above the shoulder of a seated passenger. The top edge of the partition is finished with a 1-in. pipe bent to a graceful curve. These partitions are high enough to form a support to the passenger and thus obviate the disagreeable effect due to the sudden starting and stopping of trains. The Hale & Kilburn Manufacturing Company, which is furnishing the seat cushions and backs, has developed for the Hudson Companies' cars a metal fabric which is to be used as a covering in place of rattan. The frames of the cushions are made of pressed steel, and the seats are, therefore, fireproof throughout.

A vertical hand rod is located at each of the seat partitions; this rod extends from the seat to the ceiling fixture which supports the hand strap rod. The vertical hand rods furnish convenient supports for standing passengers.

Steel sliding doors are provided at the sides of the car and in the vestibuled ends. Each door is supported on a ball-bearing hanger which runs on a track above the door. A piece of rubber hose is attached to the edge of the door to prevent the possibility of pinching the fingers of passengers when the door closes. The doors are being furnished by Hale & Kilburn Manufacturing Company, and the ball-bearing hangers by the Pitt Car Gate Company.



Fig. 4—Underframe of Hudson Companies' Steel Car.

The doors are operated by air cylinders controlled by the guard. The piston has a stroke of about 15 in., and in order to increase the movement to equal the door travel a rack and pinion is used. The mechanism is so arranged that the door moves up to the end door post, but does not strike against it. The air cylinders are connected by pipes to air valves, which are located at the ends of the car. The guard opens and closes the doors by operating these air valves. This door operating mechanism is supplied by the Burdette & Rountree Manufacturing Company. To prevent the starting of the train before all doors are closed, it is proposed to provide



Fig. 5—Side Elevation of Hudson Companies' Steel Car.

an electrical signal wire throughout the train, with a bell or indicating lamp in the motorman's cab, and with contacts at each door so arranged that every door must be closed before the motorman receives the signal to start.

Each car is equipped with 30 10-c.p. incandescent lamps, two of which are placed above each vestibule. Switches are provided so that the current may be transferred from the two vestibule lamps, in the end occupied by the motorman, to the two lamps in the destination signals. As the cars are to be operated exclusively in tunnel service, the 30 lamps will be lighted continuously. In addition to the 30 lamps in the regular lighting system, each car is provided with four emergency lamps, which are supplied from a 60-volt storage battery on each car. In case the power goes off the line, the emergency lamps continue to be lighted from the battery. The storage battery consists of 30 cells having a discharge rate of 1½ amps. for eight hours. The battery is placed in series with the six circuits of five lamps each, and the four emergency lamps are connected across the terminals of the battery. The four 60-volt lamps take nearly the same number of amperes as the 30 lamps in the main lighting system, so that the battery normally "floats" on the line. The storage batteries are furnished by the Gould Storage Battery Company.

The destination signals are placed above the ceiling of the vestibule at each end of the car. Each signal consists of a stationary lamp surrounded by a cylinder containing four segments of glass of different colors. This cylinder may be turned from the vestibule by the guard or motorman. The lamp is accessible from the vestibule by means of a hinged door at the bottom of the cylinder. A fixed lens is placed in front for each destination signal. The destination signals were designed by Hudson Companies engineers and furnished by Adams & Westlake Company.

Two oil headlights are placed on the front end of the forward car in a train, and two similar lanterns are placed at the rear end of the rear car, showing red to serve as "tail" lights. These lanterns are also furnished by Adams & Westlake Company.

The heaters are of the panel type placed below the seats. The heater coils are arranged in two circuits, which, at 600 volts, take 7 amps. and 14 amps., respectively. The heaters are furnished by the Consolidated Car Heating Company.

The drawbars are of the radial type designed for clearances with cars on a 90-ft. radius curve. The drawbars are made of 85-lb. bent rails with Van Dorn couplers.

The cars are equipped with Westinghouse automatic air-brakes. The type of brake is designated as Schedule A. M. M., which includes the following features:

Quick recharge of auxiliary reservoir.
Quick service application of brake.
Graduated release of brake cylinder pressure.
High-pressure emergency application.
Electro-pneumatic operation of triple valves.

This air-brake equipment is intended especially for the class of service required of Hudson Companies cars, and is of the latest and most improved design. Each car is supplied with air by a Westinghouse D-2-E.G. motor-driven air compressor, which has a piston displacement of 20 cu. ft. of air per minute. In addition to the air-brakes, each car has a complete system of independent hand-brakes.

The latest type of Sprague-General Electric multiple-unit control has been adopted, and a number of improvements have been made in the materials used for insulation to render them fireproof. For example, in the contactor and reverser coils mica and asbestos have been substituted for cotton tape, and all insulation in molded forms has been made of fireproof material. The control equipment on each car includes a current limit relay which provides automatic acceleration of the train with predetermined current in the motors. This relay, however, does not prevent manual operation of the master controller at less than the predetermined current, if desired. The motor circuit is protected by a copper ribbon fuse with magnetic blowout, and, in addition, by a circuit-breaker with tripping and resetting coil. The circuit breakers in all of the cars in the train may be set or tripped by means of a switch located in the motorman's cab of each car. A bus line cable is installed on each car which will connect the contact shoes of all cars in the train. The bus line cable prevents loss of current when passing through crossovers.

The motor and trailer trucks are of the M. C. B. type, and were built by the Baldwin Locomotive Works. The motor trucks have the following general dimensions:

Wheel-base, 6 ft. 6 in.
Wheel diameter, 34¼ in.
Tires, rolled steel, 5¼ in., M. C. B. tread.
Axles, hammered steel, 6 in. diameter at center, 6½ in. at wheel seat.

The wheels have cast-steel spoke centers and rolled steel tires held on by double retaining rings. One wheel on each axle has an extended hub upon which is shrunk the driving gear.

The general dimensions of the trailer truck are:

Wheel-base, 5 ft. 6 in.
Wheel diameter, 30 in.
Tires, 5¼ in., M. C. B. tread.
Axles, hammered steel, 4¾ in. at center, 5¾ in. at wheel seat.

The wheels are of solid steel, forged, and were made by the Standard Steel Wheel Company.

Each car is equipped with two 160-h.p. motors furnished by the General Electric Company and of the type known as G. E. No. 76. This motor has been specially designed for the Hudson Companies service, but follows closely the design of the G. E. 66, a motor which has given such good service on the Manhattan Elevated. In the G. E. 76 motor the armature speed has been reduced and improvements have been made in commutation.

The contact shoes are of the hinged type, similar to those used in the subway cars of the Interborough Rapid Transit Company. The shoe is pressed down on the contact rail by springs which give a tension of 15 lbs. An enclosed fuse protected by an asbestos-lined wooden box is located directly above each contact shoe. The fuse base is mounted on springs in order to reduce the vibration, and thereby prolong the life of the fuse link. Each fuse is designed to carry 650 amps. continuously.

The cars above described were designed and built under the direction of L. B. Stillwell, Consulting Electrical Engineer, and F. M. Brinckerhoff, who has followed the details of this work and to whom many of the novel features are due.

Fifty cars have been ordered for the initial operation of the Hudson Companies tunnels. Forty of the car bodies are being built at Berwick by the American Car & Foundry Company and 10 car bodies at McKees Rocks by the Pressed Steel Car Company. The writer is indebted to the latter company for several of the photographs which illustrate this article.



Fig. 6—Interior of Steel Car; Hudson Companies.

The first one of these cars is at present being equipped with electrical and air-brake apparatus. The 50 cars are to be ready for operation in September, and it is expected that the line between Hoboken and Sixth avenue, New York, will be opened for passengers a few weeks later.

Inspector Hansen, of the Prussian State Railroads, has communicated to the official engineering journal the result of numerous measurements of tracks on curves. He found very great variations from the standards which were followed in laying the tracks, and especially in the radius of curves. Not infrequently he found on a curve where a radius of 300 meters had been prescribed, places where the actual radius was more than 1,000 meters and other places where it was less than 180 meters. Hansen recommends for testing the curves a chord the length of three rails, with offsets to the prescribed position of the curved rails. In addition to this, on curves traversed by fast trains he tests with shorter chords with offsets to the rail position not less than two meters apart.

Heating and Ventilating Equipment for Paint Shops.

The new paint shop of the New York, Ontario & Western at Middletown, N. Y., is a frame building 384 ft. long and 66 ft. wide, housing three tracks with ample space between the cars. The problem of heating and ventilating the building was carefully studied with the view of providing ample heat and air at a uniformly moderate temperature in order to obtain the best results in applying paint and varnish to the cars. A system of forced circulation of warm dry air heated at a central point and distributed uniformly at frequent points throughout the entire building by means of underground conduits was decided on and installed. This equipment consists of an 8-ft. fan wheel enclosed in steel plate casing connected with a casing containing the heater. In this heater are compactly arranged ten sections containing 6,800 ft. of 1-in. pipe, across which the air is drawn into the fan and thence discharged to the distributing system. The rapidity of air flow produced by the fan increases the efficiency of the heating surface from 300 to 500 per cent. above that of the same area exposed in still air.

A direct-connected 8-in. x 12-in. engine drives the fan up to a maximum speed of 200 r.p.m., which gives a velocity of about 3,500 ft. per minute through the discharge pipe. The heater is designed for the use of high pressure steam, and arranged so that the exhaust from the fan engine may be completely utilized.

The complete apparatus is placed in a small lean-to mid-length of the main building. Its central position reduces the cost of the distributing system to a minimum. Under the floor and alongside the walls and the column piers run four tile distributing pipes branching from the main brick cross duct from fan. Branches from these pipes lead to the floor level, the upper portion of each branch being made of heavy galvanized iron, and so designed as to throw the escaping air at an angle toward the floor. As a consequence, there is maintained at the floor level a constantly changing volume of warm air which naturally ascends across the painted surfaces of the cars, thereby increasing the rate of drying. The constant replacement of the rising air by the incoming heated air insures a fresh warm atmosphere, conducive to rapid drying.

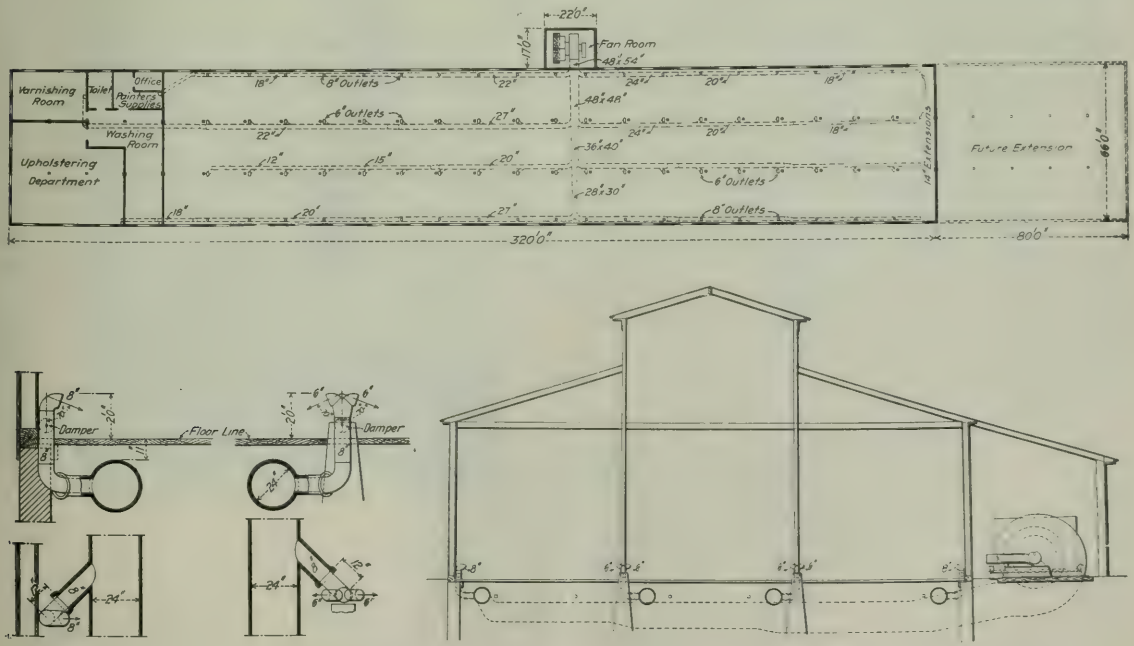


Interior of New Paint Shop at Middletown; New York, Ontario & Western.

The outlets, which range from 6 in. to 8 in. in diameter, are spaced 16 ft. apart so that practically perfect distribution and mixing is secured. Those in the middle of the building are protected from injury by the adjacent columns. The building is warm where warmth is desired, at the floor The small rooms at the end of the building are heated by the same system through risers extending up from the underground ducts.

In other arrangements of the blower system the air is distributed through overhead pipes carried upon the roof framing and provided with long discharge pipes extending downward to near the floor. Each method has its advantages, but the results secured at Middletown prove that the underground system can certainly give satisfactory results.

The building and its equipment was designed by C. E. Knickerbocker, Engineer of Maintenance of Way. All the heating apparatus was furnished by the B. F. Sturtevant Co., Boston, Mass.

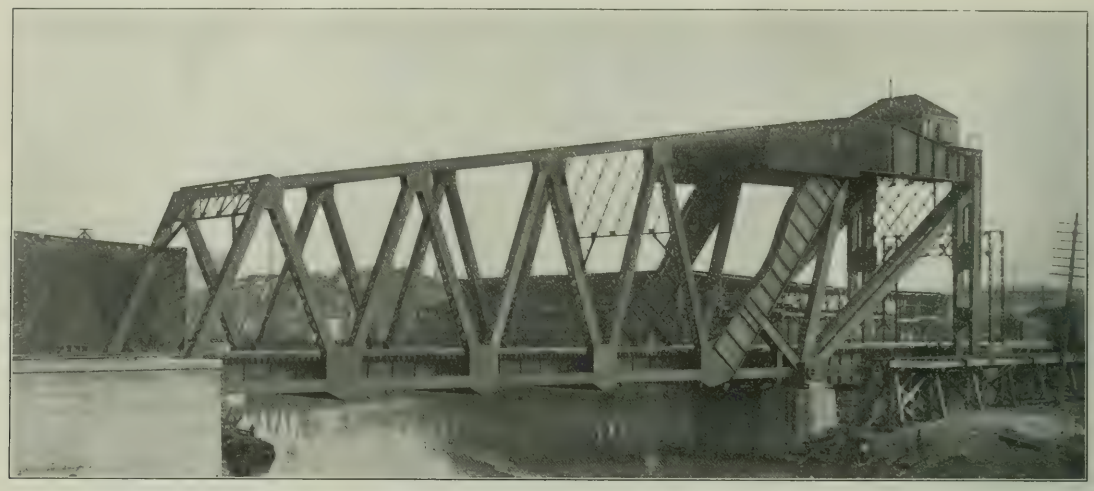


Layout of Heating and Ventilating Apparatus; New York, Ontario & Western Paint Shop at Middletown, N. Y.

Page Single-Leaf Double-Track Bascule Railroad Bridge over the Chicago River.

BY A. E. EKSTROM.
Assistant Engineer, Chicago & Alton.

In connection with certain improvement work being done to the south branch of the South Fork of the Chicago river it was decided early in 1904 by the owning railroads to replace the old swing bridge at Bridgeport with a bridge of the bascule type to give a clear channel of 100 ft. at right angles to the general direction of navigation. After considering several designs of this type it was finally decided to adopt the single-leaf, double-track bridge of the Page design as being the most economical in cost of construction. The bridge was built jointly and is used by the Illinois Central, the Atchison, Topeka & Santa Fe and the Chicago & Alton railroads. It is also used, under rights granted by the Illinois Central, by the Wisconsin Central. The design and erection were done under the supervision of the Chicago & Alton. The bridge crosses the river at an angle of 68 deg. 30 min. and made necessary a leaf of 150 ft. span to give the required clear channel of 100 ft.



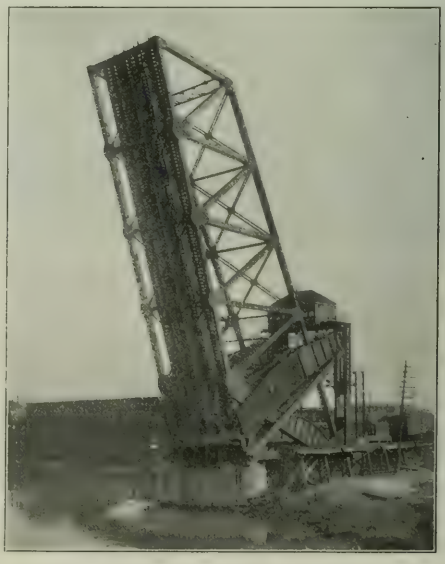
Page Single-Leaf, Double-Track Bascule Railroad Bridge Over the Chicago River.

Work was commenced on the substructure in March, 1905, and was practically completed by the end of December of the same year. The east abutment and the west river pier were located so as not to interfere in any way with maintenance of traffic over the old bridge, the grade and alinement of the new bridge being the same as the old. The east abutment of the new work was located back of the old center pier, while the west river pier was located back of the old pier which supported the end of the swing bridge and deck plate girder approach spans. The east abutment rests on a hard-pan foundation at minus 22½ ft., Chicago city datum, the wing walls of this abutment being connected up to the retaining walls of the track elevation embankment at a point about 53 ft. back from face of abutment.

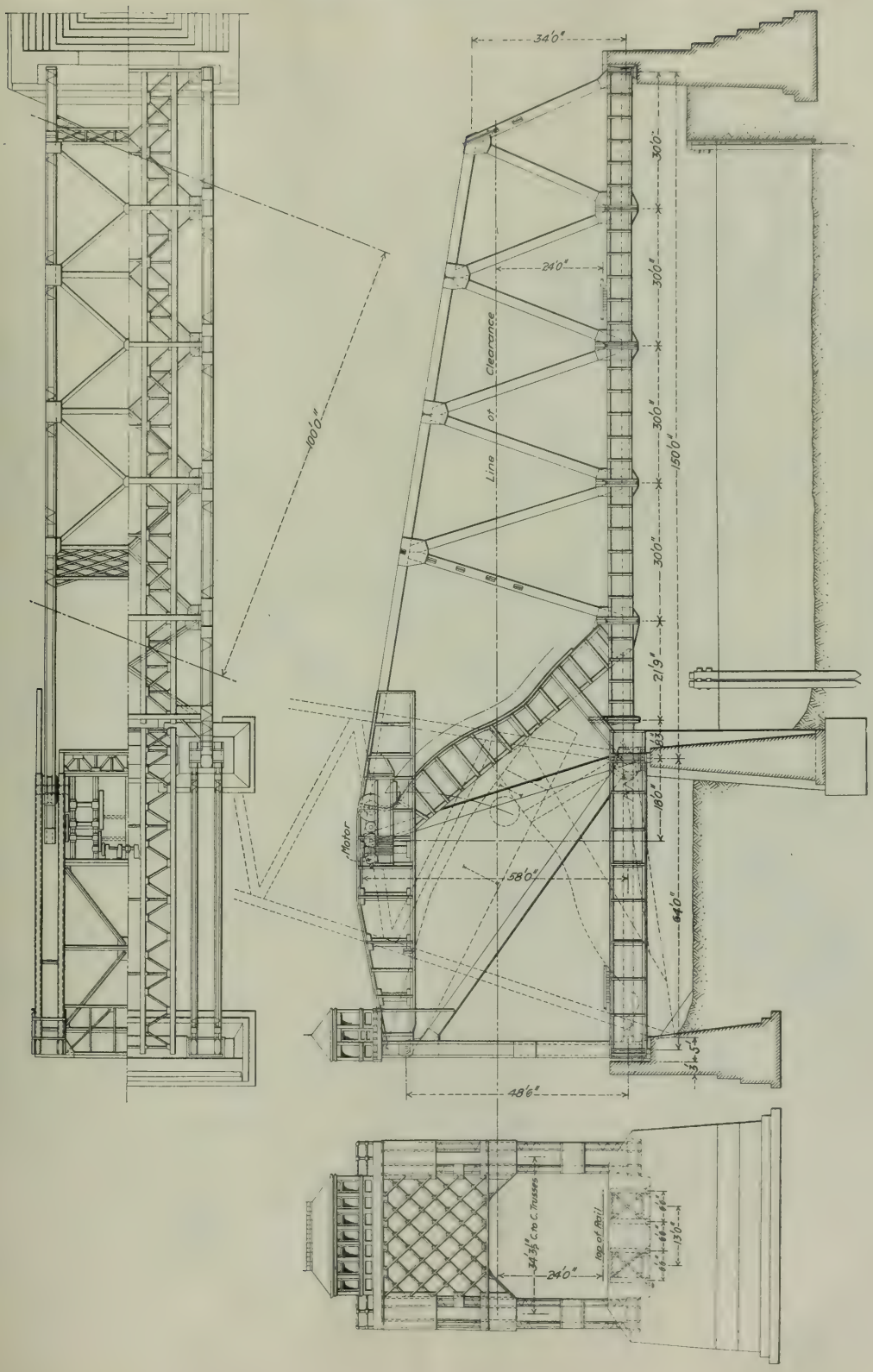
The west-river pier also rests on a hard-pan foundation at minus 27½ ft. Several difficulties were encountered in making excavation for this pier due to water breaking through under the foundation of the old pier, which consisted of grillage resting on piles at about minus 12 ft. After several attempts to stop the leakage it was finally decided to drive Friestedt steel sheet piling inside of the old pier, and after this was done no further difficulties were encountered. The maximum load on the foundation of this pier as designed is about 6,000 lbs. per square foot. Practically no settlement has occurred up to the present time.

The extreme west abutment rests on a hard clay foundation at minus 13½ ft. This abutment, in addition to supporting the embankment, acts as an anchorage to resist the uplift of the superstructure acting as a cantilever under its dead load when in a nearly horizontal position. The substructure, including the wing walls on the east side, comprised a total of about 3,200 cu. yds. The total cost of the new substructure and removal of old substructure, of dredging the channel to a depth of 21 ft. and providing timber protection, was about $50,000.

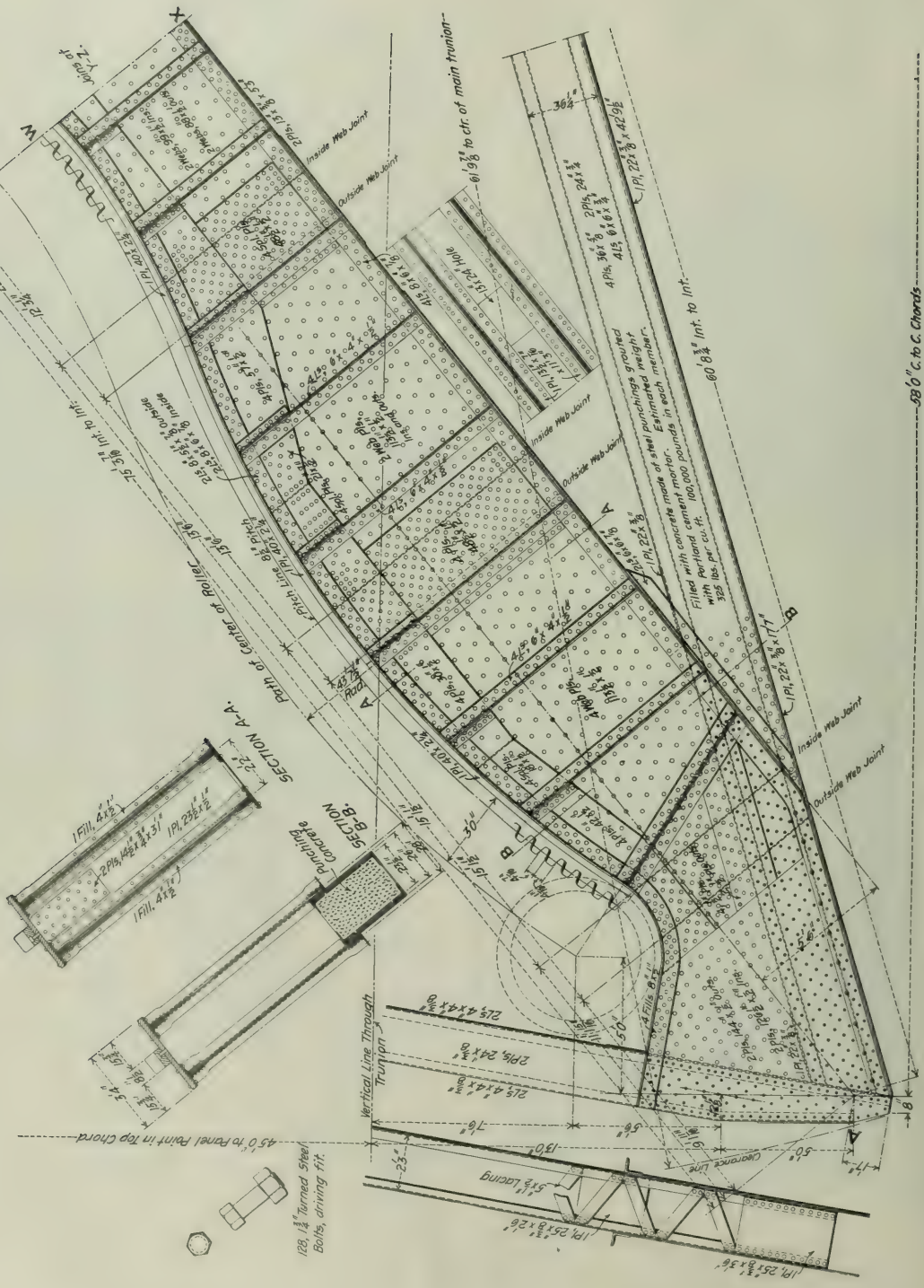
The superstructure consists of a single leaf of 150 ft. with an approach span of 64 ft., and designed to carry on each track a moving load of two locomotives weighing 192½ tons each, followed by 5,000 lbs. per lineal foot. The most important feature of the design is that all movable parts are theoretically in balance during operation, the only power required being that to put the bridge in motion and overcome the effect of wind and friction. The girders carrying the counterweight are hinged each on a pin near the top of the vertical end posts, and the opposite ends of the girders rest on a shaft which carries the load to rollers running on the rack girders. In designing the bridge, the drop of the counterweight girders was made such as to give a clear headroom of 17 ft. for the movement of trains during erection, which necessarily had to be in nearly vertical position. The main driving pinions are keyed to the roller shaft, each being between a pair of rollers, and engaging the rack mounted centrally on the rack girder. To the end of the roller shaft on the inside of the counterweight girder is attached the main driving gear, from which a train of gears leads down to the motor operating the leaf. The gearing and motors are supported on longitudinal girders, these being connected to cross girders which are attached to the inside counterweight girders; the machinery, motors and the girders supporting them thus serve as part of the counterweight. The remainder of the counterweight required on the inside girders consists of concrete placed on buckle plates riveted to the machinery girders. The counterweight on the out-

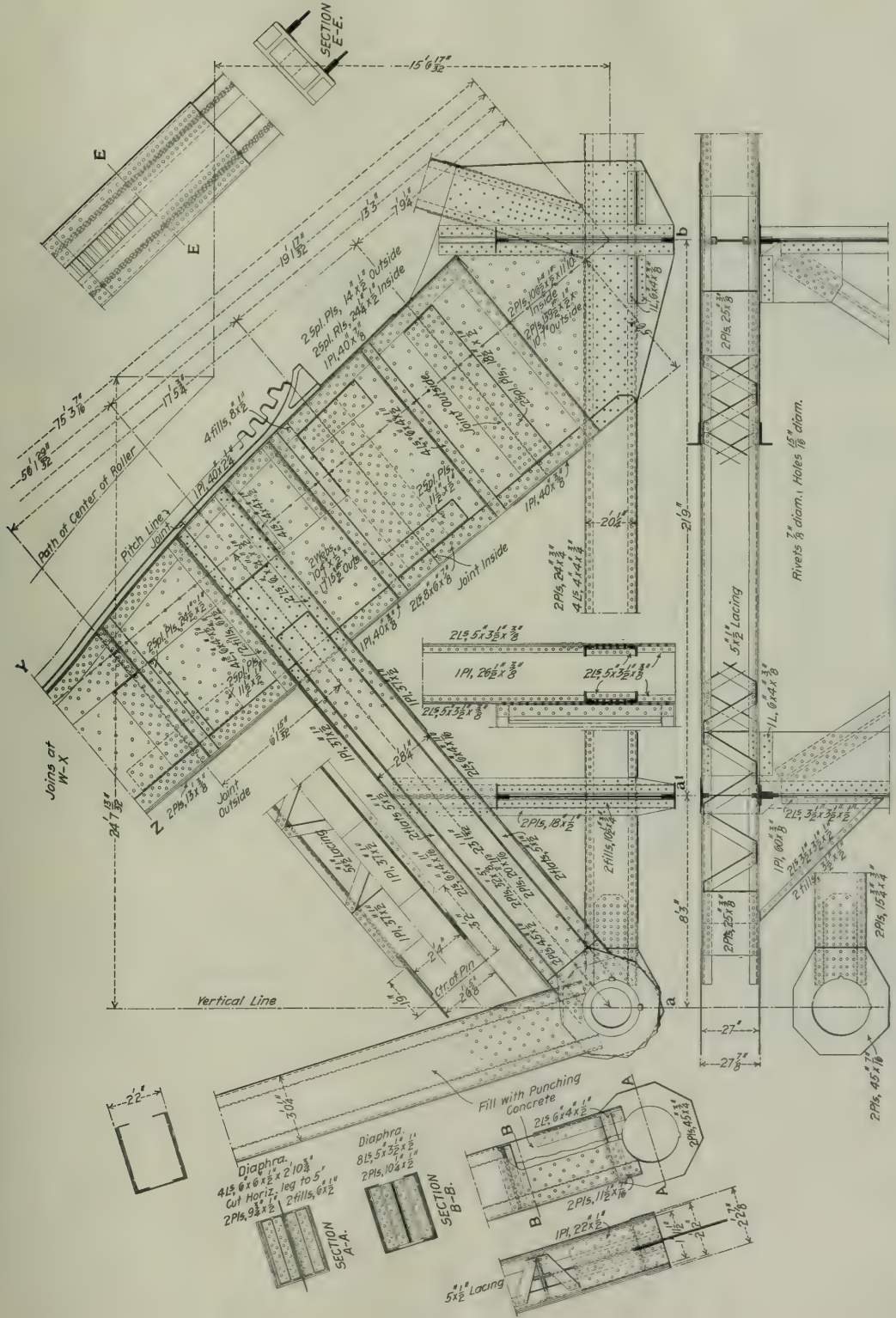


Page Bascule Bridge in Open Position.



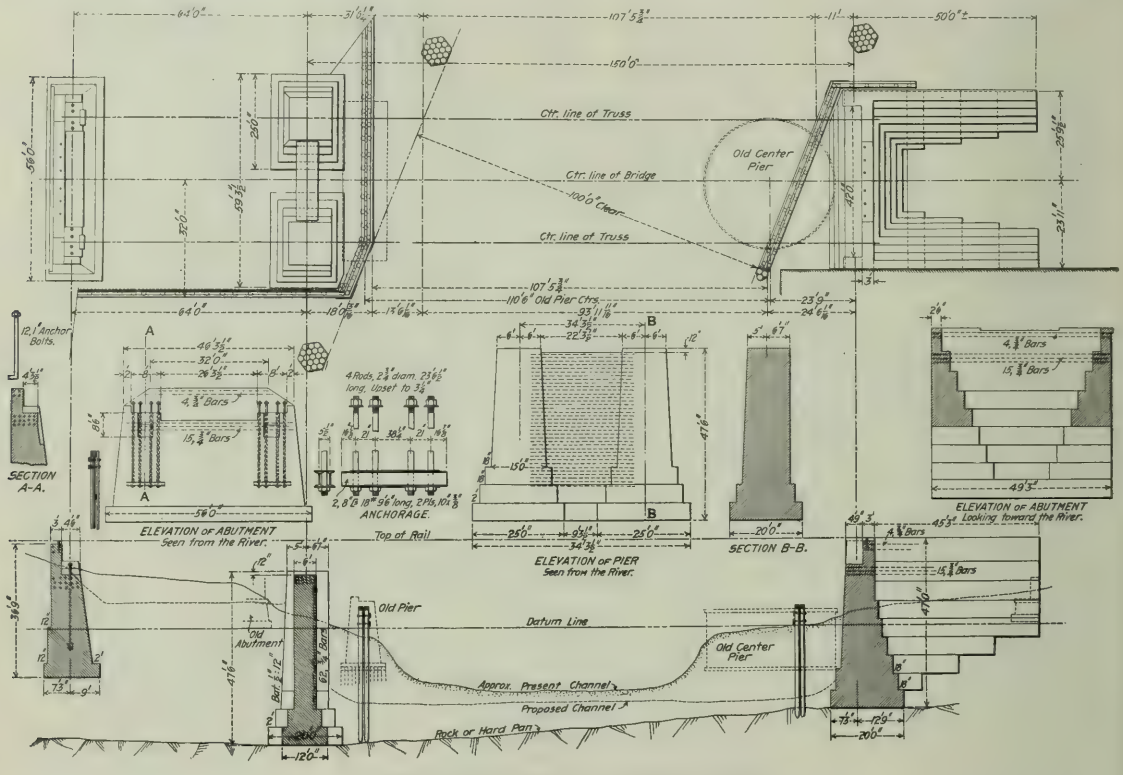
Details of Superstructure; Page Bascule Bridge.


Truss Details; Page Basecule Bridge.
58'0" C. to C. Chords
60 8¾" Inf. to Inf.
61 9¾ to ctr. of main trunion
Inside Web Joint
Outside Web Joint
Filled with concrete made of steel punchings grouted with Portland cement mortar. Estimated weight 325 lbs. per cu. ft. 100,000 pounds in each member.
Path of center of Roller
SECTION A-A
B-B SECTION
Vertical Line Through Trunion
45'0" to Panel Point in Top Chord
128, 1¼" Turned Steel Bolts, driving fit.


Truss Details; Page Bascule Bridge.
Path of Center of Roller
Pitch Line
Joint
Joint Outside
Joint Inside
Vertical Line
Joins at W-X
Rivets 7/8" diam. Holes 15/16" diam.
Fill with Punching Concrete
Diaphra.
Cut Horiz. leg to 5"
SECTION A-A.
SECTION B-B.
SECTION E-E.
Ctr. of Pin
5x1/2" Lacing

side girders consists of cast iron blocks bolted to the webs, the blocks so distributed that the load is practically equal on each of the rollers. The bearings for the trunnions, roller shafts, rollers and the rear pins on which the counterweight girders are hinged are phosphor bronze, and all shaft bearings are babbitt metal. The total cost of the superstructure, including the erection and electrical equipment, was about $115,000.

The bridge is moved by two 125 h.p. railway type motors, connected to a series-parallel controller in the main bridge tender's house, which is mounted above the tracks over the vertical end posts. An indicator consisting of a number of electric lamps is placed in view of the tender and shows the position of the bridge in four consecutive positions during the operation, by lighting or extinguishing the different lamps. This is accomplished through a specially designed contact device connected mechanically to the leaf.



Details of Substructure; Page Bascule Bridge.

The operating motors are each provided with a magnetic brake. The brakes are automatically applied at the time of stopping the motors at any point and released when the motors are in operation. The locking of the bridge in place is effected by means of two wedges moving horizontally at the extreme end in the center of the lower chords. These wedges in turn slide under rollers mounted in upright standards that are anchored in the abutment, and in operating tend gradually to draw down and lock the bridge into place. The end lock is operated by a 3-h.p. enclosed type motor near the end and supported on a platform between the stringers under the tracks. The position of the end lock is shown to the tender by an indicator similar in design to that showing the positions of the operating leaf. The switchboard in the tender's house carries the necessary complement of instruments, including circuit-breakers, cut-outs, switches, etc.

While the bridge has been in operation only a comparatively short time, it has been fully demonstrated that the amount of power provided in the motors is more than ample, though some difficulty has been experienced in securing the constant voltage requisite to their satisfactory operation, current being taken from a trolley line nearly a mile distant. Tests made before the machinery and moving parts had time to get smoothed up showed that the bridge requires approximately 70 h.p. to raise or lower, the complete movement, with the motors connected in series, being performed in either direction in about 90 seconds.

Preparatory to putting the new bridge into commission, arrangements were made to detour all trains for a period of 24 hours, though it was confidently expected that 10 hours would be sufficient time. The work of dismantling the old draw span, however, proved so difficult, owing to rusted pin connections with worn false shoulders, that there was actually an interval of 24 hours and 50 minutes before the first train crossed the new structure. Prior to the change the bridge could be operated backward and forward through part of its arc, which enabled the operation to be thoroughly tested before making the change. An all-electric interlocking plant is now being installed for the safe handling of trains.

The bridge was designed by W. M. Hughes, Consulting Bridge Engineer, Chicago, under the Page and Schnable patents. The American Bridge Co., New York, was contractor for the superstructure, the steel work being fabricated at the Lassig plant of that company in Chicago. G. P. Nichols & Bro., Chicago, installed the electrical equipment. The Thomas Phee Co., Chicago, was contractor for the substructure, and the Kelly-Atkinson Construction Co., Chicago, for the erection of the superstructure. The work was carried on under the direction of W. D. Taylor, Chief Engineer of the Chicago & Alton, the writer being in immediate charge of the construction.

Rest Houses on the Baltimore & Ohio.

The first appropriation by a railroad company for the founding of an employees' relief association was made by the Baltimore & Ohio in 1880. This company, too, has been liberal in providing in other ways for the comfort of its employees. Formerly at many of its division points there were poor accommodations or none at all for train crews while waiting over for their return runs. In order that the expense and temptations of public hotels and boarding houses might be avoided by the employees, the Baltimore & Ohio has established at ten different division points—Brunswick and Cumberland, Md.; Keyser, Grafton and Fairmont, W. Va.; New Castle Junction, Pa.; Cleveland, Lorain and Chicago Junction, Ohio, and South Chicago, Ill.—rest houses, where the men can secure good accommodations at no more than the cost to the company. In these rest houses trainmen can get clean and comfortable beds and tub and shower baths for the cost of laundering the linen and towels. There are also libraries with reading matter and games. Restaurants are also run by the company in connection with the rest houses. In order to insure the best of service throughout, the rest houses have recently been placed under the supervision of the superintendent of hotels, who is to manage them as carefully as the hotels open to the public controlled by the Baltimore & Ohio.

Program of the Master Car Builders' Convention, Atlantic City, June 17 to 19.

The sessions of the convention will be held, as was done last year, in the sun parlor near the ocean end of the steel pier. The Marlborough-Blenheim has been selected as headquarters, where the President, Executive Committee and Secretary will have offices. The registration booth will be in the entrance to the steel pier; each member, immediately upon arrival, should report at this booth, register and receive his membership button, if he has none, and be furnished with a properly numbered disc showing his registration. Cards for registration will be furnished at the registration booth. Members will also be furnished with badges for the members of their families. The standard M. C. B. button will be used, but a different disc will be issued. It is therefore necessary that you register. Those members who have attended the convention of the Master Mechanics' Association and expect to remain for the Master Car Builders' convention, should register on the first day of each convention, so that a record may be made of those in attendance at each convention; those who attend but the M. C. B. convention should register but once, and that immediately on arrival.

OPENING SESSION,
MONDAY, JUNE 17, 10:00 a. m. to 1:30 p.m.

Prayer	10:00 a.m. to 10:05 a.m.
Address of President	10:05 a.m. to 10:25 a.m.
Intermission	10:25 a.m. to 10:30 a.m.
To permit visitors to retire, although all are requested to remain.	
Reports of Secretary and Treasurer	10:30 a.m. to 10:45 a.m.
Assessment and announcement of annual dues; appointment of committees on Correspondence, Resolutions, Nominations, Obituaries, etc.	10:45 a.m. to 11:00 a.m.
Election of Auditing Committee	11:00 a.m. to 11:05 a.m.
Unfinished Business	11:05 a.m. to 11:10 a.m.
New Business	11:10 a.m. to 11:25 a.m.
Discussion of Report on: Revision of Standards and Recommended Practice	11:25 a.m. to 12:00 m.
Topical Discussions: Up-to-date Cleaning of Passenger Equipment. To be opened by P. H. Peck	12:00 m. to 12:30 p.m.
Passenger Car Ventilation. To be opened by Wm. McIntosh.	12:30 p.m. to 1:00 p.m.
Discussion of Reports on: Triple Valve Tests	1:00 p.m. to 1:10 p.m.
Brake-shoe Tests	1:10 p.m. to 1:30 p.m.

Adjournment.

MIDDLE SESSION,
TUESDAY, JUNE 18, 9:00 a.m. to 1:30 p.m.

Discussion of Reports on: Tests of M. C. B. Couplers	9:00 a.m. to 9:30 a.m.
Revisions of Rules for Loading Long Materials	9:30 a.m. to 10:00 a.m.
Rules of Interchange, including Report of Arbitration Committee on Revision of Freight and Passenger Car Rules and Prices for Repairs of Steel Cars.	10:00 a.m. to 11:00 a.m.
Cast-iron Wheels.	11:00 a.m. to 12:00 m.
Topical Discussions: Solid Steel Wheels for Passenger Cars	12:00 m. to 12:30 p.m.
Freight Car Repair Shops for Winter Work. To be opened by D. Van Alstyne	12:30 p.m. to 1:00 p.m.
Discussion of Reports on: Arch-Bars for 80,000-lb. capacity Cars	1:00 p.m. to 1:15 p.m.
Air-Brake Hose Specifications; Chemical Analysis of Hose	1:15 p.m. to 1:30 p.m.

Adjournment.

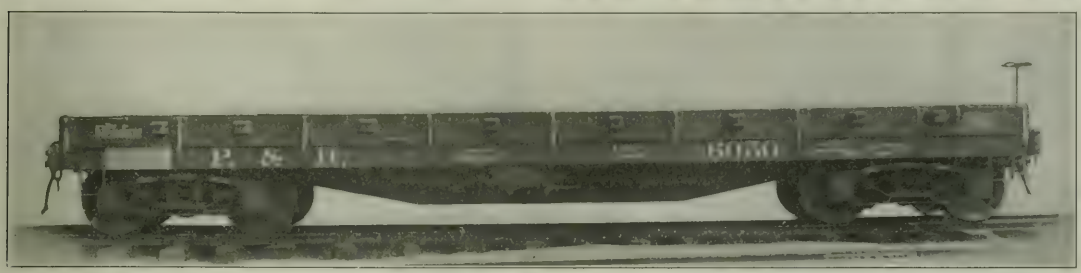
CLOSING SESSION,
WEDNESDAY, JUNE 19, 9:00 a.m. to 1:30 p.m.

Discussion of Reports on: High-Speed Brakes	9:00 a.m. to 9:30 a.m.
Height of Brake Staff	9:30 a.m. to 9:40 a.m.
Automatic Connectors	9:40 a.m. to 9:50 a.m.
Tank Cars	9:50 a.m. to 10:00 a.m.
Stresses to which Wheels for 100,000-lbs. Capacity Cars are Subjected.	10:00 a.m. to 10:30 a.m.
Clearances for Electrical Equipment	10:30 a.m. to 10:45 a.m.
Subjects	10:45 a.m. to 11:00 a.m.
Unfinished Business; Reports of Committees on Correspondence, Resolutions and such other committees as may be named during the convention	11:00 a.m. to 12:00 m.
Topical Discussions: Lateral Coupler Clearances. To be opened by Le Grand Parish.	12:00 m. to 12:30 p.m.
Truck Springs on Journal Boxes rather than under Bolster. To be opened by F. W. Brazier	12:30 p.m. to 1:00 p.m.
Election of Officers.	1:00 p.m. to 1:30 p.m.

Adjournment.

Low Side Steel Underframe Gondola; Philadelphia & Reading.

The Middletown Car Works, Middletown, Pa., has recently built for the Philadelphia & Reading 400 low side steel underframe gondola cars from designs made in the office of the Superintendent of Motive Power of the road. The cars have a rated capacity of 100,000 lbs., but they have an exceptionally heavy underframe and are capable of sustaining loads much in excess of the normal 10 per cent. overload when required. On this account the light weight is high for this type of car, being 42,700 lbs. The cars are 38 ft. 2½ in. long over end sills, 36 ft. 4¼ in. long inside and 8 ft. 9¼ in. wide inside. They have wooden plank floor and sides 12 in. high, but the ends are formed of 12-in. channels, hinged to drop down when required. The underframe is built up entirely of structural steel, the end sills and side sills being respectively 12-in., 25-lb. and 10-in., 30-lb. channels. The center sills are built up girders to which the 12-in. channel draft sills are spliced in front of the bolster. The center sills are 30 deep at the center and are built up of ⅜-in. web plates, a 20-in. x ¼-in. top cover plate, a single 4-in. x 5-in. top flange angle, and two 4-in. x 5-in. bottom flange angles. The side sills transmit their load through three girder cross bearers between the bolsters, in addition to which they are stiffened with eight channel cross braces which support the floor nailing strips. The side planks are supported by pressed steel stakes riveted to the side sills and the stake pockets for temporary stakes are bolted to the planks instead of the sills.



50-Ton Low Side Steel Underframe Gondola; Philadelphia & Reading.

The Cost of Freight Car Repairs.

BY M. K. BARNUM.

For the last few years the cost of freight car repairs has been increasing at the rate of approximately 10 per cent. a year, or about $5 a car, on many of the large railroads. On some roads the increase in cost of repairs per car has, to a certain extent, been due to nursing the old cars to an ultimate age of from 20 to 25 years, but even those roads which have adopted the steel car as standard, and have dismantled cars only 12 or 15 years old, have found repairs steadily mounting upward. These increases might be satisfactorily accounted for in full by the advance in wages and cost of material, but as they began to be conspicuous two or three years ago, while the most important advances in the cost of labor and material are more recent, there must be other contributory causes which are not so easy to determine.

The lack of accurate data has made it difficult and often impossible for car department officers to explain this steady increase in the cost of repairs. It has not been customary for railroads generally to keep a separate account of repairs to each car by number, or, as a rule, to certain classes of cars, the usual practice being to charge all labor and material to a general freight car repair account. Because of this practice, there is little accurate information as to the actual or proportionate cost of repairs to the various parts of freight cars, such as roofs, doors, draft gear, drawbars, truck frames, etc. One western road has compiled figures for the fiscal year 1906 which distribute the repairs to freight cars somewhat roughly under a few heads as follows:

Items.	Per cent. Material.	Labor.	Total.
Wheels and axles	15.0	1.6	16.6
Remainder of trucks	9.2	3.3	12.5
Draft gear	12.2	7.2	19.4
Sills and underframing	6.1	3.4	9.5
Superstructure	15.9	9.8	25.7
Couplers	8.1	2.5	10.6
Doors, side and end	1.6	1.0	2.6
Doors, grain	0.6	0.6	1.2
Roofs	1.2	0.7	1.9
Total	69.9	30.1	100.0

Average number of times each car was repaired, 5.5.

This distribution of expense has not been made in sufficient detail to be of much value to car department officers in determining those parts of the car which are most in need of improvement and in which there is the greatest possibility of reducing the cost of

Another western road has had in effect for the past year a

system of distributing the cost of repairs to locomotives and passenger cars among the most important parts which has been found satisfactory and a committee is now working up the details of a similar plan for distributing the cost of freight car repairs. This committee is composed of representatives from the car shops, the supply and auditing departments, and from the mechanical engineer's, superintendent of motive power's and executive offices. After numerous meetings and a careful consideration of every part of a freight car, it has been decided to divide and classify the cost of repairs to each car under the following heads:

(Form "A.")

A. B. & C. RAILWAY COMPANY.

Freight Car Repair Report.

Car Initial ... No..... Kind..... Capacity..... Length.....
.....Shops, ...190...

Description of Repairs.	Cost of Repairs. Labor.	Material.	Total.
I. TRUCK:			
No... Kind... Removed... Applied...			
1. Wheels and axles			
2. Journal box and box bolts			
Kind ... Removed..... Applied...			
3. Arch and tie bars			
4. Steel side frames			
Kind.... Removed..... Applied...			
5. Column and column bolts			
6. Barber roller device			
7. Bolster .. Kind.. Removed... Applied..			
8. Brake hanger brackets			
9. Other truck parts			
II. DRAFT RIGGING:			
Kind..... Removed..... Applied...			
1. Couplers.. Name.. Removed.. Applied..			
2. Yoke rivets			
3. Draft timbers			
4. Draft lugs			
5. Other draft rigging parts			
III. UNDERFRAME.... Kind			
1. Body Bolsters.... Name and Kind.....			
Removed..... Applied			
2. Center sills.. Kind.. New or Spliced...			
3. End sills			
4. Center and end sills in combination....			
5. Other underframe parts			
IV. SUPERSTRUCTURE:			
1. End posts			
Kind..... Removed..... Applied.....			
2. Ends (including side plates in combination)			
3. Lining			
4. Doors and fixtures (roofed cars)			
5. Doors, fixtures and operating mechanism (open cars)			
6. Other superstructure parts			
V. ROOF:			
Kind..... Removed..... Applied.....			
1. Upper course			
2. Lower course			
3. Framing			
4. Running board and fixtures			
VI. PAINTING AND LETTERING			
VII. BRAKES: Kind..... (Inside / Outside)			
1. Brake Company's parts			
2. Brake-beams, Name and kind			
Removed..... Applied			
3. Other brake parts			
Grand total			

Remarks:.....

.....

.....

Most railroads have at some time tried to obtain the cost of repairs to certain parts of cars such as wheels, journal bearings, couplers, etc., but, so far as we know, none have yet attempted to distribute the total cost of repairs among the more important parts of the car, as in the plan just outlined. It is estimated that the cost of keeping these records for a road owning about 50,000 freight cars, in sufficient detail to obtain all desired information, will be about $1,000 a month; also it is believed that after these records are kept for six months or a year sufficient information will be obtained to serve all present practical purposes, so that the record may be suspended until such time as a change in design of the cars or in other conditions makes it desirable to obtained revised data.

The benefits to be derived from this information are: (1) An analyzed record of expenditures will greatly facilitate keeping down the cost of repairs; (2) figures showing definitely the amount spent for maintaining the separate parts of freight cars will enable the railroads to determine pretty closely the possible savings to be effected and how much they can afford to pay for improved or patented designs. In short, it is believed that this plan will furnish the prime requisite towards keeping down or reducing the cost of repairs, namely, accurate knowledge as to how and where the expenditures are applied.

School of Railway Engineering and Administration of the University of Illinois.

In noticing in our issue of March 22 a pamphlet sent out by the University of Illinois about its school of Railway Engineering and Administration, it was stated that a bulletin containing full detailed information regarding these courses would soon be issued. This bulletin has just been issued. It is a 60-page book and gives the information about the four courses comprised in this particular school with all of the detail and fullness of the usual college catalogue.

Four railroad courses are offered: civil engineering, electrical engineering, mechanical engineering and administration. The main object of these courses is to provide a thorough training in theory and general principles, amply illustrated and fixed by practice. The civil and mechanical engineering courses are intended to fit the student for the construction and maintenance of way, and the motive power departments respectively. The electrical course is for service on electric railways or steam roads having electrified lines. These engineering courses differ but slightly, if at all, from the regular university courses under these headings until the last year is reached. The administration course, which is also four years in length, has been specially framed throughout to give wide knowledge and training in the specific matters which relate to the organization and operation of all departments of railroad administration and at the same time give the student a liberal education.

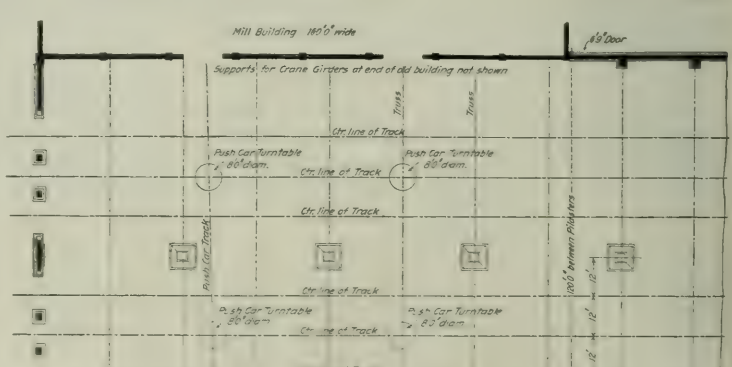
The instruction corps for all phases of the work in this newly-formed railroad engineering department has been selected, with one important exception, namely, the head of the department. The man selected for this position will have general charge of all the engineering work and therefore should preferably be one who has had experience in the maintenance of way department and can give instruction in railroad civil engineering. Efforts are now being made to find a suitable man for this vacancy.

Recent Shop Construction.

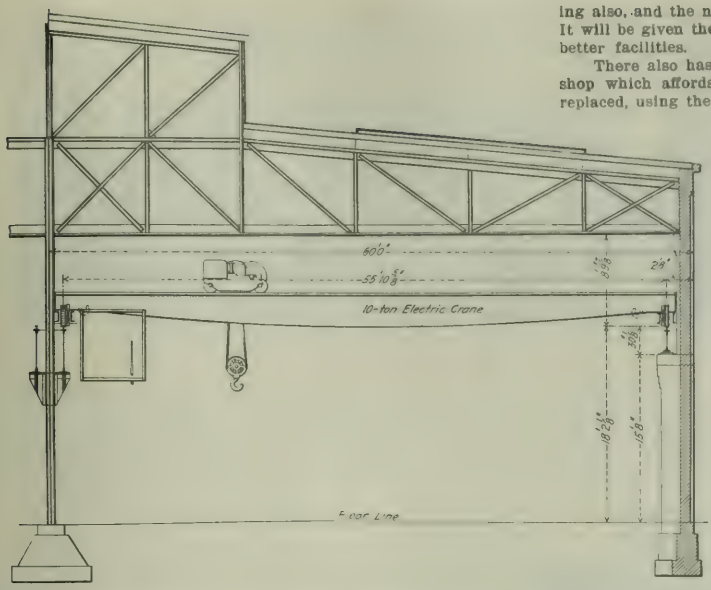
BURNSIDE SHOPS OF THE ILLINOIS CENTRAL.

The Illinois Central has recently completed at its Burnside shops, Chicago, a new freight car shop which enlarges the plant's capacity for work of this character by 130 per cent. The old freight car shop is 502 ft. long and 100 ft. wide, with track room for 40 cars. The new building is 574 ft. long by 120 ft. wide and has space for 52 cars. It was planned to handle the work through it as expeditiously as possible.

A part plan and cross-section of the building are shown herewith. Its long dimension is east and west and it is built on to the north end of the mill building, lying at right angles to it, the east walls of the buildings being flush and the two therefore forming an L in plan. The new building has steel columns and roof trusses and brick walls. It is in two bays of equal width, each containing three tracks, the central one of which is a material track. There are two push-car turntables in each of these tracks at both ends of the building. Each bay is served by a 10-ton electric traveling crane running the full length of the building. These cranes are capable of lifting car bodies off the trucks and depositing them at any desired point in the shop. Because of the crane service the usual style of platform for the men to work on the upper parts of box cars cannot be installed and there is now being built a special



Part Plan of Burnside Freight Car Shop, Showing Track Arrangement.



Half Cross-Section of Burnside Freight Car Shop; Illinois Central.

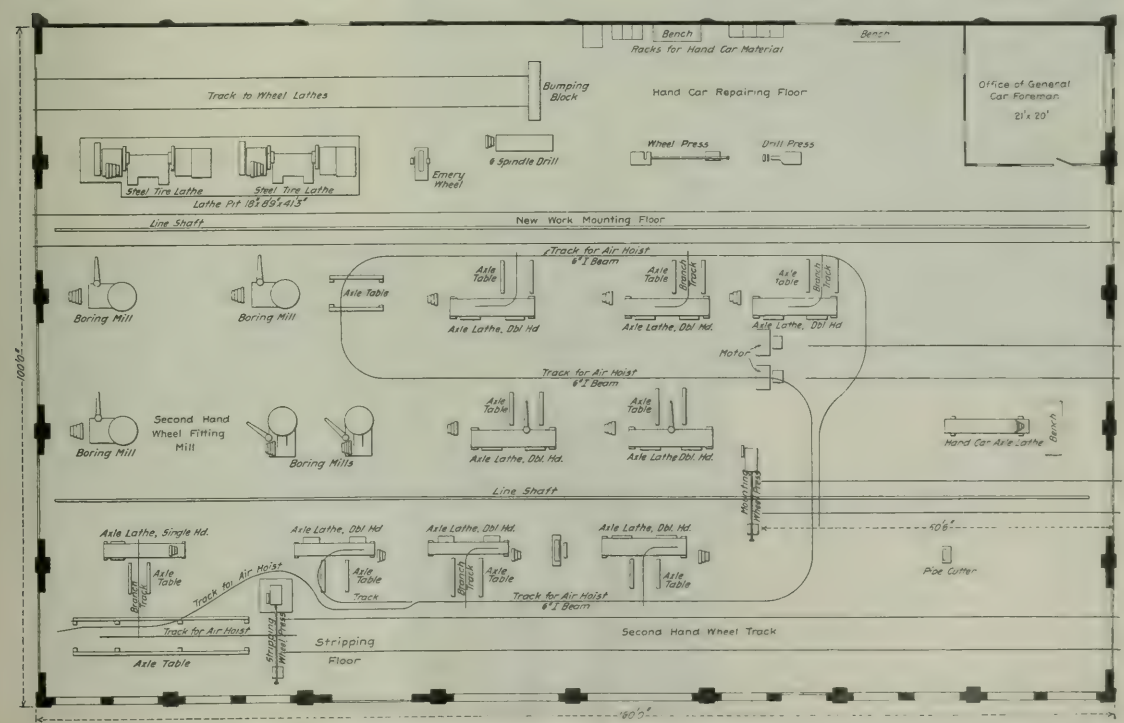
ing also, and the new shop will therefore afford much-needed relief. It will be given the preference in new construction work because of better facilities.

There also has been completed lately at Burnside a new wheel shop which affords a 30 per cent. greater output than the one it replaced, using the same size force and the same machinery, except that there is a reduction in the quantity of same. This result is due to laying out the shop and handling the work through it in such manner as to minimize lost motion and the interference of one movement with another. The arrangement and controlling conditions of the old shop were admittedly bad, also its location was unfavorable. It was too far removed from the car shops, being at the south end of the machine shop, about 1,200 ft. from its present location, which may be considered the logical one. There was only one large door through which everything had to come and go. The result was a continual congestion and inability to furnish wheels and axles as fast as needed.

A plan of the present shop is here reproduced. It forms an extension to the north end of the passenger car repair shop, with the new freight car shop directly west of it and the old freight car shop immediately north. The second-hand wheel storage yard is just north of the new freight car shop. The wheel shop thus occupies a central point in the car section of the plant. Second-hand wheels and axles are brought into the building through the door at the northwest corner, where there is a storage track leading to the stripping floor and wheel press at the east end of the building, affording room for a large number of wheels and axles. This is a convenient feature, particularly in the winter time, avoiding frequent opening of the door to admit a fresh supply. As the plan indicates, the scrap wheels are taken through an adjacent door in the north wall of the building where they are loaded into cars standing on a depressed track just outside. The axles are rolled onto a table back of the press, whence they are carried to the axle lathes by the air hoist trolley. New wheels and axles are stored outside of the east end of the building and move west past boring mills and axle lathes to the mounting wheel press, beyond which

design of portable platform which the cranes will move from point to point as they are needed. Each track has its individual compressed air line, with hydrants on or opposite the roof-supporting columns. The building is heated by the hot blast system, overhead distribution. The artificial lighting is by Cooper-Hewitt mercury vapor lamps swung to the lower chord of the roof truss, there being 25 in the shop.

Besides the large amount of repair work, the Burnside shops build all equipment for replacement. The older freight car shop was altogether inadequate to handle the heavy repairs and do the build-



Wheel Shop of the Illinois Central at Burnside.

is a storage track for 25 pairs of wheels leading out to the yard distributing tracks.

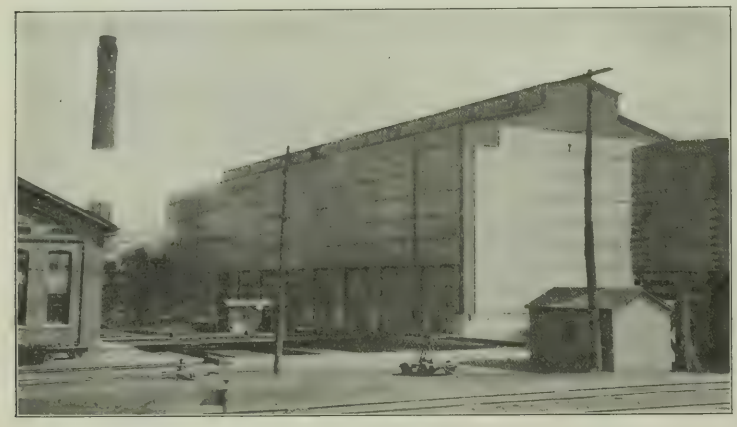
The steel-tired wheel section is in the southeast corner of the shop. The wheels and axles are stored on a track back of the two tire-turning lathes. The latter are depressed 18 in. for convenience of placing and removing the work. In front of the lathes, running through the shop, is a track for mounting new work and running the re-turned wheels out of the shop. The southwest corner of the shop is used for hand car work.

This shop has one axle lathe and two wheel presses less than its predecessor, yet because of its arrangement, location, and the freedom with which business is handled through it, it is able to turn out 30 per cent. more work, and easily keeps ahead of the demand for wheels and axles.



Car Repair Shed with Saw-Tooth Roof; Princeton, Ind.

Another feature of the car work deserves mention. All passenger cars coming in for overhauling are first run into a stripping and scrubbing room lying between the passenger paint shop and the upholstery room, and having space for four cars. Here the cars are stripped of upholstery, windows, brass work, etc., the departments for which immediately adjoin this room. The car is then thoroughly washed and sent to the repair shop. This separate room for this work has proven a great convenience, as it avoids all interference with the other car work. At one end of the room is a bench for repairing injured or broken sash before passing them into the varnish room.



Erecting Shop; Princeton, Ind.

The method of cleaning the plush of seat cushions, etc., here used is simple and effective. After blowing out the dust as well as possible with an air blast, the surface is gone over with a brush dipped into a warm very weak solution of ammonia. It is then subjected to the air blast a second time, which blows out practically all of the moisture and with it all remaining dust, restoring the plush to its original brightness. The method is much more satisfactory than the use of a cleaning soap, which cannot be entirely removed from the plush and in time stiffens and hardens it.

PRINCETON SHOPS OF THE SOUTHERN.

The principal repair point of the St. Louis-Louisville lines of the Southern is Princeton, Ind. The facilities here have lately been increased by a number of important additions, most notable of which is a new erecting shop. A photographic view of this building is given herewith, and shows it to be unique for a building of this character, the sides and ends being entirely enclosed with glass.

The building adjoins the old machine shop, one wall of which was removed to consolidate the two. The erecting shop is 220 ft. x 76 ft. outside. The framework is entirely of steel. The bents are spaced 20 ft. centers. There are no intermediate supports for the roof, the trusses, which are riveted steel, one-third pitch, having a clear span of 74 ft. A clear-story runs the entire length of the roof. A noticeable feature of the steel framework is the absence of unsightly wind bracing, all bracing being by means of gussets at the top and bottom of the posts. The crane girder, 45 in. deep, is bracketed to the posts, and runs the length of the building. The crane, which has an ultimate capacity of 140 tons, has developed 120 tons in a working test.

The glass in the sides of the building extends from the top of the concrete wall, which reaches 5 ft. above the floor, to the roof line and is composed of 12 in. x 18 in. lights of ribbed glass, which prevent all glare and diffuse the direct rays of the sun. The lighting is a special feature of the building and has proven highly satisfactory.

In each 20 ft. panel of the building is a 50 ft. concrete engine pit, or ten in all. Between these pits are large pits for the storage of "o. k." materials stripped from engines on the repair pits. The storage pits are covered with heavy oak doors, fitted flush with the floor, and provided with rings to enable them to be hauled by the crane. The floor of the shop is Portland cement concrete. The building is heated with steam radiators secured to the posts and extending from the floor to a height of 20 ft. There are also steam coils in each repair pit.

Locomotives enter and leave the building over an electric transfer table of 150 tons capacity, 75 ft. long. It runs on five rails and has a working speed of 150 f. p. m. The equipment of the shop is electric driven and strictly up-to-date.

The Princeton improvements include a new coaling station and dry sand supply house. The coal plant is a gravity dumping, bulk storage system of 400 tons capacity. There are 12 coal pockets on each side of the chute. These pockets are of three sizes, there



Interior View of Erecting Shop; Princeton, Ind.

being 12 six-ton pockets, six 7 ton and six 8 ton pockets. The coal passes from the storage bin into each pocket through an undercut retaining gate worked by hand from the inside of the chute. The Williams-White pattern of apron and exterior retaining door is used. Loads are moved up the incline by a motor-driven Lidgerwood hoist, carrying 600 ft. of cable. The coal is deposited in the storage bin from hopper-bottom cars. On the rear of the coal chute, forming a part of that structure, is the sand house having a sand storage bin of ten cars capacity, two dry-sand pockets of 4 yds. capacity each, and a steam sand dryer. The sand storage bin is under the track, enabling the sand cars to dump directly into same. The dryer is above the sand pockets, likewise affording a gravity run for the dried sand. The gradient of the station incline is 20 per cent., decreasing to 10 per cent. on the final, or top, panel. This plant has effected a material saving in the handling of sand and coal at this point and assures prompt service to the locomotives.

A view of the new freight car repair shed is also shown. It has a saw-tooth roof and the lighting of the interior is said to be altogether satisfactory. The building, which is wood throughout, is 261 ft. long and 80 ft. wide. It contains four freight car repair tracks and two tram or material tracks. The roof is carried on wooden Howe trusses of 40 ft. span, the building being divided into two bays.

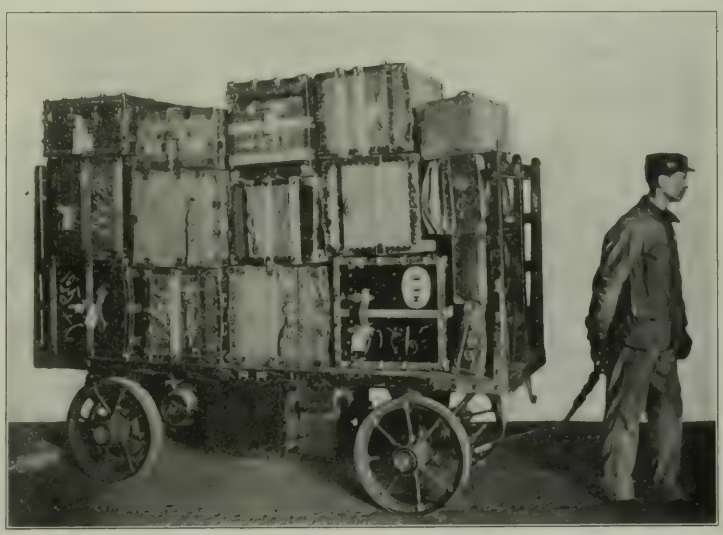
We are indebted for data to Mr. Edward Gray, Engineer Maintenance of Way of the St. Louis-Louisville lines of the Southern, who had charge of the work.

Electric Baggage Trucks.

The Pennsylvania Railroad has recently built three electrically propelled trucks for carrying baggage and mail between trains, and the baggage and mail rooms in stations. Two are in service in the Broad street station, Philadelphia, and the third at Altoona. Although similar in general appearance, the three trucks differ in many essential details. They are still in the experimental state, and careful records are being kept to determine which type is the best for general use. The type of truck which has been found to be most serviceable up to the present time is similar to the hand drawn type in common use. It is operated by one man, who walks ahead of it and steers the front wheels with a tongue or handle. Power is taken from a storage battery carried in a box secured to the under side of the platform. It consists of 14 Willard cells and has a capacity of 136 ampere hours. The batteries are charged about eight hours daily at the rate of 17 amperes.

Each of the rear wheels is driven by a Westinghouse type AA, 4-pole, series wound, 20-volt motor. Double reduction gearing is used between the motor and rear wheel, and each motor is provided with a solenoid brake of the multiple disc type on the end of its shaft. These brakes are essential for safe operation, for the truck cannot start itself even on an incline, and if in motion it stops promptly and automatically as soon as the power is shut off. Only two speeds forward and two backward are provided. These are approximately 4 and 6 miles per hour for the loaded truck, and on the crowded platforms they have been found fast enough.

The two motors are operated in series and on the low speed a wire resistance is inserted. The motor current is controlled by two single pole solenoid switches, one for the low and the other for the high speed. The solenoid switches are enclosed in a box in front of the storage batteries, and current for operating them is controlled by contacts in a small box on the outer end of the tongue or handle. The contact box is of metal, cylindrical in form, and operated by a rod which slides axially through it. The rod is provided at one end with a ring, which is grasped by the operator. A slight movement of the rod starts the truck forward at low speed; further movement of the rod gives the high speed. The rod is returned to the off position by a spring so that when the ring is released the truck stops. It cannot be started by any accidental knock, but only by an intentional pull on the ring. The pole changing switch for running the truck backward or forward, is located in the box with the solenoid switches and operated by a small lever under the front of the platform. The tongue or handle is connected by reach rods to pivoted bell cranks carrying the two front wheels in a way similar to that generally used upon automobiles. This truck has been in successful operation about six months. One man can handle heavy loads of baggage and mail quickly and easily.



Electric Baggage Truck; Pennsylvania Railroad.

Proposed Rules to Prevent Diversion of Cars.

The Car Service Committee of the Association of Transportation and Car Accounting Officers has prepared the following rules to define and prevent diversion of freight cars. These rules are based on a recommendation of the committee made at New Orleans in November, 1906, and also on rules presented to a special committee of the American Railway Association on April 22, 1907. The amendment rules finally prepared are as follows:

Whereas, The Car Service Rules are not observed in present practice; therefore be it

Resolved, That we recommend to the Committee on Car Service of the American Railway Association that rules governing the handling of cars be incorporated in the Code of Per Diem Rules and be made a part of the Per Diem Rules Agreement; and be it further

Resolved, That we recommend to the Committee on Car Service of the American Railway Association the principles embodied in the following declaration and rules, to wit:

That the owner has a right to demand that his cars shall be kept moving in a homeward direction.

That the marks of ownership on a car are a sufficient guide to insure its movement toward the owning road.

That the intent of these rules is to make railroads responsible for keeping foreign cars moving toward the home road and to prohibit them from sending a foreign car in an opposite direction if in serviceable condition, except as hereinafter provided for.

Cars will be furnished to *shippers* for loading, under the following regulations:

1. Shippers will file a written order on a prescribed form with the agent at the station where cars are to be loaded, specifying the kind and number of cars wanted, commodity to be shipped, destination, when required and routing.

2. Agents will keep suitable record of orders for cars and of cars furnished, and will notify shipper in accordance therewith.

3. Shippers will be held responsible for loading cars contrary to the assignment made by the agent: For failure to properly load, the railroad may demand that the shipper unload or transfer cars at his expense, and car service charges at the current rate will apply against the load for each day car is held awaiting transfer or unloading, no free time to be allowed.

Foreign cars must be handled as provided for in one or more of the following sections:

WHEN LOADED.

4. Cars owned by *immediate* connections must be returned direct to owners or loaded via any route so that the home road will participate in the freight rate.

5. Cars owned by roads not immediate connections may be loaded to the road from which originally received if such loading is in the direction of the home road, *but not otherwise.*

6. Cars owned by roads not immediate connections may be loaded to an intermediate road in the direction of the home road or

loaded via any route so that the home road will participate in the freight rate.

[Note.—A road or combination of roads connecting with the road owning the car from point of delivery to destination shall not be considered as an intermediate road or roads.]

7. Loaded in local service in the direction of home route junction point or to any junction point with the home road: All movements to be in the same direction.

8. Cars may be loaded locally in an opposite direction from the home road or home route, if to be loaded according to rules 4, 5 or 6.

9. Loaded cars may be reconsigned or delivered to connecting roads only for movement within the switching limit.

10. The reconsignment of a loaded car, except as provided for in Rule 9, stands in the same attitude as the use of a car for a new load.

WHEN EMPTY.

11. The car owner shall have the right to demand the return of his empty cars at the junction point where delivered loaded.

12. Empty cars belonging to a system having a direct connection must, unless the owner objects [see Rule 11], be returned to such connection regardless of whence they came.

13. Empty cars may be sent in an opposite direction from the home road or home route, if to be loaded according to rules 4, 5 or 6.

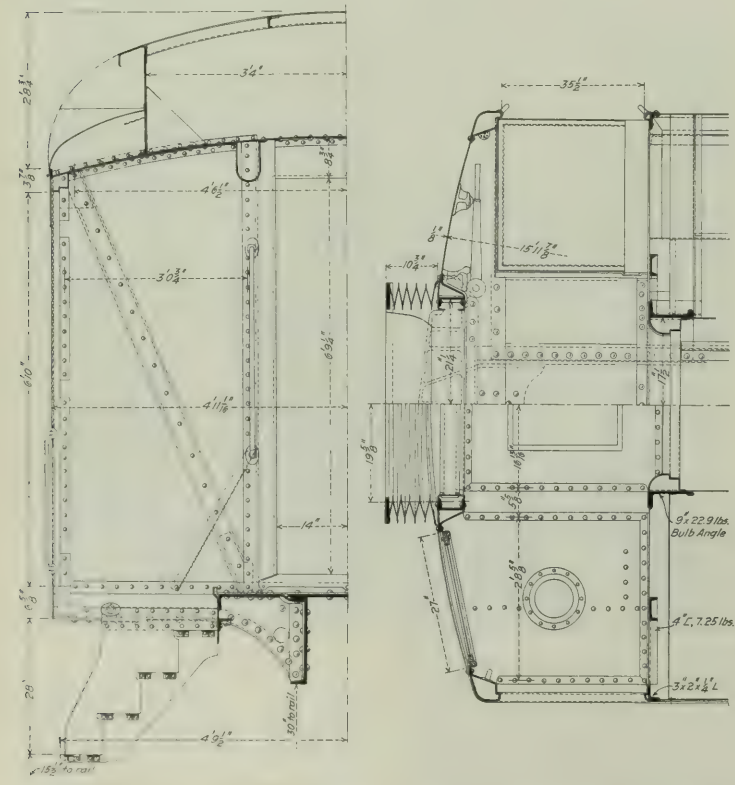
14. Empty cars may be delivered to connecting road switching or otherwise, to be loaded in accordance with rules 4, 5 or 6, *but not otherwise.*

15. When necessary to return cars empty belonging to roads other than direct connections, they may be delivered via home route junction to the road from which originally received.

16. If a road has an empty car that cannot be disposed of according to the foregoing it must be reported to the owner and disposition arranged for.

WHEN IN SWITCHING SERVICE.

17. Cars received loaded in switching service must be confined to switching territory, and when made empty must be returned to the owner, if a direct connection within that territory, otherwise to the road from which received.



Plan and End Elevation of Vestibule Framing; Pennsylvania Steel Cars.

Steel Passenger Cars for the Pennsylvania Railroad.

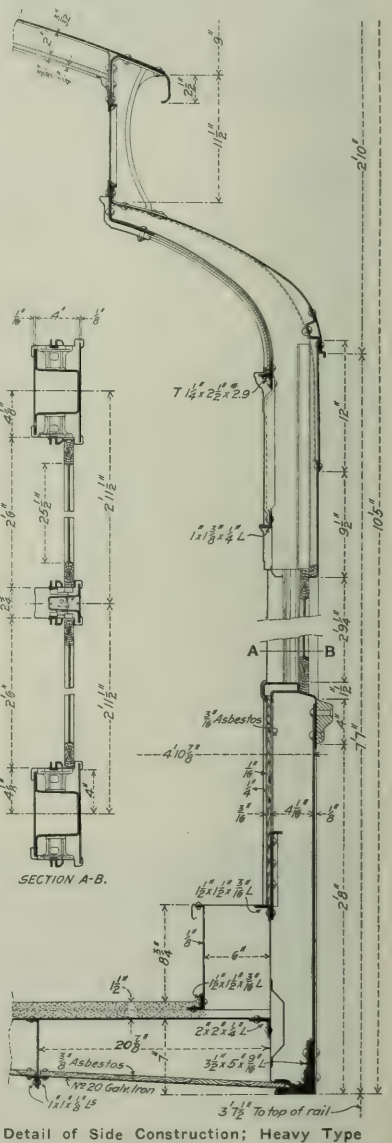
The Pennsylvania Railroad has ordered the construction this year of 200 all-steel passenger cars, which is the largest order yet given for this class of equipment. This is the result of a long period of inquiry and experiment, in which the late President Cassatt took an active part. After several cars had been built the President appointed a committee of motive power officers to make a thorough report on the design to be adopted and the orders placed are in accordance with the recommendations of that committee.

Two general types of steel passenger equipment have been adopted: For through trains; drawn by steam or electric locomotives and composed of mail, baggage, sleeping, dining or day coaches; a long car of heavy construction suited to withstand the strains incident to pulling, coupling or buffing long trains.

For suburban trains; drawn by a locomotive or propelled by motors upon the truck axles; a short car of lighter construction suited to operation in frequent short trains to accommodate the traffic.

The heavy equipment will be composed of cars of the following general dimensions:

Passenger Coach—70 ft. 5¾ in. long over body, estimated weight



Detail of Side Construction; Heavy Type Steel Car.

113,500 lbs., four-wheel trucks, and two closets, seating 88 passengers.

Mail Car—71 ft. 4⅜ in. long over body, weight 128,000 lbs., provided with universal or interchangeable interior arrangement and six-wheel trucks.

Baggage and Express Car—60 ft. 10⅜ in. long over body, weight 91,000 lbs., capacity 40,000 lbs., four-wheel trucks.

Special Baggage and Express Car—Baggage and mail compartment, or horse express cars; 70 ft. long over body, approximate weight 120,000 lbs., capacity 60,000 lbs., six-wheel trucks.

Passenger-Baggage Combined Car—71 ft. 1 in. over body, approximate weight 130,000 lbs., six-wheel trucks, one closet and one lavatory.

Dining Car—71 ft. 11¾ in. over body, approximate weight 140,000 lbs., six-wheel trucks, table capacity to serve 30 passengers.

The suburban, or light equipment, will include cars of the following general dimensions:

Passenger Coach—54 ft. 4 in. long over body, approximate weight 75,000 lbs., seating about 70 passengers, four-wheel trucks; height from top of rail to underside of frame 41 in., to admit application of electric motors; total height of car above rails 13 ft., to permit installation of overhead trolley; vestibule doors for both high and low platforms.

Passenger-Baggage Combined Cars—Mail compartment and baggage cars of the same general dimensions as passenger coach.

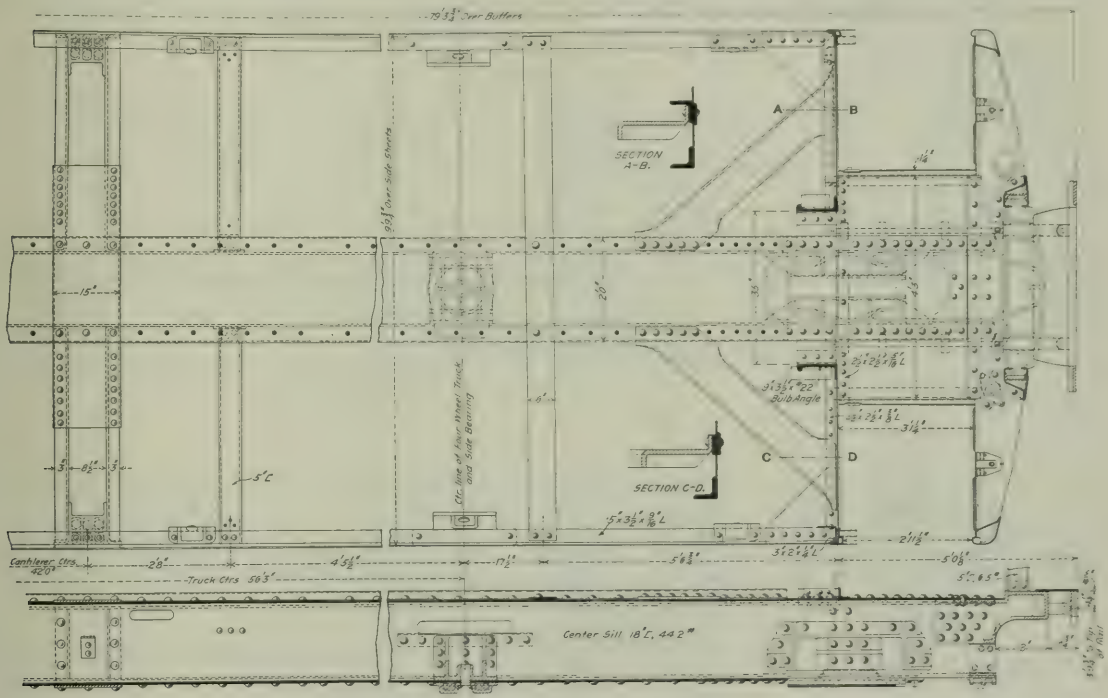
In the development of steel passenger cars the Pennsylvania has played an important part. When steel cars were proposed for use in the New York Subway, none of the car builders in the country was in a position to furnish them, and the first steel motor car was built at Altoona in 1902.

In 1904 designs were made for a 58-ft. passenger coach, which had a steel underframe and a steel outside sheathing up to the roof. The interior finish was largely of composite board and the roof was of wood covered with copper. One car of this type was built, but as it contained about 1,500 lbs. of wood further development of the design was considered necessary.

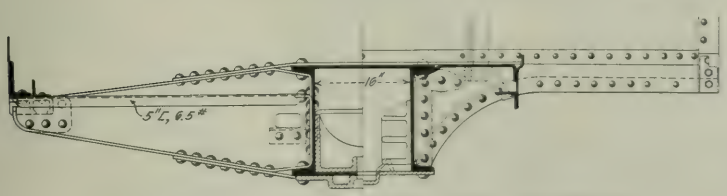
The next was a 60-ft. baggage car, completed in November, 1906, and closely followed by a 70-ft. mail car turned out in February, 1907. In the two latter cars only a small amount of wood was used.

Designs have now been prepared for a 70-ft. dining car, also for a 70-ft. passenger coach, which contains but 300 lbs. of wood (used for brake rod guards, window sash and arm rests for the seats). The interior finish is of steel except the headlining, which is of composite board. Designs are being completed for a suburban type car, 54 ft. 4 in. long.

In general arrangement and appearance, the heavy type 70-ft. coach is almost an exact copy of the standard wooden passenger coach. The underframe consists of two 18-in., 44.2-lb. channels with ½ in. x 24 in. cover plates top and bottom forming the center sill. Cast-steel center plates are riveted to the under side of the sill, which is reinforced at these points by steel castings riveted inside. Projecting beyond each end of the center sill are steel castings designed to transmit directly to the center sill the loads due to buffing, and to support the spring rods carrying the vestibule buffer plates. These castings are provided with projecting lugs and flanges to which the platform end sills and vertical channels forming vestibule posts are riveted. Within the center sill near each end are riveted steel castings arranged to carry the couplers and draft gear.



Detail of Underframe and Draft Attachments for Heavy Type Steel Car; Pennsylvania Railroad.



Part Cross-Sections Through Underframe; Heavy Type Steel Car.

The side sills are 5 in. x 3½ in. by $^{9}/_{16}$ in. angles. Each sill is supported at its end by end sills, and at two intermediate points about 14 ft. from each end by cross bearers. The end sills are of cantilever form, riveted to the center girder and built up of angles, the outside sheathing plate acting as the web. The cross bearers are also of the cantilever form, each composed of two triangular plates flanged on the edges, and riveted at their base to the center sill. Opposite cross bearers are joined by cover plates which pass over the top and under the bottom of the center sill. Each side sill is held in line by nine struts of 5-in. channels connected to the center sill. These struts do not transmit any vertical load from the side sills to the center sill. Cast-steel side bearings are secured to the side sill in line with the center plates.

Pressed sheet steel posts spaced 5 ft. 11 in. centers support the superstructure. They are of channel section and the edges are flanged out and riveted to the inside sheathing forming a box sec-

tion. Their lower ends are securely riveted to the outside sills and their upper ends are tapered down and bent inward, forming lower deck carlines. At their upper ends these posts are riveted to the plate carrying the deck sash. The lower edge of this plate is bent out beneath the ends of the posts and forms a continuous beam of angle section running the entire length of the superstructure. Between the main posts are shorter intermediate posts, which extend only from the window sill to the plate carrying the deck sash. They are of light channel section with edges flanged for riveting to the outside sheathing, forming thereby a box section.

The upper deck carlines are of sheet steel pressed to channel section with edges flanged out for riveting to the $^{3}/_{32}$-in. steel roof-plate. Ends of the carlines are riveted to the plate carrying the deck sash. The upper edge of this plate is bent outward and down, forming a continuous beam of channel section, to which the edge of the roof-plate is riveted. Malleable iron braces unite the end of each post and its corresponding carline. The outside sheathing is $^{1}/_{8}$-in. steel and the course below the belt rail is riveted to the outside sill and vertically to each post.

The steel shape forming the under sill for the windows laps over the side sheathing, and rivets passing through the belt rail, which runs the entire length of the car, secure this joint. Outside sheathing above the windows is riveted vertically to the posts and its upper edge is riveted to a channel shaped steel section forming the eaves for the lower deck and extending the entire length of the superstructure.

Headlining for the upper and lower decks is of composite board secured to the carlines and posts with metal strips. Below the belt rail the inside sheathing is of $^{1}/_{16}$-in. steel, to the unexposed face of which $^{3}/_{16}$-in. asbestos is cemented. Bulkheads and remaining parts of the inside lining are of $^{1}/_{16}$-in. sheet steel. Mouldings, closely resembling those used in wooden construction, are pressed from steel and their use adds to the appearance of the interior. It has been possible to almost wholly eliminate machine screws from the construction, and economy in both construction and maintenance has been secured thereby.

The window sash are of wood and slide in a formed steel frame. (Steel sash have been successfully built, but wooden sash were deemed preferable.) Malleable castings riveted to the posts support the window frames. These castings are machined by jig, after riveting in place, so that the frames will be true and parallel regardless of any slight irregularity in location of the posts. Window stops, which also form ways for the curtains, are of extruded bronze. The deck sash are of malleable iron.

The floor is formed by corrugated steel plates which are supported by the center sill and upon longitudinal angles secured to the side posts. These corrugated plates are covered to a depth of 1½ in. with a plastic surface filling, composed largely of cement. A sub-floor of asbestos ⅜ in. thick supported by No. 20 galvanized sheet steel is secured to the center and outside sills. Along each side of the car just above the floor rectangular ventilating ducts are provided, which enclose the heating pipes and discharge warmed fresh air into the car.

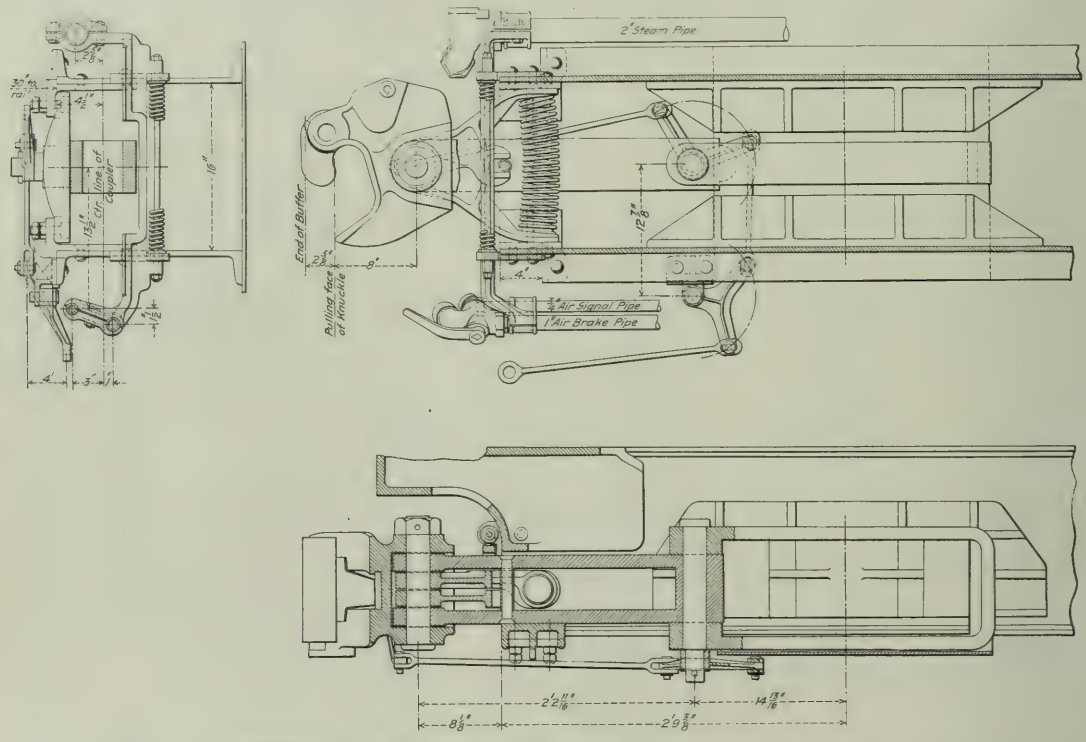
In designing the platform and vestibule an effort was made to secure sufficient strength in the end of the car to prevent the superstructure from being swept off from the underframe by the next car in event of a collision. The center sill is the main support of the entire vestibule and to it are securely framed the 9-in. bulb angles forming the end door frame together with the 5-in. channels forming the vestibule posts. These strong vertical members are relied upon to prevent damage to the superstructure during collision. The vestibule floor plate, the end sills and sheathing, and the vertical bulb angles, are securely framed together to give a strong foundation for the entire end construction.

Vertical corner angles uniting with the sides, and an angle across the top secured to the vestibule ceiling form the support for end sheathing. Two diagonal braces running from the eaves down to the floor, and securely riveted to the sheathing give additional stiffness to the ends. The end of the vestibule is supported by two outside posts of pressed sheet steel together with two channel posts forming a doorway. The base is formed by a pressed steel platform end sill, and the top support is given by the vestibule ceiling plate. Door jambs and lintels are of pressed steel (closely imitating the forms used in wooden construction), provided with cast diaphragms at intervals to prevent collapse and furnish support for attaching hinges, railings, etc. The end of the roof is of formed steel plates reinforced by angles secured to the end carline and the vestibule ceiling.

The general arrangement and appearance of the heavy type 70-ft. steel mail coach closely resembles the standard wooden car. It is, however, 10 ft. longer than former cars, and storage space is provided at each end instead of only at one end, thereby avoiding the necessity of turning the car around at terminals.

The underframe is similar to that used on the 70-ft. passenger coach, except that four side bearing plates are provided for each truck, and the ends are modified on account of the omission of the vestibule and side steps.

The end castings of the center sill are of such shape as to pro-



Application of Radial Coupler and Attachments; Pennsylvania Steel Cars.

vide rigid support for the door posts of 12-in. I beams. Their upper ends are securely framed into the roof structure so that an end shock to the car would be well distributed and not cause serious damage.

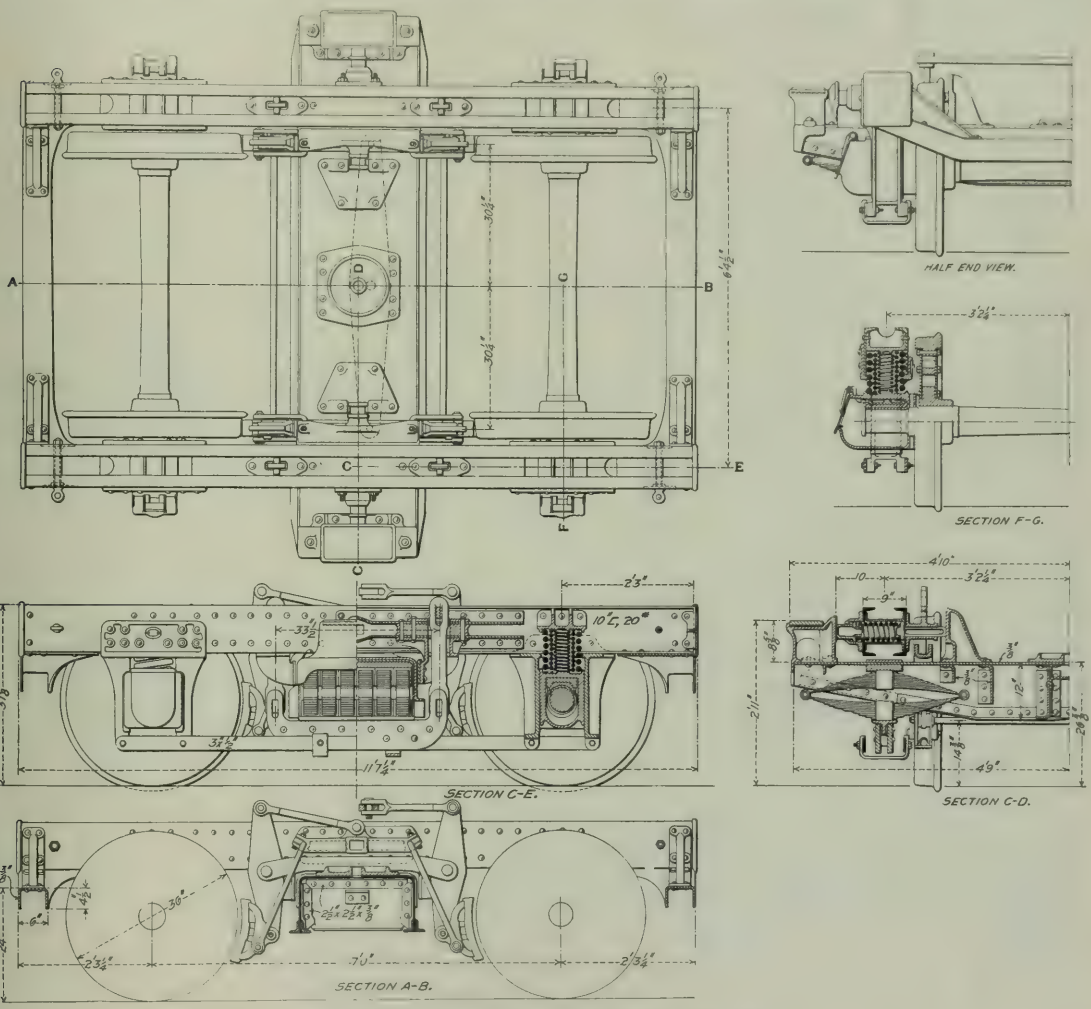
The roof construction is practically the same as that used in the passenger coach with the exception that the upper deck sash are of wood arranged to open for ventilation. The belt rail is of a flat bar instead of the formed section used on the passenger coach and between posts it is reinforced by a "T" section.

The window sash are of wood, the lower one is stationary and the upper one slides down. The upper sash is about twice the height of the opening it covers and its upper half is covered with a wire screen. When in the lowest position it affords ventilation through the screen, and in the upper position, glass closes the opening.

All the interior furnishings are of steel, conforming in dimensions to the requirements of the Post Office Department. The letter cases are built up with vertical partitions of steel plate and horizontal partitions formed by wires passing through holes in the verticals. Short horizontal plates are inserted between the verticals and secured to the horizontal wires to form the bottoms and tops of the pigeon-holes. Large and small paper cases are made of $^{1}/_{16}$-in. sheet steel, reinforced at the edges and similar in appearance to the cases used in wooden cars. The car contains but 370 lbs. of wood; it is lighted by electricity and heated by steam.

The general arrangement and appearance of the suburban type 54-ft. passenger coach are similar to the heavy type equipment, but the car is lower, shorter and the space allowed each passenger is less than in the larger cars. The arrangement of seats will be modified to suit the traffic and the saloon omitted if occasion warrants it.

The underframe construction closely resembles the heavy type car, but in order to provide sufficient space for motors the center sill is made more shallow. It is formed of two 10-in. channels with a single ¼-in. cover plate on top and two ⅜-in. cover plates on the bottom. This section keeps the center of gravity low and decreases the bending moment due to the fact that the drawbar is below the center sill. The center plate is of special form adapted to fit the same trucks used on heavy type equipment, and the casting enclosing the coupler and draft gear is attached to the under side of the center sill instead of being placed within it as in the heavy type car. Framing of the body is similar to that used in the heavy type coach, the main posts being identical except in the matter of length and shape at the top. There are three windows between each pair of main posts instead of two as in the heavy type coach.



Four-Wheel Steel Truck. Pennsylvania Steel Cars.

In order to complete its equipment of steel cars for passenger trains, the Pennsylvania Railroad has arranged with the Pullman Company to design and build all-steel parlor and sleeping car equipment. A sample sleeping car has recently been completed and is now at the Jamestown Exposition. In both exterior and interior appearance it closely resembles the standard wooden car, except in the delicate pearl grey interior finish, which replaces the highly polished natural wood.

Inside sheathing is of sheet steel, backed by asbestos board, to act as a non-conductor of sound and heat. Seat frames and berth fronts are of sheet steel, and window sash are of brass provided with automatic spring balances. Trucks are of standard Pullman

type supplied with cast-steel frames and bolsters, in place of the usual wooden members.

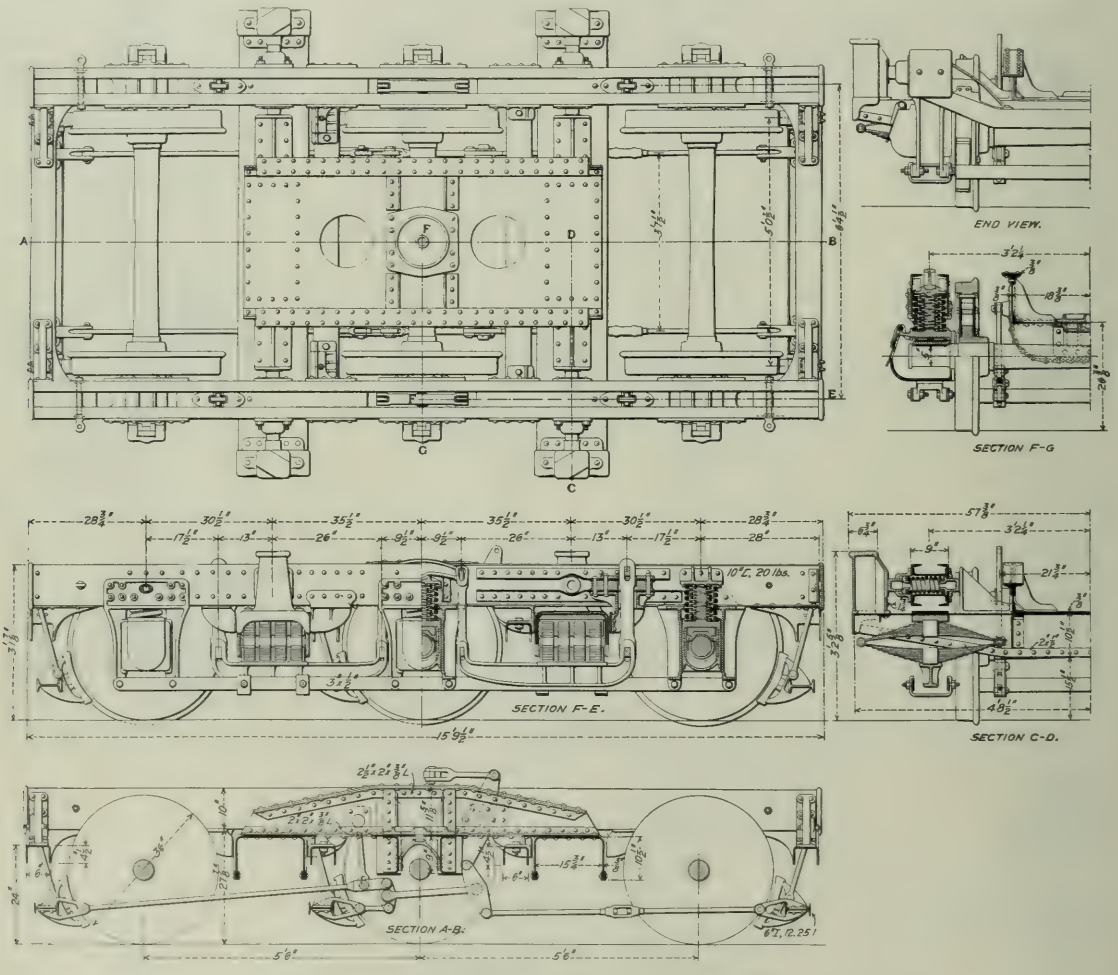
The principal dimensions of the car are:

Length over end sills	72 ft.	6 in.
Length over platforms coupled	80 "	6 "
Width over side sills	9 "	9¼ "
Width over eaves	10 "	0 "
Height over all	14 "	7 "

In preparing these designs great care was used to provide ample strength to resist end shock of buffing or collision. Standard steel freight cars are designed to resist an end shock equivalent to 300,000 lbs. compression. Experience with freight cars during the last five years indicated that this is not excessively high. In collision between passenger and freight cars it is desirable that the passenger car should be the stronger in order to escape with as little injury as possible. In computing loads upon the various members of the frame, therefore, it was decided that a compression load can roll completely over without danger of collapse. Posts, carlines and other parts are proportioned under this assumption.

In wooden car construction the center sills are usually rather shallow and the coupler is supported below them. Buffing loads tend to bend down the ends of the car due to the fact that the center sills are not symmetrically loaded. In these steel cars the center sill is made deep enough to bring the center line of draft within its section.

With the heavy center sills, body bolsters are unnecessary, for the major part of the transverse load is delivered directly to the center sill which transmits it to the trucks through center plates. The transverse loads which come upon the sides of the car and which must be transferred to the center girder are delivered at four points to equalize the loading. As a problem of design, the center sill is considered as a continuous girder, supported at two points by truck center plates and loaded with a practically uniform longi-



Six-Wheel Steel Passenger Truck; Pennsylvania Railroad.

of 250,000 lbs. between buffers, also 150,000 lbs. between draft gear, should be added to the normal loads due to the weight of the car and lading. Under these conditions the combined fiber stress is limited to 12,500 lbs. per sq. in. for cars in through train service and 20,000 lbs. per sq. in. for cars in suburban service. In determining these stresses none of the material above the belt rail was included. The sides of the cars beneath the window sills form girders about 3 ft. deep, for which the belt rail acts as the top flange and the outside sill the bottom flange. Owing to their great length, the thinness of the web, and the comparative shallowness of the flanges, these girders would probably collapse if subjected to end thrust. In calculations, therefore, the web and upper flange are not considered as resisting any of the 400,000 lbs. load assumed to represent the effect of buffing.

The superstructure of cars is made strong enough so that they tudinal load which it carries directly, together with four transverse loads delivered to it from the sides of the car through the cross bearers and end sills. The points of application of the concentrated loads are so selected that the two loads at each end are about equidistant from the center plate. Under this condition it has been possible to obtain in the center sill practically equal fiber stresses at the middle and over the center plates, thereby securing economy in metal and avoiding the use of a center sill of deeper cross section at the middle than over the trucks. Each of the four points of application is deflected practically the same amount. They therefore are always in line with one another and no load is placed upon the superstructure of the car by the unequal deflection of the center sill. With the comparatively thin sheet metal used in the sides and roof it is important to avoid unnecessary loading, as it is likely to cause loosening of the joints and working of the rivets

in their holes. With this form of construction the side girders can be made comparatively light as they sustain little transverse load and are supported at four points. Side doors required by mail, express or baggage cars can be located where most convenient without requiring any material strengthening in the side truss.

The following table gives the comparative strength and weight of steel and wooden cars:

	Passenger coach		
	Standard, wooden, 53 ft. long.	Heavy type steel, 70 ft. long.	Suburban steel, 54 ft. long.
No. of passengers	62	88	72
Car weight, lbs.	91,000	113,500*	75,000†
Car weight per passenger, lbs.	1,470	1,290	1,042
Area center sill at midle of car, sq. in.	152	50	24.32
Area center sill at center plate or car, sq. in.	152	50	33.32
Stress in center sills, ‡ lbs. per sq. in.	10,850	11,000	18,500
Comparative value of center sills, per cent.	25	100	60

*Estimated weight (including 6,000 lbs. storage battery).
†Estimated weight.
‡Due to 150,000 lbs. compression on draft gear and 250,000 on buffer

An entirely new form of truck was required for the steel cars, owing to the fact that the deep center sill lowered the center plate until it just cleared the middle axle of a six-wheel truck. The new truck is applicable either to motor cars, or cars drawn by locomotives. It is designed to carry a load equivalent to the maximum capacity of the three 5 in. x 9 in. axles, but it weighs only 19,500 lbs., while the wooden truck, which was not as strong, weighed 21,700 lbs. Transoms, spring planks and equalizers are not required, as their functions are covered by other elements.

The drawing shows the construction of the truck. Two principal elements are embodied: the rectangular frame carrying the wheels, and the bolster which transmits the load delivered at the center plate to the axles through the spring rigging.

The axles run in boxes of the usual type which slide vertically in pedestals, secured to the wheel pieces and connected at their bottom ends by pairs of tie bars (sufficient space being allowed between tie bars to permit the use of a jack in removing bearings). Each wheel piece is composed of two 10-in. channels with their flanges turned toward each other, separated to permit certain of the parts to go between them, and secured to one another at intervals.

The two wheel pieces are held together by four pressed steel cross members of channel section, one at each end of the wheel pieces and one on either side of the middle wheels. They are depressed below the bottom of the wheel pieces in order to clear the center sill of the underframe. The bolster is composed of four girders running across the truck, to the top of which are secured two girders running lengthwise. The center plate rests upon the two short transverse girders of pressed steel. The lower flange of these girders is turned up at the ends and the plate riveted to the lower flange is brought up and riveted to the longitudinal girders. Between the girders is riveted a reinforcing casting to transmit the load delivered by the center plate. A horizontal rectangular plate forms the lower flange of both girders and acts as a diaphragm to square the bolster. Spring beams are riveted to the under side of girders and to the rectangular plate which forms their lower flanges. They extend on both sides beneath the wheel pieces and are confined between guides, which allow only vertical and transverse motion of the bolster with reference to the truck frame. The spring beams are of sufficient width to admit between their downwardly projecting legs four elliptical springs.

The entire load borne by the truck is delivered by its bolster to 16 elliptical springs which rest upon equalizers having ratio of 2 to 1. The equalizers are suspended from hangers, which deliver to each box of the middle axle one-sixth of the entire load borne by the truck and to each wheel piece one-third of the entire load borne by the truck. This load is delivered to the wheel piece at two points near the outside pedestals so that each box of the outside axles receives one-sixth of the entire load borne by the truck. Each box receives its load through a nest of three helical springs, which in the case of the end axles, bear upon castings secured to the wheel pieces, and in the case of the middle axle, bear upon short equalizers connected to hangers. The boxes of the middle axle, therefore, move up and down freely and without any connection or relation to the wheel pieces.

Side motion of the bolster relative to the wheel pieces, provided for by the hangers and guides, is limited by the abutments secured to the spring beams. Helical springs, resting upon followers guided by the wheel pieces and engaging these abutments, center the bolster and give easy riding qualities equal to those secured by the link suspension generally used on wooden trucks. The outer abutments also act as side bearings for the car body and engage castings secured to the outside sills.

Most of the parts used in the six-wheel truck also enter into the four-wheel truck, which is similar in principle. As in the case of the six-wheel truck, a considerable saving in weight has been brought about by the change from wood to metal. The steel truck weighs 12,500 lbs. while the wooden truck weighs 16,000 lbs.

The frame of the four-wheel truck is similar to that of the six-wheel except that the wheel pieces are connected by only two cross members instead of four. Consolidation of the two spring beams of the six-wheel truck into one, and elimination of the longitudinal girders and transverse girders, which become unnecessary, produces a simple bolster of channel section reinforced at the middle for the center plate and broad enough to cover six elliptical springs.

The entire load borne by the truck is delivered by its bolster to 12 elliptical springs which rest upon carriers suspended from hangers which are hung from the wheel pieces. No equalizers are necessary as the wheel pieces perform that function. Each axle box receives its load through a nest of three helical springs, which bear upon castings secured to the wheel pieces, in the same way as the outside axles of the six-wheel truck. Side motion of the bolster relative to the wheel pieces is provided in the same manner as in the six-wheel truck. Some of the parts are slightly different in form in order to act as supports for the brake rigging.

In redesigning the six-wheel truck careful consideration was given to the brake rigging, and a system was devised embodying the principle of an independent set of triple brakes for each side of the truck, which apply their braking force to the brake-beams adjacent to the brake heads, thereby avoiding the heavy bending strains usually present in brake-beams. In the brake rigging of the four-wheel truck the principle of an independent set of duplex brakes for each side has been carried out, and brake-beams have been entirely dispensed with by directly suspending the brake heads from hangers attached to the wheel pieces.

It was found that the standard form of drawbar and coupler heretofore used on wooden cars did not allow sufficient side motion of the coupler head in rounding curves. The binding was particularly noticeable upon long cars, and to remedy the defect an entirely new arrangement was devised by means of which a lateral motion of 8 in. each side of the center was secured.

The construction and operation of the coupler are shown in the drawings. The drawbar at its inner end is connected to the draft gear by a pin and at its outer end is connected to the coupler head by another pin. The socket of the coupler head, into which the drawbar enters, is broad enough at its end to allow considerable rotation of the coupler head with reference to the drawbar about the pin.

Pivoted about the outer pin, between the two jaws of the drawbar, are two levers. Their outer ends are pressed apart by a helical spring and engage faces formed by vertical webs of the center sill. The outer edges of these levers engage the inner faces of cavity in the coupler head. The helical spring serves the double purpose of centering the coupler head with reference to the drawbar and also of centering the drawbar with reference to the center sill.

If the coupler head should be rotated about its pivot so that the outer end would move to one side, one lever would be rotated at the same time due to its engagement with the inner face of the coupler head socket. This motion would compress the helical spring, which would tend to restore the coupler head to its central position as soon as the acting force was removed. A movement of the character just described would probably take place in coupling, if the couplers were not in perfect alinement with one another.

In rounding a curve, the drawbar pivots about the inner pin giving its outer end a lateral motion. If the outer end of the drawbar moved to the left the connecting lever due to its engagement with the center sill would rock about the outer pivot toward the center line of the drawbar, thereby compressing the helical spring, which would tend to restore the drawbar to its mid-position as soon as the acting force was removed. During the action just described the other lever would not move with relation to the drawbar, as its lug would engage the small pin on the drawbar due to the thrust exerted by the helical spring.

In the uncoupling device a large amount of side motion given to the coupler head would require considerable slack in a chain connecting with the uncoupling lever upon the platform. To avoid possibility of trouble from this source, bell crank levers coupled by rods have been introduced into the connection with the uncoupling lever. Their form and points of application have been so chosen that any motion of the coupler head will not affect their successful operation.

Because of the large amount of side motion, the coupler heads would interfere with steam and air-pipe valves in their regular position. A yoke has been provided, which slides laterally in bearings, and to which the ends of these pipes are secured. A helical spring maintains this yoke in its central position, and it is moved laterally when the drawbar moves by the sides of the drawbar engaging lugs on the under face of the yoke.

The steel cars will be lighted entirely by electricity, current being furnished by storage battery, trolley connection, axle generators or train generators as the conditions may require. Incandescent lamps will be used for side lights and in the toilet rooms, while in the body of the car special lamps and reflectors will be employed.

Passenger coaches will be equipped with a ventilating system by which, with all windows and doors closed, each passenger will be supplied with 1,000 cu. ft. of fresh air per hour, which is equivalent to a complete change of air in the car every four minutes.

The system employed was developed after careful experiments and has been successfully used in over 1,000 wooden cars. Air is taken in by two hoods situated on diagonally opposite corners of the car roof. From each hood a vertical duct leads down, within the side of the car, to a horizontal duct which runs the entire length of the car, between the floor and the sub-floor next to the side sill. Above the floor of the car, and running its entire length along the sides, are rectangular ducts containing the steam heating pipes. Air entering the hood passes down to the duct beneath and along this to openings into the duct containing the heating pipes. After circulating about the heating pipes and becoming thoroughly warmed it is delivered into the aisle of the car through tubular outlets beneath each seat.

Air is discharged from the car through ventilators in the roof, which are provided with valves to limit the amount of air passing. Movement of the car forces the air into the car under slight pressure, and limiting the discharge maintains the pressure and prevents the entrance of cold air through cracks about the doors and windows. The ventilation system works equally well in either winter or summer, but the warming of so much fresh air requires considerably more steam than would be needed by the usual methods of heating without much if any ventilation.

In suburban cars heated by electricity, it will be impractical to supply sufficient heat to warm the great volume of air required for ventilation, and these cars will, therefore, be ventilated in the usual way, by opening windows or ventilating sash on the roof. As passengers in this class of service usually make trips of comparatively short duration, the means of ventilation supplied will doubtless prove satisfactory.

Foreign Railroad Notes.

The short but costly ship canal across the isthmus of Corinth, which greatly shortens the passage from the Adriatic to the Ionian Sea, has long been bankrupt. It was a de Lesseps undertaking, but vessels refused to use it, and it is not wide enough for the large modern steamers, such as carry grain from the Russian Black Sea ports. The canal was sold under foreclosure of mortgage March 17 and was bought by the National Bank of Greece for $83,420. It cost many millions.

In 1906 the shipments of butter westward over the Siberian Railroad amounted to 52,213 tons, thus averaging 143 tons daily. This was nearly one-half more than in 1905, but only 29 per cent. more than in 1903.

Steel Postal Cars for the Harriman Lines.

In the *Railroad Gazette*, June 22, 1906, we showed drawings of the new standard steel postal car of the Harriman Lines. One of the first cars built to these drawings was recently completed at the Sacramento, Cal., shops of the Southern Pacific. The accompanying illustrations show interior and exterior views of the car, which has the following general dimensions:

Length of body over end sills	60 ft.	2 in.
Width of body over side sills	9 "	9⅜ "
Width at eaves	9 "	10⅛ "
Height from top of rail to eaves	9 "	7¼ "
Height from top of rail to top of roof	13 "	10⅝ "
Distance, center of bolster to end sill	8 "	0 "
Width inside	9 "	5⅝ "
Length inside	60 "	0 "
Height inside	9 "	4⅝ "
Light weight	107,000 lbs.	

The underframe consists of two 12-in., 31.5-lb. I beams spaced 16 in. center to center of webs, and reinforced by two 1½-in. truss rods with a drop of 12 in. at the middle beams. The draft gear is secured to the bottom flanges of these I-beams, which extend from end sill to end sill. The sides of the car below the belt rail form deep plate girders which transmit their load to the center sills at the bolsters and at the heavy needle-beams 10 ft. apart in the middle of the car. The belt rail forming the top flange of the girder is a 2¼-in. x 4-in. x ⅜-in. angle, and the bottom flange or side sill is a ½-in. x 3-in. x 7-in. angle. The web plate or side sheathing is a $^{3}/_{16}$-in. steel plate riveted with buttonhead rivets to the top and bottom flanges and to the side posts which form vertical stiffeners. The continuity of of the side plate is broken by the two side doors. The door openings are framed with heavy angle posts and in addition diagonal braces are carried up on each side from the side sill angle to the plate, in effect forming an A-truss over each door. The upper side sheets are ⅛-in. plate.



Steel Mail Car; Southern Pacific.



Interior of Steel Mail Car; Southern Pacific.

The end framing is made heavy and strong to prevent telescoping. There are four posts on each side of the end door made up of 3½-in. x 6-in. x ⅜-in. angle reinforced with ¾-in. x 3-in. plates and extending from the end sill to the reinforced end plate. The roof is curved and without the usual upper deck. All the framing is of light angles bent to shape, to which are riveted the inside and outside roof sheets $^{1}/_{16}$ in. thick. The inside sheets are flanged to form panels 24 in. wide between carlines. The floor is composed of two layers of corrugated steel separated by a layer of hair felt and covered with monolith.

The car is mounted on six-wheel trucks and lighted by electricity generated from the axle. Cottier ventilators placed radially in the roof provide the necessary ventilation. The other fittings are standard designs.

Master Mechanics' Association Committee Reports.

We give below abstracts of nine of the eleven committee reports presented to American Railway Master Mechanics Association convention this year. The reports of the committees on superheating and widening gage of track on curves will be abstracted in a subsequent issue. With the exception of the report on motor cars, the committee work of the year is uninteresting compared with previous years.

SUBJECTS.

The committee suggests subjects for the noon-hour discussions at the 1907 convention, also subjects for committee work and individual papers, for the 1908 convention as follows:

Topical Discussion.

First day.—Apprenticeship System on the New York Central Lines. To be opened by Mr. C. W. Cross.

Second day.—1. Is it desirable to eliminate water gage glasses on locomotives to enforce the use of gage cocks? To be opened by Mr. F. F. Gaines.

2. Relative merit of outside and inside delivery pipes in connection with locomotive injectors. To be opened by Mr. Strickland L. Kneass.

Third day.—1. The corrugated tube for locomotive service with the view of bringing out the reasons and advantages for its use. To be opened by Mr. G. W. West.

2. What is the best metal for hub liners for driving and engine truck wheels, the best method of applying and the limiting lateral hub play for such wheels before repairs are required? To be opened by Mr. J. F. Dunn.

Committee Reports.

1. Laboratory test of various valve gears being used—Stephenson, Walschaert, Alfree-Hubbell and Young—at Purdue or Altoona, to determine their relative efficiency. R. D. Smith (Chairman), F. H. Clark, W. F. M. Goss.

2. Best system of washing out and refilling locomotive boilers, including blow-off lines, flushing tanks, hot wells and other similar methods and data pertaining to benefits in the way of reducing defects in firebox sheets, staybolts and tubes. H. T. Bentley (Chairman), L. H. Turner, W. R. McKeen.

3. Organization of large railroad shop forces. H. H. Vaughan (Chairman), James Milliken, W. H. Lewis, T. S. Lloyd, A. E. Manchester.

4. A system of accounting for labor and material for railroad repair shops. H. Emerson (Chairman), T. H. Curtis, Le Grand Parish.

5. Handling scrap. H. D. Taylor (Chairman), D. J. Redding, A. Forsyth.

6. The use of castellated nuts for machinery of locomotives with a view of having some standard dimensions established. Committee to be appointed by the Executive Committee.

Individual Papers.

Is it desirable to have uniform specifications and drawings of locomotives covering the most common types and sizes? By G. M. Basford.

Standard definition of the term "engine failure," with a list of locomotive characteristics and the numerous varied conditions of operation on which any definition would need to be predicated, in order to enable comparison to be made. By M. K. Barnum.

Design and strength of crank axles for balanced compound locomotives. By F. J. Cole.

The report is signed by Henry Bartlett (Chairman), J. A. Carney, R. P. C. Sanderson.

MECHANICAL STOKERS.

Since the last convention, trials of the Day-Kincaid, Hayden and Krouse automatic stokers for locomotives have been continued by various railroad companies. The data obtained from these tests are not, as yet, in sufficiently conclusive shape to make it desirable to present same to the Association. One of the larger railroads in the country has prepared designs of two types of experimental stokers, the test of which, it is expected, will be started at an early date. The state of the art is such that the committee can only make a progress report at this time.

The report is signed by Wm. Garstang (Chairman), D. F. Crawford, J. F. Walsh, G. F. Hodgins.

DEVELOPMENT OF MOTOR CARS FOR LIGHT PASSENGER SERVICE.

This report deals simply with the development of the motor car in this country during the past year, and the situation as it exists abroad at this time.

Gasolene Motors—Mechanical Transmissions.

Union Pacific.—This railroad has built nine gasolene motor cars, all of which have direct mechanical drive. The latest design of car is equipped with a 200 h.p. motor, of six cylinders, 10 in. diameter by 12 in. stroke. The total weight of the car is 61,300 lbs., equivalent to practically 300 lbs. weight per 1 h.p. This car has, since last summer, been running regularly between Beatrice and Lincoln, Nebraska. Ten additional cars, similar to this successful model, are being built, as well as a number of trailers to be used in connection with them. Four regular branch line services have been maintained in Kansas and Nebraska, on the Union Pacific, during the severe weather conditions of the past winter, with success. After two years of continuous service, it has been found that the average cost of fuel the year around, taking into consideration both summer and winter conditions, using 72 deg. gasolene, amounts to 3.5 cents per car-mile. As a substitute for gasolene, California distillate has been used in regular service with good results. The distillate is a much cheaper product than gasolene. Some experiments have been conducted, using denatured alcohol as fuel. The results were satisfactory, in fact the motor gives equally as good performance with that fuel as with gasolene.

"Sunny Brook."—A light motor car, recently built at Indianapolis, Ind., for service in Yellowstone Park. This car has a four-cylinder gasolene motor, cylinders 6 by 6 in., the engine developing 50 h.p. at 700 r.p.m. The car is built after the conventional street car design and weighs 30,000 lbs. At full speed the car can attain 35 miles per hour. The transmission is of the mechanical type with three speeds forward and three reverse, with chain drive of the Renold silent chain type.

Gasolene Motors—Electric Transmission.

Strang Cars.—Three Strang cars are in regular operation between Kansas City and Olathe. The first one has been in continuous service for over a year, the second and third cars having been in operation between six and seven months. Other cars of this type are now under construction for use on several steam roads. In the Strang system the generator is direct connected to the motor, forming a self-contained generating unit. Directly from the brushes of the generator, main wires lead to a controller of the series-parallel type. From this controller, wires lead to electric motors hung on the axles of the front trucks according to standard electric railway practice. In multiple with the wires between the generator and controller is connected a small storage battery, and in one of the main wires between the battery and the generator is placed a rheostat, which is used for the purpose of temporarily converting the generator into a motor when starting the engine. The first of the above-mentioned cars weighs 78,000 lbs., and the gasolene consumption has averaged about 0.45 gallons of gasolene per motor car-mile for a mileage of 60,000 miles. The largest car is 52 ft. 9 in. long, weighs 84,000 lbs., and has the following equipment: 100 h.p. gasolene engine, 50 k.w. generator, two 65 h.p. motors and storage battery of 112 cells, with 250 a.h. capacity.

St. Joseph Valley Traction Company.—The motor car used on this road has been in actual daily service for two years. The service of this car consisted in hauling from one to three trailers, three round trips per day, over a road 11½ miles long, making the half trip in 35 minutes with four stops, the heaviest grade being 1½ per cent. The fuel consumption with one trailer was 0.75 gallon per mile. The motor consisted of a four-cylinder, 70 h.p. gas engine direct connected to a 50-k.w., 250-volt generator in parallel with which was connected a battery. Four 50 h.p. motors were used on the trucks. Weight of motor car 70,000 lbs.; trailer 38,000 lbs.

General Electric Company Car.—The car body is of steel, the ends being rounded to decrease wind resistance. The roof is of the Mann type, equipped with globe suction ventilators. The car body is divided into an engine compartment, baggage, smoking, main and toilet compartments, and operating cab at rear end. It has a seating capacity of 40. The equipment consists of an eight-cylinder V construction gasolene motor of 150-175 h.p., direct connected to an 8-pole, commutating pole, 90 k.w. generator with an exciter of 3½ k.w. capacity, for the purpose of exciting the fields of the main generator, and effecting the variable potential control. From the generator, leads are conducted to two 65 h.p. motors, one on each truck of the car. These motors are always connected in parallel, the required torque or speed being obtained by varying the field current of the generator through a specially constructed controller, embodying essentially the required resistance suitably arranged in 15 steps. The gasolene motor is of the four-cycle type, equipped with two separate systems of ignition; one, the high tension using induction coil connected to a four-volt storage battery, the other make-and-break connected to a direct-driven Simms-Bosch low tension magneto. The carbureter is of the single-nozzle hand-compensated type, gasolene being supplied to it by means of a diaphragm pump. Radiators for water cooling are located on the roof of the car. The circulation is by thermo syphon. The gasolene motor is controlled by one lever superimposed over the controller handle. The normal speed of motor is 550 r.p.m. The car is heated by by-passing as much as required of the exhaust gases through pipes approximately in the same position as steam pipes in the standard railroad coach. An acceleration of a mile per hour per second is obtained to approximately 25 to 28 miles per hour. From this point,

acceleration falls off gradually until full speed is attained at approximately 50 to 55 miles per hour. The total weight of the car is 60,000 lbs.

Steam Motors.

Canadian Pacific.—This car was in operation all summer between Montreal and Vaudreuil, a distance of 24 miles, giving a service of three round trips per day, on a regular schedule, allowing one hour for the run out, including 12 stops, and the same on the return trip. It gave fairly good satisfaction to the railroad company. The boiler is of the return tube marine type, carrying 180 lbs. pressure, equipped with superheater coils and a "Morrison" furnace, brick lined; crude oil is used as fuel with a burner of the "Booth" type having 1-in. slot. The cylinders were originally turned out with bushes 10 by 15 in., but after a time the bushes were removed, leaving the cylinders 11 by 15 in. The valves, which are of the piston type, are fitted with "Walschaert" gear. When the car was first put into service, 1.8 imperial gallons of oil were consumed per mile, but as the men gained experience the consumption was reduced to 1.6 imperial gallons per mile; 5,000 gallons of water were evaporated per hour, giving a factor on 1 lb. of oil to 10 lbs. of water. Experiments have recently been made on the testing plant at the Canadian Pacific shops with the same boiler and motor, using ordinary run of mine coal as fuel, instead of oil, with satisfactory results. During a test of 1½ hours, an average steam pressure of 172 lbs. was maintained at a speed of 47½ miles per hour. Total water evaporated, 8,569 lbs.; water evaporated per hour, 5,720 lbs.; total coal consumed, 1,300 lbs.; pounds of water evaporated per pound of coal, 6.6; average temperature of gases in combustion chamber, 952 deg. F.; average temperature of steam at steam chest, 578 deg. F.

Ganz Cars.—Motor cars of this type are being built for four different roads in the United States. All-steel construction is used for the body, which has a seating capacity for 52 passengers. Total weight of car in working order is 70,000 lbs. The boiler or steam generator carries a working pressure of 270 lbs., the steam being superheated; capacity 120 h.p. The steam motor is of the enclosed type with compound cylinders, all moving parts running in oil. It is mounted in the forward truck and drives the rear axle thereof through one set of gears. This car is designed to maintain a speed of 35 miles per hour on a level track. Average fuel consumption is claimed to be from 10 to 12 lbs. coal per mile.

Foreign Cars.

Numerous English and Continental railroad companies have permanently established rail motor car service in different localities with marked success. A brief description of the motor cars in operation on the principal railroads of England and the Continent is given herewith.

Gasolene Motors—Mechanical Transmission.

German Daimler Car.—Has been used in considerable numbers on some of the smaller German railroads, notably the Wurtemburg State Railway and on the Swiss Federal Railway. It is a small car, having a total length of 33 ft., with a seating capacity of 36. It is equipped with a 30 h.p. Daimler engine of the heavy, slow-speed type, its normal speed being about 550 r.p.m. The motor has four cylinders 5¼ in. diameter by 6¾ in. stroke. It is located in the middle of the car, attached to a subframe upon which the car body is supported by eight elliptic springs, the subframe being carried rigid on the two axles. Power is transmitted from the motor through a leather-faced cone friction clutch, and through a sliding gear transmission (arranged to give four speeds and reverse) to one of the axles. Control levers are provided at each end of the car, by means of which the speed of the motor, or the direction of motion, is controlled from either platform.

Gasolene Motors—Electric Transmission.

North-Eastern Railway.—The power plant consists of a four-cylinder horizontol opposed Wolseley gasolene engine (8½ by 10 in., 85 B.h.p. at 420 r.p.m.) directly connected to a compound wound, separately excited generator, of 55 k.w. capacity, which furnishes current to two 50 h.p. electric motors, of the ordinary railroad type, on the leading truck. The total weight, including 60 gallons of gasolene and about 100 gallons of cooling water, is 35 tons, of which 22 tons are carried on the power truck. These cars are used during the summer season only. Three and one-half car-miles per gallon of gasolene is claimed for them. As this particular type of car has not been perpetuated by the original builders and users, it is safe to assume that it is not entirely satisfactory. The enormous size and weight of the power plant and the space occupied (being about one-third the total length of the car), are undoubtedly the reasons for discontinuing the construction of this design.

Arad & Csanadar Railway.—On the Arad & Csanadar Railway, in Hungary, a number of gasolene electric cars are used, the largest of which has a 70 h.p. gasolene motor direct connected to a 45 k.w. generator, which supplies current to ordinary railroad type motors attached to the two axles. The usual series parallel controller is provided for starting. After the car is once under way, its speed is almost entirely controlled by the throttle of the gas engine. Controlling apparatus is provided at only one end of the car. The car is equipped with air and hand-brakes, air being supplied by a small compressor driven from the outer end of the armature shaft. Jacket water from the motor is passed through coils inside the car for heating during cold weather. When no heat is required the water is passed through a coil of tubes on the roof. The space occupied by the power plant is considerably less in proportion to the length of the car than that of the North-Eastern Railway, although the systems are practically identical in principle. The acceleration of the car is good. Its maximum speed is about 35 miles per hour without trailer. It is claimed that 65 per cent. of the power is delivered at the wheels. Satisfactory results are reported from these cars.

Steam Motors.

Great Western Railway of England.—Sixty of these cars are in service and others are in course of construction. They combine large seating capacity with moderate weight, flexibility of control, reasonable speed and acceleration, reliability, low maintenance and fair operating costs. The boiler is of the vertical, fire-tube type with no superheater, supported directly on the frame of the power truck and serving as a center pin by transmitting the driving effort to the sills of the car through flat springs. It is enclosed within a compartment of the car body (about 14 ft. long), which contains coal bunkers, operating levers, etc. As the car is arranged to run in both directions and controlled from both ends, a stoker is employed in addition to the driver. Aside from attending to the fire, it is his duty to regulate the cut-off when the driver is at the other end of the car, as only brake and throttle connections are provided there. The motor consists of two single-expansion cylinders, 12 by 16 in., coupled direct to the rear driving wheels, which in turn are coupled to the front drivers. Walschaert valve gear is used. The water supply is carried in tanks hung beneath the car body midway between the trucks. The cars are equipped with brakes. A maximum speed of 55 miles per hour can be obtained, although the average running speed is from 30 to 35 miles per hour. The maximum acceleration is about one mile per hour per second.

Taff-Vale Railway.—The Taff-Vale Railway has built a number of cars for its own use and for other railroads, similar in design to the Great Western car, the chief difference being in the construction of the boiler. This is of the fire-tube type and consists practically of two horizontal barrels placed on either side of a central furnace, the hot gases passing horizontally through the fire tubes to a smokebox at the outer ends, and from there through the flues to a central stack. The boiler is placed transversely with reference to the car body and rests directly upon the truck frame back of the forward axle, which is the driving axle. The forward end of the car body is pivoted on the power truck, but does not include a compartment for boiler equipment as in the case of the Great Western. The power truck is self-contained and a cab is provided for the driver similar to that of a small locomotive. The cylinders are placed outside and the valves operated by an ordinary link motion with rocking shaft. This car is capable of running 35 miles per hour on the level and will ascend a 2½ per cent. grade at 20 miles per hour. It can be operated from either end, and all operation, except starting, performed from the guard's compartment. The general dimensions of the latest type of Taff-Vale car are: Over all, length, about 70 ft.; seating capacity, 43; total weight, 42 tons; weight on power truck, 30 tons; cylinders, bore 10½ in., stroke 14 in.; total heating surface of boiler, 465 sq. ft.; grate area, 10 sq. ft.; capacity of water tank, 550 gallons; steam pressure, 180 lbs.; tractive force, 5,292 lbs.; boiler has 232 1⅝-in. tubes.

Lancashire & Yorkshire.—Has cars similar to the Taff-Vale, in that the forward end is pivoted on the power truck. The boiler is of the usual locomotive type with horizontal fire-tubes. This engine is practically a small locomotive with drivers coupled. The following gives the principal engine and boiler dimensions: Heating surface, 509 sq. ft.; grate area, 9.4 sq. ft.; water capacity, 550 gallons; boiler pressure, 180 lbs.; coal, 1 ton; two cylinders, bore 12 in., stroke 16 in.

Ganz System.—Ganz cars are used extensively in Central Europe in three sizes, 35, 50 and 80 h.p. at 260 r.p.m. The boiler is placed in a compartment at the forward end of the car, together with fuel bunker, feed pumps and controlling apparatus. The motor is placed horizontally on the leading truck, and drives the rear axle through spur gears. It is supported in the usual electric railway motor style, one end being swiveled above the axle, and the other supported elastically from the truck frame. The car is controlled from only one end and one man is required to operate it. The boiler consists of four concentric cylinders with headers (held in place by bolts) forming two annular water spaces joined together by means of slightly inclined steel water tubes, 25 mm. outside diameter and 2 mm. thick. Within the inner cylinder is another cylinder of slightly smaller diameter through which the fuel is fed to the grate below, the flame and hot gases passing around the water tubes to the stack. The motors are two-cylinder cross compound. The largest car, 80 h.p., weighs 23 tons, and is capable of climbing 1.6 per cent. grade, with two trailers weighing 12 tons each, at a speed of 25 miles per hour.

Purrey System.—The Paris-Orleans road has 10 cars and 12 power trucks equipped with this system. It has also been used for a number of years on different tramway lines in the city of Paris. The Paris-Orleans cars have a total length of about 60 ft. with a capacity of 30 third-class passengers in three compartments, and 25 first-class passengers in 2½ compartments, and in addition there is a baggage compartment at the forward end 11 ft. 6 in. long. The forward end is pivoted on the power truck, the rear end being carried on a single axle. The total weight of this car is about 35 tons. The power truck which carries the boiler, motor, fuel, water, etc., has a 126-in. wheel base, the rear wheels only being used for driving. The Purrey boiler is tubular, consisting of two drums, the lower one of rectangular section and made of cast-steel, the upper one cylindrical and of cast-iron. The lower drum is divided into three compartments, two of which are provided for water, the third being for superheated steam. The outer and lower compartment is connected with the upper drum by two large return pipes. It is also connected with the intermediate compartment of the same drum by 41 U-shaped tubes. The feed-water entering the lower compartment is thus heated in passing through these tubes, which are in direct contact with the flame. From this point the water rises through a series of U-shaped tubes to the upper drum, and the steam thus formed is returned from the upper drum through a number of similar tubes to the third compartment of the lower drum, from which it is taken to the motor. The steam is highly superheated in these tubes, the average temperature of superheat being from 750 deg. to 900 deg. F. Coke is used for fuel, feeding automatically from a bunker attached to the side of the boiler, the supply being regulated by a vertical sliding door. The motor is a four-cylinder tandem compound, rated at 260 h.p. at 650 r.p.m. Ordinary D-type valves are used, operated through Stephenson link motion. In this design the motor is attached horizontally to the frame of the car and its power transmitted to the rear axle by two toothed chains of similar construction to the Renold and Morse silent type. As a rule, one or two trailers are attached to these cars, the average weight of the train being 50 tons. The fuel consumption of this train is about 21 lbs. of coke per mile. The car is capable of maintaining a speed of about 56 miles per hour. The cost of operation per train-mile is about 7 cents.

Serpollet System.—The Serpollet system differs from the Purrey and Ganz types chiefly in that the boiler is of the flash type, and kerosene is generally used as fuel. A very high degree of superheat is obtained (reaching even 1,200 deg. F.), which, together with the incrustation attending the use of more or less impure water, is conducive to the burning of tubes. The experience of the Paris, Lyons & Mediterranean Ry. with this type of car has been rather unsatisfactory, because of tube troubles, and the Purrey car is now being adopted in its place.

Komarek Car.—This car is used to some extent by the Austrian State Railway and several of its branches. It is manufactured by F. X. Komarek in Vienna. The following type is representative: Car body, total length, 51 ft.; seating capacity, 35; baggage room, 44 by 96 in.; length of boiler and fuel compartment, 10 ft.; weight, empty, 20 tons; coal capacity, 1,100 lbs.; water capacity, 420 gallons; motor, two-cylinder cross-compound, outside cylinders; cylinders, diameter, 10 by 15 in., stroke 16 in. This car is capable of running at a speed of 25 miles per hour on a level while hauling trailers comprising a total of 50 tons. The operating cost is said to be about 5 cents per train-mile (exclusive of the guard's pay) coal costing $3.25 per ton, made up as follows: Coal, $0.0253; oil, .0014; labor, .0046; maintenance, .0011; driver, .016; total, $0.0484.

Conclusion.

That there is a field for the rail motor car cannot be questioned; its breadth at the present period being limited only by the development of the motor-car power equipment. Steam, as a motive power, has always possessed the distinct advantage of flexibility of control as well as reliability. The internal combustion motor within certain defined limits of horse-power sizes has been developed to that stage of excellence where these advantages cannot be said to apply exclusively to the steam engine. With the experimental work that is being conducted in the development of the internal combustion motor using lower cost fuels than gasolene, and with promising results, who can predict the final outcome of the motive power that will be the most satisfactory from all points of view for the rail motor car? It is probable that both types will have their distinctive fields, depending upon the availability of the fuel.

The report is signed by H. F. Ball (Chairman), F. T. Hyndman, W. R. McKeen, Jr., L. R. Johnson, G. W. Wildin.

TIRE SHRINKAGE AND DESIGN OF WHEEL CENTERS.

The committee was asked to consider the subject, "Distortion of Wheel Centers and Tires Out of Round Due to Heavy Counterbalance." This whole question is so involved that it should be made the subject of a separate committee report. A great deal of work has been done in the past investigating the question of flattening of tires other than by sliding, and apart from the flattening action between the spokes which might result from a thin tire in combination with wheel centers having too light sections of spokes and rim, it does not seem to be particularly a matter which need necessarily be discussed with the shrinkage of tires and design of wheel centers. If the suggestions made by the committee in former years are generally adopted for the section of spoke and rim for cast-steel wheel centers, it will result in eliminating any possibility of distortion taking place from the above-named causes, as it will be generally found that wheels made from these suggestions will be much heavier than many designed some years ago.

The committee renews its recommendations made in 1905 and 1906, and suggests that the whole question covered by its previous reports be referred to letter ballot.

The report is signed by F. J. Cole (Chairman), J. E. Muhlfeld, W. A. Nettleton, D. J. Durrell, W. L. Tracy.

PROPER SPACING OF FLUES IN HIGH-PRESSURE BOILERS.

A circular of inquiry was sent out by the committee and answers were received from 32 members. From the answers received, the majority of the members are in favor of wider bridges than are used at the present time, but no one seems to have made any tests regarding the water circulation between flues or the consumption of fuel, so it is impossible to get data bearing upon these important points. One of the members recommends very strongly a special arrangement, as shown in Fig. 1, an arrangement which has been used successfully for a number of years, but no special tests have been made to determine the efficiency as compared with boilers having the common arrangement of flues, although it is claimed it is a great improvement over the present arrangement in general use. To determine the proper spacing of flues, this subject must be considered from the transportation as well as the mechanical standpoint; that is, the engine failures on account of leaky flues, as well as the cost of maintenance and steaming qualities of an engine, must be considered. The committee is of the opinion that wider bridges, from ⅞ in. to 1 in., or even wider, should be recommended, but before determining exactly what size bridges should be used it would be advisable to make a series of tests to determine the water circulation between flues, the coal consumption for boilers with different size bridges, as well as the cost of maintenance in regard to flues. The committee started several tests to determine the above question in regard to water circulation between flues and the coal consumption, and to ascertain if the same size bridges could be used in both large and small boilers without interfering with the steaming qualities of the engine, but they were unable to continue the tests so that positive data could be obtained on account of unavoidable interference of business. The width of bridges and the necessary reduction in flue heating surface can be determined only by a series of tests to ascertain how far we can go without detriment to the efficiency of the boiler, both in regard to steaming qualities and coal consumption, and at the same time obtain the best results in flue maintenance.

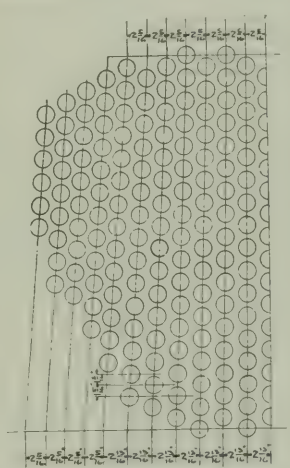


Fig. 1—Flue Spacing in Minneapolis & St. Louis Locomotive Boilers.

The report is signed by C. E. Fuller (Chairman), H. J. Small, T. J. Cole, John Tonge, O. H. Reynolds.

BLANKS FOR REPORTING WORK ON ENGINES UNDERGOING REPAIRS.

Under the present method of making heavy or extensive repairs to engines at one or two main shops, and of making only light or running repairs at the small division shops or terminals, and of running engines out of terminals in either direction in pool service, and where division master mechanics have no regular assignment of engines and, therefore, cannot be held entirely responsible for the condition of engines on their respective divisions, the most important and essential feature in connection with the cost of repairs of locomotives and the results of operation is that of obtaining a correct and accurate report of the condition of engines in service, that they may be sent to the shops best equipped to do the class of repairs which they need, and that the condition of the

engines on the various divisions may be kept consistent with the service required.

In order to assign engines to the shops intelligently, an accurate report of their condition and a comprehensive classification of the repairs required is necessary. The "classification of locomotive repairs recommended by a committee at the last convention, is not well adapted for this purpose. In addition to the classification recommended being complicated, it costs considerable more to make repairs in some cases than in others, though the classification is the same. The most practical and comprehensive classification is the unit classification, based on the estimated cost of repairs, and therefore it is used in connection with the blanks recommended in this report. Under the unit system engines requiring repairs estimated to cost $100 is termed class "1" repairs; $500, class "5" repairs; $800, class "8" repairs; $1,500, class "15" repairs; $3,000, class "30" repairs, etc. Also a more detailed report than the mere classification number (under any system of classification) is necessary in order to intelligently assign engines to the shops for repairs.

In order not to hold engines out of service awaiting room in the main shop, it cannot be left to the discretion of division officials to forward engines to the main shop. They should be assigned to the shops by the head of the Mechanical Department, or one delegated by him to perform this duty. A record of the mileage made by each engine between shoppings and the repairs made to the engines at previous shoppings, as well as accurate reports of the condition of engines and a knowledge of the service required on each division, is essential to intelligently make shop assignments and secure the longest and best possible service at reasonable cost.

The committee recommends the use of the following blanks:

1. Blank showing condition in detail of engines which will require shopping within 30 days. This report is in duplicate form and that part pertaining to the condition of the engine is made by the division master mechanic where the engine is in service and forwarded to the head of the Mechanical Department. The information relative to date, place and class of repairs, and mileage made since last shopping is inserted in the superintendent of motive power's office, and if the shopping is approved the engine is ordered to such shop as best adapted to do the work required and at such time as it can be relieved and space can be assigned it in the shop. The original report will, at that time, be sent to the master mechanic or superintendent of shop to which the engine is assigned for repairs, and the duplicate report filed in the office of the superintendent of motive power as a permanent record. The master mechanic making the report should be held equally responsible with the master mechanic making the repairs for failure to report repairs needed to essential parts, if they are not made.

2. A weekly report to be made by each master mechanic to the head of the Mechanical Department, showing "Engines Turned Out of Shop," with date taken in, date turned out, and class of repairs made; "Engines in Shop," with date taken in, date will probably be turned out, class of repairs, and, if waiting on material, the items, date and number of requisition upon which it is ordered; "Engines Out of Service, Waiting Repairs Account no Room in Shops," with date taken out of service, and class of repairs needed; "Available Track Room in Shop for More Engines," with number of additional engines that can be taken in shop. From these reports a very concise statement can be compiled to be submitted to the heads of the operating department, but a printed form is not desirable for this statement as it can (on account of the varying number of engines in shop) be made on typewriter in more concise form.

3. Blank showing in detail repairs made to the various parts of engines, dates in and out of shop, mileage since last shopping, cost of repairs (with that due to collision and accident shown separately), and other general information which is of interest as a permanent record.

4. Blank showing in detail stay-bolt test and firebox inspection and renewal of stay-bolts. This blank is supplemental to blank 3, and is an essential record which cannot practically be incorporated in blank 3.

5. Blank showing continuous shop record, mileage, cost of repairs of each individual engine. This is a permanent record for use in the superintendent of motive power's office and the information is obtained from reports made on blanks 3, as furnished by the various division master mechanics.

All of the foregoing blanks should be made of loose leaf form, that they may be bound in suitable binders. Blanks 1, 3, 4 and 5 should be bound with engine numbers in consecutive order and each fiscal year in separate volumes. Blank 2 should be bound in order of date.

The report is signed by Theo. H. Curtis (Chairman), E. W. Pratt, C. H. Quereau, F. W. Lane.

HISTORY OF LOCOMOTIVE MOVEMENTS AT TERMINALS.

The committee was instructed to propose a blank form for use at terminals, to give the history of the movement and time of every locomotive from the time of leaving a train until it takes another,

ENGINEMAN'S DAILY REPORT

FOR 24 HOURS, ENDING MIDNIGHT,_____190

DIRECTION (East or West)								
			TIME ARRIVING			TIME DEPARTING		
Train No.	Engine No	Engineer	In Yard	On Ash Pit	In Round-house	Leaving Round-house	Arrived in Yard	Coupled to Train
R	S	T	U	V	W	X	Y	Z

Engineman's Daily Report.

the object being to secure closer co-operation between the mechanical and operating departments. A blank is submitted, which is arranged in such a way as to necessitate co-operation in the record itself by rendering it necessary for each department to fill in the items, the control of which lies in its own hands. In this way each department may become conversant with the delays and the reasons for delays for which both departments are responsible.

It is recommended that the roundhouse and the yard shall use the same form, one for each 24 hours. Both the roundhouse and the yard should make its own entries in duplicate—an original and a carbon copy. Immediately at the close of the day, after midnight, the carbon copies may be exchanged and the record completed on each original copy. If sufficient force is available, the records may be combined or completed by a third party. By such a plan close co-operation may be expected.

THE A, B AND C RAILROAD.

DAILY RECORD OF LOCOMOTIVE MOVEMENTS AT_____TERMINAL.

_____DIVISION,

FOR 24 HOURS, ENDING MIDNIGHT,_____190

	ARRIVING						TO BE READY			DEPARTING						MECHANICAL DELAY		TRANSPORTATION DELAY	
	Train No.	Engine No.	Engineer	Time in Yard	Time on Ash Pit	Time at Round-house	Time Order Rec'd.	Promised	Ready	Ordered For		Left Round-house	Arrived in Yard	Coupled to Train	Departed			H. M.	Cause	H. M.	Cause
										Train No.	Time				Train No.	Time	Engineer				
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q				
Averages																					

Daily Record of Locomotive Movements.

In the blank proposed, columns A to F, inclusive, indicate train and engine numbers, the name of the engineer and the time of arrival at the yard, the ash pit and the roundhouse. If necessary, columns may be added to indicate whether the engine is in freight, passenger, switch or work service; but these are not recommended for use where they are not necessary.

Column G will show the time when orders for engines are received. This information may be important in checking the work of the roundhouse. Column H shows the time engines are promised, and column I when they are actually ready. Columns J and K show the number and leaving time of trains for which engines are ordered. Columns L, M and N show when engines leave the

roundhouse, when they arrive in the yard and when they are coupled to trains. Columns O, P and Q indicate the number and time of the departing train; also the name of the engineer. In the remaining columns the delays, both mechanical and transportation, are indicated together with the reasons therefor.

On roads where clerical force is not available it may be desirable to have enginemen supply information for columns A, B, C, D, E, F, L, M and N. For this purpose a small blank form is presented—merely as a suggestion—as a part of this report. One form may be used for arrival as well as departure. For the arrival record the engineer should fill out columns R, S, T, U, V and W. For departure he should fill out columns R, S, T, X, Y and Z. Upon arriving at the ash pit on an incoming engine he should send the blank to the roundhouse, and upon coupling to an outgoing train he should leave another blank with the yardmaster. This information may then be easily transferred to either the roundhouse or the yard record, depending upon whether the engine is arriving or departing.

The committee submits the record form with the recommendation that it be tried experimentally for a year by as many railroads as possible, with a view of gaining opinions from experience upon which to base further action of the Association, and also suggests the advisability of securing the opinions of operating officials concerning such a blank form. It is also suggested that during periods of congestion an energetic man be placed at each locomotive terminal to follow up locomotive delays by aid of this form.

The blank form recommended herein should be understood as offering means for accelerating movements of locomotives when locomotives are greatly needed. Unless acceleration is especially desired, it seems inadvisable to stimulate action on the part of roundhouse forces to hurry the handling, inspection and, more especially, the repair work when there is ample opportunity to take sufficient time to improve the quality of maintenance and inspection and at the same time economize in the cost by eliminating overtime and other irregular work for which a premium must be paid. The committee does not desire to recommend the continuous use of this blank form, except in cases where it may be necessary to increase the activity of terminal operations. Its occasional use to check locomotive service may, however, be exceedingly valuable.

The tendency toward placing an unnecessary burden by exacting unnecessary conditions from either the transportation or the locomotive department should be discouraged. One purpose of this blank form is to enable each department to help the other. It should not be the desire of either the motive power or the transportation department to show the other department that its own work is done and lies waiting. While such a case frequently brings about the desired result, it is an expensive matter for either department to carry on its work in such a way for the purpose of unnecessarily stimulating action on the part of another department.

The report is signed by G. M. Basford (Chairman), H. M. Carson, C. E. Chambers, T. Rumney, J. E. Muhlfeld.

LOCOMOTIVE LUBRICATION.

The subject is divided into four heads:

1. With reference to high steam pressures and superheated steam.

2. How far may we economize in lubrication, both internal and external?

3. The consideration of standard fittings for lubricators.

4. The consideration of sight-feed lubricators versus pumps for internal lubrication.

At the 1906 convention, the committee reported that for locomotives with steam pressures as high as 225 lbs., or those using superheated steam, the temperature of which is as high as 600 deg. F., the ordinary valve oil had been found by experience to be quite suitable, and the problem is one of delivering the oil in proper quantities to the places needing it. This is possible with the modern sight-feed lubricators now in use.

(a) *Internal lubrication.*—Internal lubrication should not be stinted. Dry valves and dry cylinders mean rapid wear of the surfaces of contact in the steam chest and cylinders, also excessive trouble with the valve motion parts. Aside from the increased machine friction, the performance of the engine is affected. Hard-running valves cause a derangement in steam distribution, and worn packing in valve chambers or at rods causes a loss due to leakage. With the slide-valve locomotive there is not so much danger of these troubles, as the jar of the reverse lever attracts attention to the fact that oil is needed and the engineman will see that the valves are properly lubricated. With piston-valve locomotives the internal lubrication may be much below the required amount without any indication from the reverse lever. The engineer on a slide-valve engine, even on a small allowance of oil, is more apt to keep the valves supplied with enough oil to prevent hard service to the machine, while with piston-valve engines he is not so able to tell that the valves need oil, and no one knows that the parts have been running too dry until trouble comes through heated bearings and worn or broken parts. For internal lubrication, 70 miles per pint for large freight locomotives and 80 miles per pint for large passenger locomotives seems to be the amount needed to lubricate properly. The amount to each class depends upon the speed at which the locomotive is running; in bad water districts the oil allowance should be increased about 25 per cent.

(b) *External lubrication.* The use of grease on crank pins and driving axles offers the best solution of how to decrease the cost of external lubrication and at the same time secure the best results. In reference to the cost of external lubrication as compared with that of four years ago, the cost per square inch lubricated, or per pound carried, is less with the use of hard grease than when oil was in general use.

The committee's recommendations as to standard fittings for locomotives were referred to letter ballot in 1906 and are now standards of the Association.

A well-designed sight-feed lubricator, that has pipe connections suitably arranged so as to deliver the oil in the most direct way to the parts needing it, will under present conditions do the work properly. On superheated locomotives it is generally conceded that there should be one pipe from the lubricator leading direct to the cylinders and attached to separate plugs near the center, so that the oil fed from the lubricator, for the cylinder, may be properly distributed. The question of location of plugs in the steam chest is one point on which there is considerable difference of opinion; one member of the committee, who has had considerable experience with superheated steam, favors putting the steam chest plugs at the end of the valve chest in preference to attaching the oil pipe to the center of the chest and letting the oil be carried by the steam to the parts where needed. The committee as a whole believes that the question of locating steam chest connections is one that can be left open and, therefore, does not make any recommendations.

The report is signed by D. R. MacBain, R. D. Smith, R. F. Kilpatrick, C. Kyle, W. O. Thompson.

RESULTS OF USE OF DIFFERENT VALVE GEARS ON LOCOMOTIVES.

By far the greater number of engines in this country are equipped with the Stephenson link motion. This is probably true also, but in a less degree, in the British Isles, but on the continent of Europe the Walschaert motion leads all others. The Stephenson link motion has held its own in this country, almost without consideration being given to other types, until within very recent years. The types and weights of engines employed lent themselves to convenient use of the link motion which has many desirable and valuable features to commend it. The time came, however, when it became expedient to make changes for the following reasons: Some types of engines have so many wheels or they are so closely grouped that it is a difficult matter for engine men to get under them except when over a pit. This contributes to neglect, lack of prompt adjustments for wear, lack of proper inspection and a more rapid deterioration. With the increase in size and weight, the dimension of eccentrics required for large axles are excessive and their peripheral speed is so great as to make maintenance and lubrication of the eccentrics and straps expensive and troublesome.

By the abolition of eccentrics and straps, a long list of engine failures is eliminated; expense for maintenance and lubrication reduced; room gained for better cross-bracing and strengthening of frames and adding to convenience on account of men not being required to go under engines to the same extent. On heavy engines, the weight of all moving parts of a link motion, from the eccentric straps through to the valves, is so great as to contribute to accident and rapid wear so that an equally efficient valve motion with lighter parts and greater accessibility is in demand for heavy power.

For many reasons, we cannot lower the standard of efficiency as set by the Stephenson link motion. Economy in the use of coal and water are more necessary than a reduction in weight and wear of valve motion parts. No railroad manager will sanction the use of a device, no matter how simple it may be, if his costs as measured in coal are increased thereby. Fortunately, we are able to obtain a valve motion having the desirable features of lighter parts and accessibility without a loss of efficiency in the Walschaert motion, which has come into extensive use the last few years.

The report does not describe the arrangement and detail of these motions, but presents some valve motion diagrams and data furnished by the courtesy of the American Locomotive Company and the Baldwin Locomotive Works, comprising recent examples of both Stephenson link and Walschaert motions. (Not reproduced.—ED.)

The Baldwin Locomotive Works has recently developed a machine which may be quickly attached to an engine for the purpose of obtaining a valve motion diagram. Used in this way, the results obtained show also the effect of spring and of all lost motion in the valve-moving mechanism. Two sets of diagrams drawn by this machine on similar engines, except as to their valve motion, show that the Stephenson motion, with 2.45 in. valve travel, gives about the same results as the Walschaert motion with 2 in. travel. These diagrams clearly show the fact, that, notwithstanding the constant lead of the Walschaert motion, the preadmission is more favorable at short cut-offs than with the Stephenson motion. The

various points of preadmission, port openings, equalization of cut-offs, release and the closures can be as favorably arranged with Walschaert motion as with the link motion examples presented.

The following tables of weights are given for 22-in. consolidation engines built by the Baldwin Locomotive Works, and said to be identical in everything except the valve motion:

	Complete moving and structural parts		Moving parts only.	
	Stephenson.	Walschaert.	Stephenson.	Walschaert.
Crossheads	676	746	676	746
Guide bearer	814	1,116	...	...
Guides	1,712	1,712	...	...
Eccentrics	660	...	660	...
Crank arms	...	250	...	250
Eccentric straps	1,100	...	1,100	...
Main crank pins	520	516	520	516
Links	388	418	388	418
Reverse shaft	625	655	625	655
Rockers and boxes	618	730	618	730
Rocker rods and hangers	169	...	169	...
Link bearing	...	234	...	...
Eccentric rods	184	264	184	264
Valve rods	220	546	220	546
Valve yokes	154	140	154	140
Valve rod guide	24	28	...	...
Complete set	7,354	8,321	4,804	4,265

While the engine with Walschaert motion weighed 1,000 lbs. more than the other one on account of the motion, yet the weight of the moving parts was less. The *American Engineer and Railroad Journal*, June, 1905, published some figures showing saving of weight by the use of Walschaert motion on L. S. & M. S. engines, as follows: 1,283 lbs. on a consolidation, 1,215 lbs. and 1,745 lbs. respectively on two classes of Prairie type engines. These figures indicate a larger saving than the foregoing example, but it is possible that as these were early developments, they may not be representative of present successful practice. Similar valve motion parts on engines abroad are very much lighter than we dare use in our own practice. It seems fair to conclude, therefore, that we may yet look for improvement in this respect.

The matter of lead has received much attention, particularly with link motion, but, as a matter of fact, the measured full gear lead is only used possibly for a few turns of the wheels in starting the engine, and when running notches are in use the lead is entirely different, the amount being dependent upon various conditions. As the running notch leads for best results are within narrow limits, it is apparent that the full gear leads vary within a wide range. The amount of full gear lead is therefore of little importance in the operation of the engine if the running notch lead is right. If these premises are correct, then there can be no argument as against the constant lead characteristics of the Walschaert motion, provided the lead is the proper amount for the running notches. The valve motion diagrams show that all the other events as derived by a link motion can be duplicated by the Walschaert motion so that, except in so far as the lead is concerned, equivalent operation can be obtained; hence, equivalent economies.

The practical operation of Walschaert motion is best shown by the testimony of roads using it in considerable numbers, and at a recent meeting of motive power officers and locomotive builders held to discuss the results of the use of Walschaert motion engines, the roads represented having about 1,000 such engines, it was the unanimous opinion that Walschaert motion was equally well adapted to fast and slow passenger and freight service; that equivalent economies in fuel and water were obtained; that no reductions of tonnage ratings were necessary; that expense of maintenance and repairs were reduced; that inspection and repairs were facilitated; that construction advantages in the way of frame-cross bracing, etc., were increased; that valve adjustments made are maintained and engines kept square much longer on account of the motion being more direct, rigid and positive for the passage of the valve-driving stresses; and that convenience of the enginemen, inspectors and shop men is promoted by the accessibility of the motion.

There are also available for the use of railroads some patented forms of valve motion or systems of steam distribution which are claimed to obtain economies superior to those of the types already mentioned. The Young valve gear has been applied to engines with Stephenson link and later a Walschaert motion having some detail modifications from the regular design has been proposed. The motion acts upon a wrist plate which has connections to two semi-rotary valves, and the effect of the combination produces valve events remarkable on account of absence of preadmission, small amount of lead, quick port opening, large exhaust area and fine equalization of the events. It is claimed, due to these features, that fine performance and superior economies are obtained which more than compensate for the cost of maintenance of additional parts required.

For the past six years, the Allfree-Hubbell designs for improving steam distribution have been under test and the designers have made changes from time to time as to them seemed best. The first design or "geared system," as the designers called it, has been superseded by what is known as the "compression system," which has been in service for several months. This design is supposed to embrace the economic features of the original design with some additions, and, as it now stands, it attempts to produce the following results: late release, late compression, low clearance, balanced compression, reduced cylinder radiation, quick admission and quick release. In the later design an auxiliary valve has been introduced for the control of compression alone, and allows the main valves to be made and set for a desired release with the Stephenson link, Walschaert, or any other motion, all the changes being made in the cylinders and valve alone.

This device has been under test on several roads and from an average of several reports it seems to give about 6 per cent. reduction in fuel consumption and 5 or 6 per cent. increase in train load, and is able to maintain the same or a little more speed than engines of the same size and ordinary design, except the cylinders. There is also a lighter drain on the boiler for steam, but we are unable to express the amount in figures.

In making a study of this system for causes of the results claimed, we find a very late compression, which, according to the argument of the designers, means that the negative working pressure is acting at a time when it produces the least effect on crank pin. In other words, when the crank pin is very near the center, from this point alone, an increased load is possible, not so much from an increased working pressure as from a reduced negative work. In view of the above argument, any given load could be handled with a less amount of steam, which means a less amount of coal and therefore brings the handling of greater load within the possibilities of the boiler. In addition to this, the reduced clearance is claimed to be responsible for a considerable steam economy.

The report is signed by C. A. Seley (Chairman), R. Quayle, L. H. Turner, J. H. Manning.

Exhibits at the Atlantic City Conventions.

The exhibits at this year's conventions of the Master Car Builders and Master Mechanics Associations have again been placed on the Steel Pier. While the number of exhibitors this year is 285 compared with 254 last year the total floor space occupied is considerably less, 55,500 sq. ft. as against 66,350 sq. ft. last year. The erection and decoration of booths and exhibit spaces has been placed in the hands of one contractor and an artistic and uniform scheme has been worked out. In addition to the exhibitors on the Steel Pier the Goodwin Car Co., Hicks Locomotive & Car Works, Modoc Soap Co., and St. Louis Car Co. have track exhibits near the Pennsylvania Railroad station at the foot of Virginia and Mediterranean avenues. A partial list of the exhibits follows and the remainder will be printed in another list next week.

Adams & Westlake Co., Chicago. Adlake acetylene gas car lighting system; railroad lanterns; non-sweating, down-draft signal lamps; car hardware, and gas and electric chandeliers. This company also has an exhibit truck, consisting of a demonstration of the Newbold system of electric car lighting from the axle.

Addressograph Co., Chicago.—The card index "Addressograph," combined addressing machine and complete card index system.

American Balance Valve Co., Jersey Shore, Pa.—Balanced slide and piston valves for pressures up to 250 lbs., including piston valves after two years' night and day service passing over ports without bridges; models of the Walschaert valve gear and of a modified Stevens gear, the latter including an internal admission, double-acting Wilson valve at each end of the cylinder.

American Blower Co., Detroit, Mich.—Blowers, ventilators, motor-driven air compressor.

American Brake Shoe & Foundry Co., Mahwah, N. J.—Steel back, wrought lug brake shoes for locomotives, coaches and freight cars.

American File Sharpener Co., New York.—American file sharpening machine; "Carborlynt" for sharpening files.

American Mason Safety Tread Co., Boston, Mass.—Lead and carborundum safety treads for car steps, stations, etc.

American Steam Gauge & Valve Mfg. Co., Boston, Mass.—Locomotive steam specialties, such as mutfled pop safety valves, steam gages, duplex gages, chime whistles, American dead weight gage tester, American Thompson improved indicator, etc.

American Steel Foundries, Chicago.—Cast-steel locomotive frames; cast-steel driving wheel centers; Simplex brake beam; Simplex driving wheel and coach springs; Simplex car and tender bolsters; cast-steel bolsters; cast-steel side rods and crossheads; Janney cast-steel coupler; the Davis cast-steel car wheel; Susemihl roller-side bearings; Andrews cast-steel side frame; and spring controllers; Kelmont passenger and freight coupler; Leeds pilot coupler and American Steel Foundries Co.'s complete truck mounted in turntable in motion; spring controllers and spring seats.

American Water Softener Co., Philadelphia.—Complete working model of an American water softener.

Anglo-American Varnish Co., Newark, N. J. Varnishes.

Armstrong Brothers Tool Co., Chicago.—Various designs of tool holders, "Universal" ratchet drills, planer jacks, tool posts, lathe dogs and boring tools.

Atha Steel Castings Co., Newark, N. J.—Cast-steel truck bolsters; "Titan" manganese steel motor gears.

Baeder, Adamson & Co., Philadelphia, Pa.—Large model of refrigerator car, showing hair-felt insulation.

Barnett Equipment Co., Newark, N. J.—Demonstration of the Barnett Connector automatically coupling the steam heat, signal and air-brake service and safety hooks (in lieu of safety chains) between cars; also Barnett universal steam hose coupler.

Besly, Chas. H., & Co., Chicago.—Spiral-grooved steel grinding disks; heavy spiral cloth and paper circles; Helmet tempered taps; Helmet babbitt; Helmet oil, and Helmet bronze, spring and sheets.

Best, W. N., American Calorific Co., New York.—Oil furnaces for annealing, brazing, heating, etc.; also oil burners and safety regulator cocks.

Bethlehem Steel Co., South Bethlehem, Pa.—Staybolt iron, high speed steel, special alloy steel, rails, heavy machinery and special structural shapes.

Bettendorf Axle Co., Davenport, Ia.—Bettendorf 40-ton capacity structural steel underframe equipped with Bettendorf all cast-steel trucks and cast-steel center sill ends; I-beam body and truck bolsters of 30, 40 and 50-ton capacity; trucks of 30, 40 and 50-ton capacity; removable journal box truck frame and riveted arch bar truck frames.

Bickford Drill & Tool Co., Cincinnati, Ohio.—Standard plain radial drill in operation with variable speed motor drive.

Birdsboro Foundry & Machine Co., Birdsboro, Pa.—Jackson belt lacing ma-

chine, Wagner universal cold saw machine, Disston's Premier inserted tooth metal saw.

Bliss Electric Car Lighting Co., Milwaukee, Wis. The Bliss constant potential bucker electric train lighting system; Bliss, N. Y. C., constant potential booster system; Bliss, Santa Fe, constant current system; also standard batteries.

Bordo, L. J., Co., Philadelphia, Pa.—Blow-off valves, hydraulic valves and swing joints for locomotive and tender connections, double seated gage cocks.

Bowser, S. F., & Co., Fort Wayne, Ind.—Oil house equipment for railroads and factories; also shop tanks, cabinets, lubricating oil tanks, self-measuring oil tanks, power pumps, etc.

Bradford Draft Gear Co., Chicago.—Four-spring and three-spring draft gears, rocker bottom cars and air-brake connectors.

Brady Brass Co., Jersey City, N. J.—Cyprus bronze locomotive castings and bearings; Cyprus bronze journal bearings; motor bearings for electric railways; babbitt metal solder, brass castings, trolley wheels, battery zincs and phosphor bronze.

Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.—Locomotive guide bar motor driven grinder in operation; emery wheels and motor-driven plain grinder.

Bruen's, A., Sons Co., Elizabethtown, Pa.—Literature describing gravity molding machine.

Buckeye Steel Castings Co., Columbus, Ohio.—Major coupler for freight cars; Ohio passenger coupler; also the Buckeye cast-steel yoke, adapted for any and all kinds of draft gears.

Buda Foundry & Mfg. Co., Chicago.—Buda car replacers; Paulus drill; Buda ball-bearing jacks; Buda ratchet car jacks; Buda lining-up track jacks; Buda improved reinforced tread hand car wheel; Buda drill grinder; car replacing ball-bearing jack.

Buffalo Brake Beam Co., Buffalo, N. Y.—Buffalo brake beams; forged steel brake heads; forged fulcrums; forged chain clips; forged wheel guards, and steel backs for brake shoes.

The Bullard Machine Tool Co., Bridgeport, Conn. A 36-in. vertical turret lathe in operation.

Cardwell Mfg. Co., Chicago. Cardwell friction draft gear and Cardwell rocker side bearings.

Carey, Philip, Mfg. Co., Lockland, Cincinnati, Ohio. Plastic freight car roofing; magnesia flexible cement roofing; locomotive boiler lagging; train pipe covering; roofing paints, and magnesia and asbestos goods of all kinds.

Chicago Car Heating Co., Chicago.—Full-sized models of the vapor system of car heating, in operation; also steam specialties.

Chicago Pneumatic Tool Co., Chicago.—Franklin air compressor; Turbine air drill; Boyer and Keller pneumatic hammers; Boyer, Keller and Little Giant pneumatic drills; improved high-speed Little Giant drills; Duntley air-cooled electric drills; portable and tool post grinders; blowers; hoists; "Magnetic Old Man"; drilling stands; electric compression riveter; Duntley vacuum portable house-cleaning device.

Chicago Railway Equipment Co., Chicago.—The "Monitor" car bolster; National Hollow, Creco, Diamond, Kewanee, Reliance, Monarch, "96," and Sterlingworth brake beams; Creco roller-side bearings, and the "Creco" journal box and lid; also Creco slack adjuster.

Clark, A. C., & Co., Chicago.—Models of Clark mechanical boiler cleaners.

Cleveland Pneumatic Tool Co., Cleveland, Ohio.—Reversible and non-reversible air drills; wood boring machines; pneumatic chipping, calking, beading and riveting hammers; pneumatic drift-bolt drivers; Bowers hose-coupling, and plain and armored air hose.

Cling-Surface Co., Buffalo, N. Y.—Device for demonstrating the difference in efficiency between a belt treated with "Cling-Surface" and running slack as compared to a belt untreated running tight.

Coe Brass Mfg. Co., Ansonia, Conn.—Patent extruded brass in step nosings, step treads and platform bindings; car door, window and eave moldings; architectural and automobile moldings; special shaped bars and rods and extruded metal in various forms to supersede castings.

Coe, W. H., Manufacturing Co., Providence, R. I.—Coe's gilding wheels and ribbon gold leaf; "Hieburnish" bronze powders and bronzing liquid.

Columbia Nut & Bolt Co., Inc., Bridgeport, Conn.—Columbia lock nuts being exhibited by the U. S. Metal & Manufacturing Co., railroad sales agents for the Columbia company.

Comercial Acetylene Co., New York.—Acetylene gas lighting fixtures and apparatus for the storage of acetylene gas in cylinders filled with porous substance and acetone; also acetylene locomotive headlight; locomotive marks; yacht searchlight and portable table lamps; also tank cut open, showing asbestos packing.

Commonwealth Steel Co., St. Louis, Mo.—Models of Transom draft gear for wooden and steel cars; separable body bolster for steel and wooden cars; Davis locomotive wheel; cast steel tender and engine truck; also the tire graph machine.

Consolidated Car Heating Co., Albany, N. Y.—Steam car heating apparatus; automatic steam couplers; automatic traps; heavy valves and fittings; electric heaters; regulating switches, and the McElroy automatic axle lighting system shown in operation.

Consolidated Railway Electric Lighting & Equipment Co., New York.—"Axle Light" system for electric car lighting, showing new type "D" dynamo running at all speeds without variation in current output or voltage, the current and voltage being controlled by the new "Kennedy" regulator.

Curtain Supply Co., Chicago.—Forsyth No. 86 roller tip fixtures; "ring" fixtures; eccentric fixtures; also a full line of curtain materials.

Davis Solid Truss Brake Beam Co., Wilmington, Del.—Brake-beams for freight and high-speed passenger service. A special brake-beam testing machine in operation.

Dearborn Drug & Chemical Works, Chicago.—Boiler compounds; anti-foaming compounds for locomotives; vegetable water treatment for locomotive boilers; and samples of tubes, showing action of alkali.

Detroit Hoist & Machine Co.—Full sized sample of locomotive turn-table pneumatic mule in operation; also geared pneumatic hoists.

Detroit Lubricator Co., Detroit, Mich.—Locomotive lubricators having three, four, five and seven feeds.

Detroit Seamless Steel Tube Co., Detroit, Mich.—Seamless steel locomotive flues and safe ends.

Dickinson, Paul, Inc., Chicago.—Cast-iron engine-house smoke jacks; also cast-iron ventilators and chimneys.

Dill, T. C., Machine Co., Philadelphia, Pa.—15-in. Dill slotting machine with variable speed motor drive in operation.

Dixon, Joseph, Crucible Co., Jersey City, N. J.—Steel structure painted with Dixon silicate graphite paint; graphite lubricants, pencils, foundry facings, greases and crucibles.

Dressel Railway Lamp Works, New York.—Headlights; latest design of train tail-marker lamps and engine signal lamps; gage lamps, engine cab lamps, etc.

G. Drouve Co., The, Bridgeport, Conn.—Examples showing the Lovell window operating device and the "Anti-Fluvius" skylight; also models of different styles of skylights.

Dudgeon, Richard, New York.—Thirty-ton universal jacks of the railroad, plain, claw and independent types; 40-ton universal railroad jack and 60-ton independent pump universal jack; circulars describing the full line of universal jacks.

Duff Mfg. Co., Pittsburg, Pa.—Various types of Barrett and Duff track and car jacks.

Edwards, The O. M., Co., Syracuse, N. Y.—Window fixtures; vestibule trap doors, and tin barrel spring rollers for curtains; samples of metal windows and window sash; also samples of new designs in car windows.

Electric Storage Battery Co., Philadelphia, Pa.—Latest types of "Chloride Accumulator" for car lighting, signal service, etc.; sample of accumulator used in New York Central electric zone sub-stations.

Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio.—Hollow staybolt bars of various diameters in 10-ft. lengths; also samples of raw materials from which the bars are rolled.

Farlow Draft Gear Co., Baltimore, Md.—The Farlow draft gear as applied on cars of the Great Northern and Seaboard Air Line; on Atlantic Coast Line cars in connection with the Westinghouse friction barrel, and another in connection with Sessions friction barrel; twin-spring gear as applied to malleable iron draft sill casting and to channel sills for wooden underframe; also gear cut from a wrecked steel car; also cast-steel end sills with Farlow draft gear slots cast in same.

Flannery Bolt Co., Pittsburg, Pa. The Tate flexible staybolt and special tools for applying the same.

Flexible Compound Co., Philadelphia, Pa. Fabrics, wood and metal covered with "Flexible Compound" and tested in acid; other demonstrations and tests of Flexible Compound mixed with paint and of Flexible Black Enamel.

Foster, The Walter, Company, New York. Lassetter staybolt threading and reducing machine; grinding machines for grinding piston rods, chasers and tools. Landis double head bolt cutter; also exhibiting photographs for the Gisholt Machine Co.

Fox Machine Co., Grand Rapids, Mich.—Fox universal wood trimmers; adjustable saw dado or grooving heads, mitre machines, heavy pipe or flue cutting machines; hand and power feed milling machines; pattern maker's bench with Linnett vise, power core-box machine.

Franklin Mfg. Co., Franklin, Pa.—Corrugated asbestos roofing and sheathing; asbestos building lumber and "Century" shingles; "Ambler" asbestos packing; K. & M. 85 per cent. magnesia locomotive lagging; asbestos packing textiles, pipe covering, roofings and lumber smoke jacks. Furnished the asbestos building lumber for covering Steel Pier.

Franklin Railway Supply Co., Franklin, Pa.—McLaughlin lock nuts, McLaughlin metal flexible conduit, Franklin driving-box lubricator; Franklin pneumatic fire-door openers; Franklin metal ball joint; demonstration of Hill's new method of applying bearing metal to journal boxes.

Frost Railway Supply Co., Detroit, Mich.—The Harvey friction draft spring shown as applied to the Butler, Farlow, Adjustable and Monarch draft gears.

Galena-Signal Oil Co., Franklin, Pa.—Reception booths on pier.

Garlock Packing Co., Palmyra, N. Y.—Full line of fibrous and metallic packings for locomotive and general railroad use.

Garvin Machine Co., New York.—Universal milling machine; vertical spindle milling machine; die slotting machine; automatic tapping machine; motor-driven plain milling machine in operation.

Gold Car Heating & Lighting Co., New York.—Electric, hot water, steam and refrigerator car heating apparatus; acetylene car lighting system.

Goldschmidt Thermit Co., New York.—Samples of steel welded by the Goldschmidt process; also samples of metal and different designs of patterns, molds and flasks used in making welds; also new designs of fire brick molds; demonstrations of welding locomotive frames; samples of chromium, manganese, molydenum, etc.

Green, Tweed & Co., New York.—Palmetto packing and the Favorite reversible wrench and the "Exacto" packing gage and cutter.

Hale & Kilburn Manufacturing Co., The, Philadelphia, Pa.—Full line of car seats for all service, including heavy electric cars; "Neverbreak" pressed steel, "Walkover" seats, all steel and fireproof upholstered seats, reclining and revolving parlor car seats.

Hammet, H. C., Troy, N. Y.—Trojan metallic packing; Sansom pneumatic bell ringer; triple valve bushing roller.

Hammond Typewriter Co., Philadelphia, Pa. Hammond interchangeable type typewriters of various sizes, including a special close space machine for tabulating work, and a "Bichrome" machine writing in two colors.

Hanlon Locomotive Sander Co., Winchester, Mass. Locomotive sand box with Hanlon sander attached.

Hanna Engineering Works, Chicago, Ill.—Two compression yoke rivetters; electric screen shaker; pneumatic screen shaker and models showing rivetter motion.

Harrington, Edwin, Son & Co., Inc., Philadelphia, Pa.—Differential, screw and spur-geared chain hoists; geared and plain travelers and a staybolt threading machine.

Harrison Dust Guard Co., Toledo, Ohio. Harrison dust guard; driving box, cellar and car journal lubricators; driving box cellars; Williams Harrison journal boxes.

Harrison-Williams Co., Toledo, Ohio.—See Harrison Dust Guard Co.

Heath & Milligan Mfg. Co., Chicago.—Reception space.

Helwig Mfg. Co., St. Paul, Minn. Pneumatic staybolt chippers, pneumatic hammers; reversible pneumatic end spindle drill motors; portable pneumatic grinders and self-feeding flue expanders.

Hicks Improved Engine Brake Co., Atlanta, Ga.—Hicks improved engine brake in operation.

Hicks Locomotive & Car Works, Chicago, Ill.—Photographs of works, office, and of cars and locomotives built by the company; also samples of wood used in private cars.

Hilmer, Henry, Sons & Co., Philadelphia, Pa. Various types of plate washers.

Homestead Valve Mfg. Co., Pittsburg, Pa.—Homestead locomotive blow-off valves.

Houghton, E. F., & Co., Philadelphia, Pa.—Hydro carbonated bone black for case hardening; tempering oil; cutting oil; cutting compound; lubricating grease; adhesive belt dressing; oil filter; "Cosmic" counter-corrodent; "Vim" air brake leathers; hydraulic leathers and cylinder oils; "Cosmolubric" engine oils; "Marck" steam trap.

Hunt-Spiller Mfg. Corporation, Boston, Mass.—Hunt-Spiller gun-iron castings for locomotives, such as eccentrics, eccentric-straps, cylinder bushings, cylinder packings, pistons, piston valve packing, piston-valve cages, driving boxes, driving-box shoes and wedges, cross-head shoes and gibbs, superheater headers, gears, etc.

Independent Pneumatic Tool Co., Chicago.—"Thor" pneumatic drills, reaming, tapping, wood boring and flue rolling machines; end spindle corner drill; hammers; turbine wood saws, etc.

Indestructible Fibre Co., Massena, N. Y.—"Fibrite," "Durite" and "Kantlite" car head linings; also indestructible fibre tiling.

Jenkins Brothers, New York.—Complete line of iron and brass valves; also packings and tubings.

Johns-Manville, H. W., Co., New York. "Vitribestos" smoke jacks and pipe covering; Portland sectional conduit; train pipe coverings; asbestos roofings; steam and sheet packings; fire felt, and cement felting; "Vulcabeston packings; 85 per cent. magnesia cement and locomotive lagging; 80 per cent. magnesia train pipe covering; "Asbesto-sponge" felted sectional pipe covering; air pump packings; "Asbesto-metallic" flange gaskets; fire resisting cements; electrical insulating materials; "Noark" fuses; fire extinguishers; refrigerator and producer car insulating materials; "Perolin."

Jaudon, Philip S., & Co., Philadelphia, Pa.—Reliance hydraulic jacks and Justice spike puller.

Kalamazoo Railway Supply Co., Kalamazoo, Mich.—Pressed steel hand and push car wheels; Moore track drills; Root locomotive scraper and dirt; and Kalamazoo ratchet jacks.

Kelly-Arnold Mfg. Co., Inc., Wilkesbarre, Pa.—Automatic air and steam connectors for passenger cars; automatic air connectors for freight cars; automatic device for detaching connector from coupler; auxiliary connections for train hose.

Kent, Edwin R., Co., Chicago.—Allen's "Air-hardening" high-speed tool steel and high-speed twist drills, flat drills, reamers, etc.; also aluminum models of manganese frogs and crossings; also samples of the ingredients used in making this steel.

Keystone Drop Forge Works, Philadelphia, Pa.—Drop forgings for car and locomotive work, including Keystone connecting links, safety shackle hooks.

Keystone Lubricating Co., Philadelphia, Pa.—Keystone lubricating grease in various densities; demonstrations of general engine lubrication and shafting lubrication.

Kinnear Mfg. Co., Columbus, Ohio.—Full size wood rolling roundhouse door and full size steel rolling freight house door.

Landis Tool Co., Waynesboro, Pa.—No. 1½ universal grinding machine with automatic feeds; No. 16 gap grinding machine; also samples of work.

Lang, G. R., Co., Meadville, Pa.—Lang's T bolt heads.

Lawrence Mfg. Co., Philadelphia, Pa.—The Filion folding vestibule trap; "Anti-waste Grabber."

Livezey, John R., Philadelphia, Pa.—Representing the Armstrong Cork Co.,

Pittsburg, and the Norristown Magnesia & Asbestos Co., Norristown, Pa.: Sheet and granulated cork for cool storage work and refrigerators; cork pipe coverings, electric insulation and bearings; models of cold storage construction; asbestos aircell pipe coverings.

Locomotive Stoker Co., The, Chicago.—The W. H. Strouse automatic locomotive stoker.

Lodge & Shipley Machine Tool Co., Cincinnati, Ohio.—No. 24 patent head lathe in operation, driven by variable speed motor.

Lord, Geo. W., Co., Philadelphia, Pa.—Full line of samples of boiler compounds.

McConway & Torley Co., Pittsburg, Pa.: Janney freight couplers; Kelso freight couplers; Pitt freight couplers: Kelso tender couplers; Kelso pilot couplers; Janney passenger car couplers, and Buhoup 3-stem coupler; the Buhoup 3-stem coupler applied to standard steel platform; also Janney "X" freight coupler.

McCord & Co., Chicago.—McCord journal boxes, draft gear, spring dampeners and force feed locomotive lubricators; McKim gaskets.

Mason Regulator Co., Easton, Mass.: Reducing valves for locomotives, stationary and marine engines; regulators, governors, belt shifters and steam pumps.

Merchant & Evans Co., Philadelphia, Pa.—Fire retarding "Star" ventilator; also tin plates, babbitt metals and other special metals for railroad use.

Michigan Lubricator Co., Detroit, Mich.—New type of double, triple, 5- and 7-feed sight feed lubricators, with the sight-feed glasses around the oil reservoir as well as on top; also a new patented automatic drain stem which drains the water from the lubricator and closes automatically, thus avoiding the loss of oil.

Nathan Mfg. Co., New York.—Monitor, Simplex and new Nathan injectors, both lifting and non-lifting; "Bullseye" and "1899" lubricators, 2, 3 and 6 feeds; reversible stop boiler check valve; "Phillips" double-safety boiler check; Coale muffler and safety valve; Klinger reflex water gage; other locomotive fittings, including whistles, strainers, cocks, valves, etc.

National Brake & Electric Co., Chicago.—Portable motor-driven air compressor, on steel frame truck, in operation; sectional motor-driven air compressor; engineer's valve; emergency valve; also oil pneumatic governor.

National Lock Washer Co., Newark, N. J.—Full line of samples of nut locks; full size models showing operation of curtain fixtures, car curtains, sash locks, sash balances and window fixtures.

National Patent Holding Co., Chicago.—National hot water boiler washing and filling system; White sectional boltless piston head; Atlas frictionless center and side bearings; National safety boiler plate clamps; samples of case hardening done by National case hardening compound.

Newman Clock Co., Chicago.—Samples of Newman watchman's clocks.

New York Air Brake Co., New York.—Forsyth automatic connector in operation.

New York Flexible Metallic Hose & Tubing Co., New York.—Flexible metallic hose for air-brakes, car heating, pneumatic tools, shop use, water, gas, fuel, oil, etc; flexible armored lead pipe; expansion joints: "Sirocco" apparatus for blowing out boiler flues; "B&B" Balata belting; "Steuerrad" packing; "Nyflexmet" flexible metallic dredging sleeves.

Norton, A. O.—Boston, Mass.—Full line of Norton ball-bearing jacks.

Norton Co., Worcester, Mass.—Alundum grinding wheels and specialties, including Alundum grain for polishing; India oil stones.

Norton Grinding Co., Worcester, Mass.—Car wheel grinder in operation, with indicators showing variation from true as the work is being done; also a grinding machine for piston rods and axles.

Norvell Shapleigh Hardware Co., St. Louis, Mo.—"Diamond Edge" tools, including axes, saws, augers, files; also line of shovels and scoops, showing evolution of "One-piece" Conqueror shovel.

Ohio Brass Co., Mansfield, Ohio.—Tomlinson automatic radial car coupler; Nichols-Lintern supplementary sander valve; Lintern car signal system in operation.

Pantasote Co., New York.—Pantasote car curtains and seat fabrics.

Parker Anti-Freezing and Hot Water System, London, Ont.—The Parker system of car heating.

Pels, Henry, & Co., New York.—No. 4 hand power punch; bar shear; beam shear; plate shear.

Penn Steel Casting & Machine Co., Chester, Pa.—Cast-steel locomotive cylinder, subjected to a ballistic test; high pressure valves tested hydrostatically, and other steel castings.

Perry Side Bearing Co., Chicago.—Perry roller side bearings; also bearings after four years' service.

Phillips, F. R., Sons & Co., Philadelphia, Pa.—Laffitte welding plates; brazing, tempering and welding powders; "Velos" high speed twist drills and steel.

Pilling Air Engine Co., Detroit.—See Detroit Hoist & Machine Co.

Pittsburg Automatic Vise & Tool Co., Pittsburg, Pa.—A 650 lb. double swivel solid rear jaw vise and a 725 lb. double swivel back jaw vise, each with 15 in. opening; also a variety of vises for woodworkers, pipe fitters, heavy railroad shop use, automobiles, etc.

Pittsburg Equipment Co., Pittsburg, Pa.—Cast steel side frame for deep truss bolster; cast steel column casting; cast steel interlocking spring plank; built-up rolled steel and cast steel truck bolster; twisted cast steel spindle broken in service; models of cast steel combined body bolster and draft carrier and of a three-piece cast steel side frame; perspective drawing of Hennessey cast steel body bolster for steel underframe cars.

Ralston Steel Car Co., Columbus, Ohio.—Model of steel underframe; also model of steel drop bottom dump car.

Refined Iron & Steel Co., Pittsburg, Pa.—Samples of iron showing heat and cold tests and fractures.

Republic Railway Appliance Co., St. Louis.—Republic friction draft-gear.

Restein, Clement, Co., Philadelphia, Pa.—Packings, including Belmont locomotive throttle and air pump packings; air pump tank hose and Belmont steam hose.

Rockwell Engineering Co., New York.—Oil furnaces for railroad shop use, including furnaces for bolt and rivet heating, flue welding, brass melting, forging, etc.

Rutherford Automatic Connector Co., Chicago.—Full size sample in operation of Rutherford automatic air, steam, and air signal connector.

Rund Mfg. Co., Pittsburg, Pa.—Automatic gas water heaters and storage heaters.

Ryerson, Jos. T., & Son, Chicago.—Lennox beveling shear in operation; Simplex track and car jacks; Ryerson's portable key-seating machine; model of Ryerson's flue-cleaning machine; Cleveland vertical solid frame punch; working model of Continental boiler with Morison corrugated furnaces.

Safety Car Heating & Lighting Co., New York.—"Standard" system of steam heating. Models showing the system as applied to passenger cars; also various parts of the apparatus cut out to show construction. Safety steam coupling; also has an exhibit of modern lamps for car lighting, including four-flame lamps, new types of Pintsch mantle lamps and electric fixtures and storm-proof lanterns for buoy and beacon lighting.

Schoen Steel Wheel Co., Pittsburg, Pa.—Pressed and rolled steel wheels, showing the various stages of manufacture.

Schutte & Koerting Co., Philadelphia, Pa.—Injectors and injector regulating attachment; hand test pumps, syphons, automatic eductor and variety of valves.

Sellers, William, & Co., Philadelphia, Pa.—Non-lifting injector and attachments operating under steam; lifting injectors; check valves and locomotive feed-water strainer.

Shelby Steel Tube Co., Pittsburg, Pa.—Seamless steel tubing for locomotive flues and for link bushings; seamless steel locomotive bells.

Sherwin-Williams Co., Cleveland, Ohio.—Samples railroad paints, varnishes, shingle stains and paint pigments; photographs showing railroad buildings, cars and locomotives covered with Sherwin Williams paints and varnishes.

Sprague Electric Co., New York.—Flexible steel armored hose for air brakes, car heating, signal line and pneumatic tool service.

Standard Metal Mfg. Co., Chicago.—S. T. B. car journal bearings; pig filling for old shell.

Standard Paint Co., New York.—Model of building covered with Ruberoid roofing. Ruberoid roofing for railroad cars and locomotive cabs; Giant insulating papers; P. & B. and S. P. C. insulation, and Ruberoid permanent colored roofing; flexible metal preservative paints and P. & B. insulating varnishes baking and air-drying.

Standard Steel Works, Philadelphia, Pa.—Forged and steel-tired wheels.

Stover Foundry & Mfg. Co., Myerstown, Pa.—Motor-driven pipe threading and cutting-off machine; automatic pipe bending machine.

Storrs Mica Co., Owego, N. Y.—Reception space.

Stowell Mfg. & Foundry Co., South Milwaukee, Wis.—Wilbern adjustable door hanger and Wilbern patent track for same.

Symington, The T. H., Co., Baltimore, Md.—Journal boxes for passenger, freight and electric equipment; Baltimore ball-bearing center plates and side bearings for railroad cars; testing and machining methods.

Tate, Jones & Co., Pittsburg, Pa.—"Kirkwood" combination fuel oil burners for furnaces, portable oil rivet furnaces and various appliances using fuel oil in railroad shops.

Trojan Car Coupler Co., New York.—The Junior coupler.

Underwood, H. B., & Co., Philadelphia, Pa.—Portable cylinder boring bar and portable 2-cylinder steam or air motor for driving same; portable rotary valve seat planing machine.

Union Spring & Manufacturing Co., Pittsburg, Pa.—Springs for locomotives and passenger, street and interurban cars; also springs for governors, frogs and switches and other uses.

U. S. Metal & Mfg. Co., New York.—The Columbia nut lock; Victor cast-steel car replacers; "Perfect" cast-steel car replacers; Cliff and Guilbert automatic hose reel; the Western malleable iron brake jaw; "Almeti" lumber stake; "Ideal" draw-bar centering device and the Hoyt flush car door; also a track exhibit of a car equipped with most of these specialties.

Wagenhorst, J. H., Co., Youngstown, Ohio.—Electric blue printing apparatus in operation.

Walworth Mfg. Co., Boston, Mass.—Stillson pipe wrench; Smith friction drills; "Neverstick" blow-off cock; Walworth pipe and millers' ratchet stocks and dies; general line of small tools for shop work.

Watson-Stillman Co., New York.—Hydraulic jacks, crank pin presses, wheel presses and rail benders.

Watters, J. H., Augusta, Ga.—Pneumatic track sander, working in glass case, showing action of the jet inside the sand box.

Wells Light Mfg. Co., New York.—Three sizes of the Wells light; Wells standard oil gas lamp; Wallwork's patent universal electric lamp brackets.

West Disinfecting Co., New York.—Disinfectants for all purposes and apparatus for applying the same.

Western Tool & Mfg. Co., Springfield, Ohio.—Full line of tool holders and Champion expanding mandrels; also portable stands, polishing wheels, Champion adjustable reamers and Lutz scrapers, scraper holders, file handles, etc.

Western Tube Co., Kewanee, Ill.—Kewanee union and high-duty metal valves; malleable cast iron and brass fittings; iron body valves and cocks.

Westinghouse Companies, Pittsburg, Pa.—New 8¼-in. cross-compound steam-driven air pump; Westinghouse friction draft gear; Westinghouse type "K-1" and "K-2" triple valves shown in section; also No. 5 distributing valve used in connection with new "ET" equipment; American Brake Co.'s automatic slack adjuster for passenger equipment; model of engine truck fitted with equalized brake and slack adjuster; also model of locomotive driver equalized brake gear; Westinghouse Automatic Air & Steam Coupler Co.'s automatic air and steam couplers applied to freight and passenger equipment (shown in model cars); Westinghouse Electric & Mfg. Co.'s enclosed type multiple d. c. arc lamps and the Cooper-Hewitt mercury vapor lamps; Nernst lamps for alternating current; also various types of a. c. and d. c. fan motors; a ten h. p. variable speed d. c. motor fitted with Prony brake, its operation under various methods of control shown on graphic recording ammeter; Westinghouse Machine Co.'s 20-ton shop truck standard gage motor driven, and various types of storage batteries.

Westmoreland Coal Co., Philadelphia, Pa.—Reproduction of a room in coal mine, with electric mining machine in operation.

Wheel-Truing Brake Co., Detroit, Mich.—A brake shoe fitted with an abrasive for truing and dressing flat and worn wheels.

White Enamel Refrigerator Co., St. Paul, Minn.—"Bohn" syphon system of refrigeration.

Wilmarth & Morman Co., Grand Rapids, Mich.—New Yankee drill grinders; style "D" electrical grinders.

Yale & Towne Mfg. Co., New York.—Three types of chain blocks, including triplex, duplex and differential hoists. Also electric hoists and overhead trolleys. A large assortment of locks, including Yale locks, cabinet locks and padlocks. A full line of builders' and car hardware and Blount door checks; also burglar-proof time lock.

An Adding Machine Attachment.

W. R. Gaither, Auditor of the South Chicago City Railway, Chicago, has invented an attachment for adding machines which it is claimed will increase considerably the range of usefulness of such machines. Heretofore, when an adding machine has been used in connection with pay-rolls, material accounts, car mileage, tonnage, sales and other statistics it was merely for ease and accuracy in totaling such figures after they had been posted by hand in the ordinary way. It necessitated about the same amount of delay in closing up such accounts as mental computation would have required. The inventor of the attachment referred to has shown that it is capable of an application to work of this nature which not only eliminates all mental addition, but also does away with the delay caused by the work of totaling as well.

As an illustration, take a pay-roll of 1,000 men, whether paid by the ton or hour or other basis; or a list of mileage to be credited to each of 1,000 cars. Instead of first posting this in records from day to day and leaving the totaling to be done at the end of the month or other period, the machine is arranged to receive a roll of paper, adapted to reel back and forth for daily entries, on which the time for each day is credited to the employee, and in addition thereto his accrued time is constantly brought up to date by use of the machine in making the registration. The result is a printed record of the time and also of the totals. At the end of the period the work of posting and totaling is complete just as soon as the last day's work is entered. The advantage of this to all concerned is obvious. It is especially helpful on tonnage and mileage statistics where the figures are large and tedious to post and add. It is expected that this invention will tend to relieve the stress which has been considered one of the necessary evils when closing monthly accounts in large offices.

This device can be seen in operation at the office of the Burroughs Adding Machine Co., Majestic Building, Chicago. The inventor's address is 6220 Lexington avenue, Chicago.

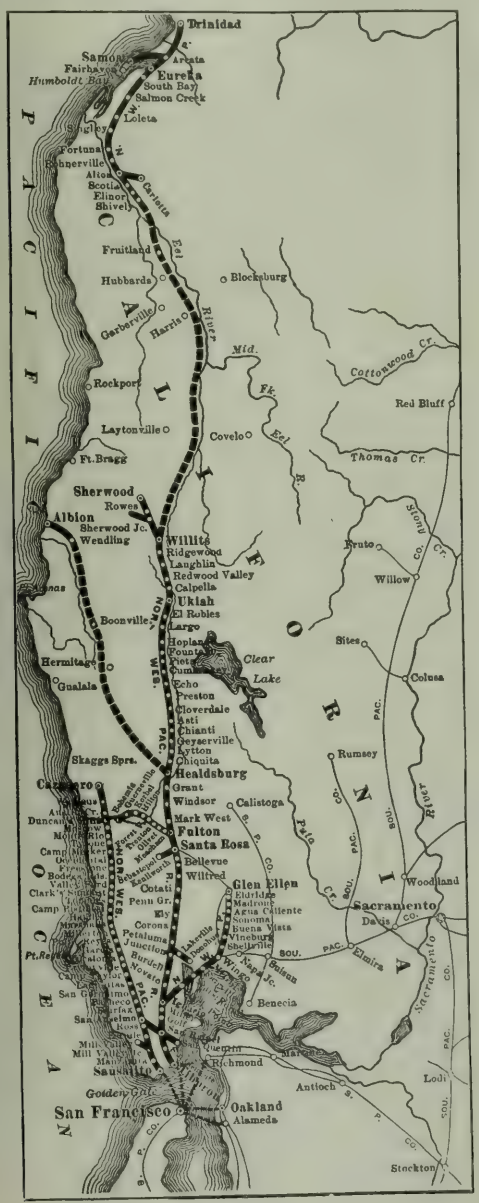
The Northwestern Pacific Railroad.

The Northwestern Pacific Railroad is a company which was organized in December, 1906, by the Southern Pacific and the Atchison, Topeka & Santa Fe to control in their joint interest certain railroads owned by them in northern California between the Southern Pacific's main line to Portland and the coast. In 1902 the Santa Fe bought the Eel River & Eureka Railroad and also a connecting road owned by the Pacific Lumber Company, in all 42 miles of line extending from Eureka into vast redwood forests. At the same time the California & Northern Railway, a nine-mile line from Eureka north to Arcata, was bought. These properties were taken over by the San Francisco & Northwestern, which was owned by the Atchison, Topeka & Santa Fe through the Santa Fe Land Improvement Company. These railroads were in a territory untouched by the Santa Fe lines and over 200 miles distant from them at the nearest point, Oakland. It was announced that the road would ultimately be extended southward to San Francisco bay or to a connection with some existing road over which the main line of the Santa Fe could be reached. The reasons for the purchase were given as follows in the annual report of the Santa Fe for 1903:

"Aside from the pine forests of Texas, Arkansas and Louisiana, the lumber supply of the United States now comes, and must continue to come, from the Pacific coast. Investigation of the subject led your directors to the conclusion that your lines should obtain access to the redwood forests of Northern California, embracing in the counties of Del Norte, Humboldt and Mendocino about 50,000,000,000 ft. The redwood lumber industry is now largely centered around Eureka, which city also possesses the only satisfactory harbor between San Francisco and Portland. . . . It is believed that these lines will not only be self-sustaining, but that they will contribute a large profitable tonnage to your existing lines."

In the territory immediately north of San Francisco bay near the coast were several roads owned by the Southern Pacific, the longest being the California Northwestern, which runs about 150 miles north from San Francisco bay. The Southern Pacific and the Santa Fe each deemed it to their advantage to consolidate these properties in one corporation through which extensions should be built so as to connect the separated lines of the two companies into a through line from San Francisco bay north to the lumber district about Eureka. This was done by the formation of the Northwestern Pacific Railroad, control of which is held by the Southern Pacific and the Santa Fe in alternate years. It will be observed that the roads originally owned by these two companies are not parallel lines.

The Northwestern Pacific is the successor of the Eureka & Klamath River (Oregon & Eureka), the San Francisco & North Pacific, the California North-western, the San Francisco & Northwestern, the Fort Bragg & Southeastern and the North Shore Railroads. The California North-western, the former Southern Pacific line, leases the San Francisco & North Pacific and has a main line from Tiburon, Cal., from which point ferry connection is made with San Francisco, north to Sherwood, 145 miles, and branches aggregating 57 miles. The Eureka & Klamath River operates 27 miles of road from Eureka to Camp 13, with 10 miles of logging spurs. Previous to the consolidation it was an independent property. The former Santa Fe line, the San Francisco & Northwestern, with a total of 50 miles of road, is to build an extension south about 100 miles to the California North-western at Willits, completing a through line of about 270 miles for the joint use of the Southern Pacific and the Atchison, Topeka & Santa Fe from San Francisco north to Eureka. The North Shore operates about 80 miles of road from Sausalito north to Cazadero, paralleling the California Northwestern on the west. The Fort Bragg & Southeastern is a short road now in operation from Albion, which is on the coast southeast to Wendling. An extension of this line is projected southeast to Healdsburg on the California North-western.



Northwestern Pacific Railroad.

President Mellen on the Boston & Maine Purchase.

The following correspondence between Governor Guild, of Massachusetts, and President Mellen, of the New York, New Haven & Hartford, in regard to the acquisition for the New Haven of the Boston & Maine, is notable for the action taken by the state executive and for the full discussion of the effects of the merger by the railroad president.

On June 4, Governor Guild wrote to President Mellen as follows:

"Undisputed but unofficial statements in regard to a proposed combination between the New York, New Haven & Hartford Railroad system and the Boston & Maine Railroad have become so general that it seems to me highly desirable in the public interest that any official statements concerning the methods that have been or are to be pursued in effecting such consolidation should be made to the responsible representatives of the commonwealth.

"I feel sure that you will have no objection to sending me such information at your earliest convenience, together with any statement you may care to make in regard to the future development of transportation, commerce and industry in Massachusetts."

Under the same date President Mellen replied as follows:

"Dear Sir: In answer to your favor of even date, let me say: Interests identified with my company have acquired a large stock interest in the Boston & Maine Railroad and have entered into an agreement to acquire such additional stock as may desire to avail of the terms within a reasonable time in the future. The basis of such acquisition made and proposed has been the exchange of shares of the two companies share for share, with a commission to be paid by Boston & Maine shareholders of 75 cents per share, a similar commission being paid by the purchasers.

"While no shares of Boston & Maine stock are held by my company and it has not been proposed any shall be, still it is unquestionably true the purchases are made and held for its account in the hope and belief that an ultimate union of the two properties will be permitted, and when the results of a common control are made manifest it is believed the benefits will so appeal to the interests of the commonwealth as to warrant a consolidation of the two properties into one, under such restrictions and regula-

tions, of course, as may seem necessary and desirable to safeguard all interests.

"Until the authority of the commonwealth is obtained, no change can be made in the status of the Boston & Maine Railroad; none is proposed—nor is there desire that any shall be. The company will be handled by its board of directors, who will elect its own officers, who will administer the property in its own interest, performing its duties and fulfilling all its obligations to the public and its stockholders in the future as in the past.

"The purchase of the shares of Boston & Maine stock referred to was made not as a result of the desire for aggrandizement on the part of the interests dominant in our company, but that they should not have been sold elsewhere, as would have otherwise been the result, and which might have been most detrimental, we believe, not only to the interests of our company but, as we conceive, of those of the commonwealth as well.

"No stock has been or will be issued in connection with this purchase against which a charge of stock watering or inflation can lie, for every share of New Haven stock issued will represent a share of Boston & Maine retired, and no capital will be outstanding on which dividends must be paid more than at the present time.

"No reduction of facilities is permissible in the view of an intelligent management of a public corporation—one that has favors to ask of the commonwealth to successfully carry out its plans—but rather that increased facilities shall be given that an increased business may result and a better net return be available; for increased development has invariably followed an increase of facilities and reduction in rates, in our experience, in a highly developed and congested territory like that served by the Boston & Maine lines.

"It is our confident belief an increased service without transfer through the Connecticut Valley through the union of these properties under a common control and ultimately by consolidation, will result in the development of a largely increased revenue through the greater convenience available. Similarly a through service by way of Worcester and Nashua through the Merrimac valley cannot fail to benefit materially the public, with resulting advantage to the revenue of the railroad. A through service to and from the state of Maine offers possibilities for revenue not to be lightly considered—possibilities so large, with such a field for exploitation so near at hand, it seems little doubt should be expressed of the result.

"It is possible through this common control to bring the roads in Boston all into a union station with resulting convenience to the traveling public and economy to the railroads. It is also possible with the great amount of contributive business under a common control to compel such consideration of Boston's position that the differentials under which its merchants have so long suffered shall no longer discriminate against its importance in the commercial world.

"Having no possibility of becoming a trunk line to and from New York and the West, the whole influence of our company must be exerted upon the attraction of the largest amount of business to and from Boston as against any other port, and the economy in concentration of the terminals must of necessity interest the company in the development of the property of the commonwealth in South Boston for this purpose, thus making possible for the first time a realization of the plans of those who projected that improvement.

"Nothing our company could do could place it under greater bonds to do all that was in its power to develop to the utmost anything and everything that will tend to promote the business of Boston and New England. If they cease to grow and prosper we shall wither and die—we cannot prosper in a community alone—we must share your burdens as well as your prosperity. It is unworthy of discussion—the fear of misuse of power if this combination be permitted. Why should this old commonwealth fear any artificial creation of its own or of a neighboring state transacting business within its borders by its permission? What matters it who owns the shares of your corporations? The corporations still exist and are subject to your laws and your control. They cannot move away or avoid service or evade their obligations if your officials do their duty. The power to control, to regulate is unquestionable—the creature cannot become greater than or independent of its creator. The company I represent recognizes fully its obligations to the public, desires to be a law abiding citizen of your commonwealth, is trying to perform all its duties efficiently and to your satisfaction, and believes it is in position to do more for the commercial interests of your commonwealth at the present time than was ever possible before, and seeks to do it in such a way as to merit your approbation and be recognized as your most efficient public servant."

The production of coal in the German Empire for the first quarter of this year was 65,164,000 tons, which is 1¾ per cent. more than last year; meanwhile the exports were 6½ per cent. less and the imports 13½ per cent. more than last year; so that the home consumption of coal increased 3½ per cent., indicating that the industrial activity, never equalled theretofore, is fully maintained.

Recent Developments in Air Brake Control Apparatus.

BY F. H. PARKE AND S. W. DUDLEY.

(*Concluded from page* 808.)

The features considered in the previous article, which were so successfully incorporated in valves intended particularly for traction service, afforded at the same time a means for securing certain results which had long been desired, but heretofore never obtained in stead road operation. It is evident that the quick action valves

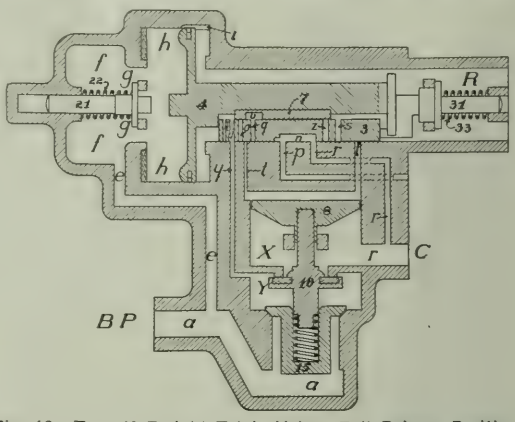


Fig. 10—Type K Freight Triple Valve; Full Release Position.

which have been referred to can be applied with equal success to steam road equipments. In handling freight trains particularly, the quick service feature is of especial advantage. It enables the brakes to be applied by a service reduction from the head to the rear end of a train of any length at a more rapid rate than the slack could run in, thus preventing the disastrous results often arising from that source.

For a similar reason, it had long been desired to effect as nearly as possible a simultaneous release of all the brakes in the train, so as to prevent the running out of the slack from the head end which, when releasing the brakes on a train of any considerable length at slow speeds, is often the cause of such severe strains on the draft gear as to part the train. To explain how this may happen, suppose the brakes to have been applied and the speed of the train reduced to five miles per hour. If a release is then made, without coming to a full stop, the brakes on the forward cars release first, allowing these to pull away from those farther back, on which the brakes still remain applied.

As is well known, it is impossible to force the air back through the brake pipe, when making a release, either in amount or at a pressure sufficient to effect the release at the rear of a long train until some time after the brakes at the head end are fully released. This is due not only to the friction in the pipe, but also to the fact that the air necessary to accomplish the desired result is being to some extent absorbed by the recharging of the auxiliary reservoirs all along the line. Consequently, the pressure at the head end of the train which is more than ample to release and fully recharge, falls rapidly as the distance from the front end increases, until,

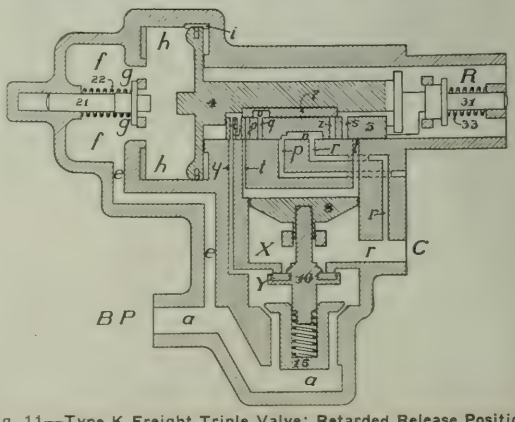


Fig. 11—Type K Freight Triple Valve; Retarded Release Position.

after about the fortieth car, it is almost impossible to raise the brake-pipe pressure fast enough to secure the desired rapidity of release and recharge.

This condition, however, was made use of in an ingenious manner to practically reverse these effects, which before had been unavoidable. Under ordinary conditions of service, an increase of a pound or two pressure on the face of the triple-valve piston is required to move it. A much greater difference than this is obtained at the head end of the train, and this difference rapidly decreases as the distance from the source of supply to the brake

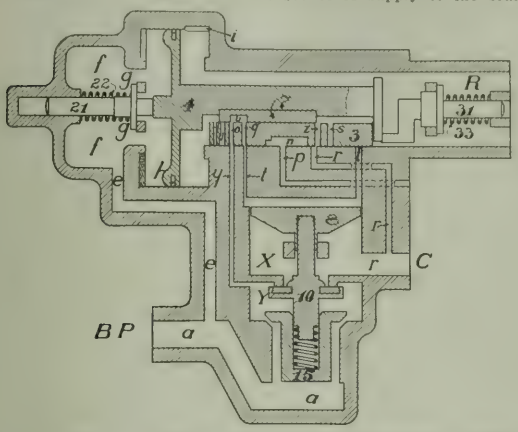


Fig. 12—Type K Freight Triple Valve; Quick-Service Position.

pipe is increased. If this greater difference of pressure which is unavoidable at the head end of the train can be utilized to cause the operating parts of the triple valve to move so as to restrict both the release of the brake-cylinder pressure and the recharging of the auxiliary reservoir, evidently the release of the brakes on the forward part of the train will be delayed, and the air forced to flow more promptly and at a higher pressure toward the rear and effect a more uniform release and recharge. In this way the brakes on the train as a whole can be released almost simultaneously.

FREIGHT TRIPLE VALVES.

Fig. 10 shows the new freight triple valve, a simple modification of the standard type, which carries this principle into effect. The modification consists chiefly in the addition of what is called the retarding-device spring and stem, shown under the letter R. When the brake-pipe pressure is raised gradually, creating only a slight increase in pressure on the brake-pipe side of the piston, its movement toward release position is arrested by striking the retarding device stem as shown in the cut. In this position the cylinder port *r* has a full opening through the exhaust cavity *n* in the slide valve to the exhaust port *p*, allowing a free flow of air from the brake cylinder to the atmosphere. At the same time the quick service port *y* is in full register with port *j* in the slide valve, which together with the feed groove *i*, produces the quick recharging of the auxiliary reservoir.

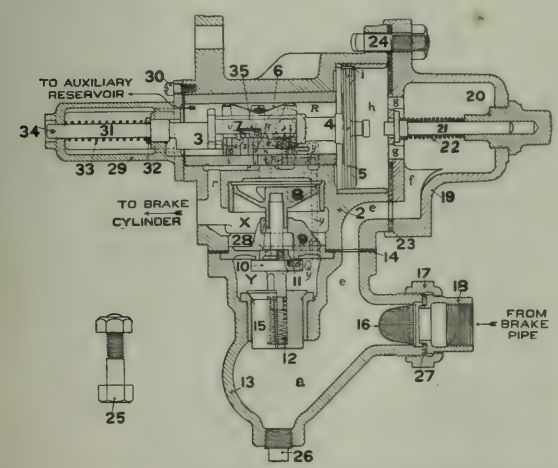


Fig. 13—Section Through Type K Freight Triple Valve.

On the other hand, when the rise in brake-pipe pressure is sufficiently rapid to cause enough difference in pressure to compress the retarding device spring, the piston and slide valves are moved beyond the full release position to that shown in Fig. 11, known as the retarded-release position. In this position a small narrow extension of the exhaust cavity *n* connects the cylinder port *r* to the exhaust port *p*, which restricts the flow of air from the brake cylinder to the atmosphere; at the same time the flow of air to the auxiliary reservoir is entirely stopped, so far as the feed groove *i* is concerned, by the piston sealing against the end of the bush, while the feed up through the quick service port *y* now passes through a much smaller port, *l*, in the slide valve. Thus the rate of recharge is greatly retarded. The piston remains in this position so long as the excess pressure on the brake-pipe side remains sufficient to hold the retarding device spring compressed. As this difference becomes less, the spring forces the piston and slide valve together back to the full release position shown in Fig. 10.

This triple valve, known as the type K, also includes the quick service feature previously described, as will be seen by reference to Fig. 12, which shows the valve in quick-service position.

This feature is of special importance in handling long freight trains, because heretofore it has been difficult to cause all the brakes to apply on a train of over 75 cars, even if a full service reduction is made, with the triple valves all in fairly good condition, for the reason that the standard type of triple valve was not designed to operate under such extreme conditions. The new type K triple valve, however, including as it does the features of quick service, retarded release, restricted recharge of the reservoirs on the head end and quick recharge of those on the rear end, affords complete control of a train of any length. The cuts of this valve, Figs. 10, 11 and 12, previously referred to, are diagrammatic. Fig. 13 shows the valve in true section, while Fig. 14 is a photograph of

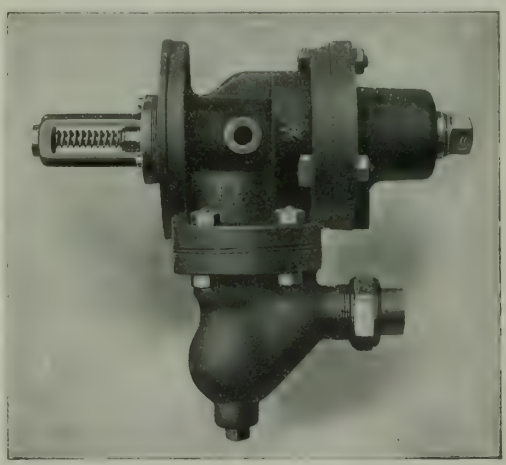


Fig. 14—Type K Freight Triple Valve.

the device. Although this valve has a new designation, and includes all the new operative features just mentioned, it is not greatly different from the old standard freight triple valve in construction or appearance. In fact, the standard F 36 or H 49 (now the H-1 and H-2) triple valves now generally in use in freight service, may be changed into the type K triple by simply adding the retarded release device, substituting a new bushing, slide valve and graduating valve for the old, and drilling the quick service port in the body and check valve case. It will be noticed from the photograph that the retarded release device projects into the auxiliary reservoir when the valve is in position. For the purpose of distinguishing this type of valve readily from the standard types, a rib is cast on the top of the body, extending about half way from flange to flange, which can be easily seen from the side of the car.

GRADUATED RELEASE.

In the application of the graduated release triple valves, to electric traction service, the reserve supply of air used to obtain the graduated release feature, was obtained in the following manner: It was necessary for the main reservoirs of all motor cars to be connected through the train in order to equalize the amount of work required from each compressor. This was effected by adding a second pipe line, the pressure in which is always maintained at that for which the feed valve supplying the system is set. This pipe, called the "control pipe," furnished a convenient source for the "reserve supply" needed, as it was then necessary only to make suitable connection between it and the triple valve. In the

case of steam road practice, however, this second pipe line did not exist, and it was impracticable to add it solely for this purpose. For this service, therefore, an additional or "supplementary" reservoir was located on each car and connected to the triple valve in place of the control pipe. When the triple valve is in release position, this reservoir is being charged from the brake pipe along with the auxiliary reservoir, and to the same pressure. When this reservoir is charged and an application of the brakes made, the action is precisely the same as when a "control" pipe is used, with this exception: With the control line, the volume of air available at feed-valve pressure is practically unlimited, while with supplementary reservoirs, the reserve supply pressure is limited by the supplementary reservoir capacity. The operation of the two systems is, however, substantially the same, since the supplementary reservoir volume is ample to permit of as many graduations in the release as it is feasible to employ during the stop.

THE HIGH SPEED VALVE.

Along with the development of the systems which have been described, the conviction had been steadily gaining ground that when a quick stop is made from high speeds a much greater braking power, and therefore higher brake cylinder pressure, can be advantageously used than has previously been employed. Obviously with a system using a reserved supply, this could be attained by locating a valve so that when an emergency application of the brakes was made, the supplementary and auxiliary reservoir volumes would unite and flow to the brake cylinder. The brake cylinder pressure thus obtained would be that at which the brake cylinder, supplementary, and auxiliary reservoir volumes equalized, the increase in pressure thereby secured being obviously considerable. This idea was first applied in practice in exactly the manner above mentioned, by means of a so-called "by-pass valve" located in the piping system. The results secured were so satisfactory that steps were immediately taken to develop this device as a

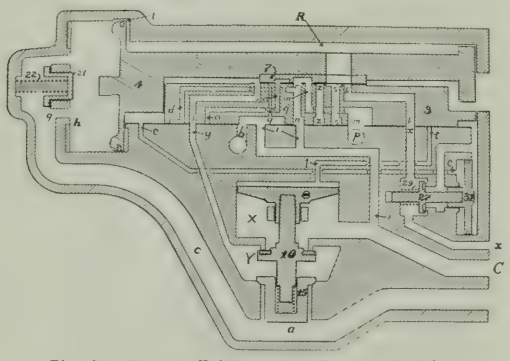


Fig. 15—Type L Triple Valve; Release Position.

permanent part of the graduated release equipments. In order to simplify the apparatus, the by-pass valve was incorporated into the triple valve itself, thus leading to the development of what is now known as the type L triple valve.

The diagrammatic view of this valve is shown in Fig. 15. The triple valve includes all of the features of the graduated release triple valves, with the addition of the by-pass valve as shown. Auxiliary reservoir pressure is always on one side of the by-pass piston, and in all positions of the triple-valve slide valve, except emergency position, it also acts on the other side through port *c*. The device is therefore entirely inoperative under these conditions. But when the triple-valve slide valve goes to the emergency position, as shown in Fig. 16, the air on the left of the by-pass piston is allowed to flow to the brake cylinder through ports *c*, *d*, *q* and *r*, thus creating an excess pressure on the right side of the by-pass piston, forcing it to the left, and allowing the supplementary reservoir pressure to flow from port *x* past the by-pass valve to the auxiliary reservoir. Thus in emergency applications, a volume of compressed air much larger than that contained in the auxiliary reservoir is allowed to flow to the brake cylinder, which increases the pressure of equalization to a very considerable degree. The reasons for adopting the methods described above, whereby a considerably increased brake cylinder pressure is available in case of emergency above that which can be obtained in ordinary service reduction, are as follows:

As already pointed out, it is necessary that not too high brake-cylinder pressures be obtained, when moderate brake pipe reductions are made, in order that ordinary service stops, from moderate or low speeds, may be made with smoothness, accuracy and in such a manner that the engineer can judge accurately his control over the train. On the other hand, when an emergency arises the consideration of safety is paramount. It then becomes necessary to stop in the shortest possible time, regardless of anything else. To

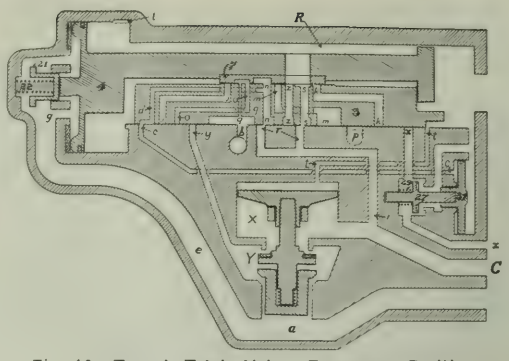


Fig. 16—Type L Triple Valve; Emergency Position.

do this requires the highest possible brake-cylinder pressure which can be used without actually sliding the wheels.

THE HIGH SPEED SAFETY VALVE.

In the high-speed brake, the high-speed-brake reducing valve serves to prevent the accumulation of excessive brake-cylinder pressures in service operation. In emergency applications not only is a higher pressure obtained, but the time during which this pressure is held is considerably lengthened.

The development of this idea is carried one step further in the type L triple valves. The service operation, so far as the amount of brake-cylinder pressure obtained is concerned, is no different than before. The high-speed reducing valve is replaced by a safety valve which forms a part of the triple valve and is connected directly to the brake cylinder pressure when the piston is in service position, as shown in Fig. 17. Port *b* leads directly to the safety valve, and in the position shown is connected through cavity *q* to the brake cylinder port *r*. This serves the necessary purpose of limiting the brake cylinder pressure obtainable in service reductions to the adjustment of the safety valve.

But in emergency applications it has been demonstrated by tests and actual service on the road that, when running at high speeds, the high cylinder pressure obtained with the L triple valve in an emergency application can safely be held without any reduction, to the end of the stop, and this without increasing the danger of objectionable wheel sliding. The L triple valve was accordingly designed so that when the piston moves to emergency position the connection between the brake cylinder and safety valve, as described above, is cut off, this position of the ports being shown in Fig. 16. In this manner the equipment comprehends, within the triple valve itself, the functions of the present high-speed brake, with the addition of the quick service, graduated release, quick recharge and augmented emergency brake cylinder pressure features.

HIGH SPEED TRACTION SERVICE VALVE.

This latter feature of augmented emergency brake-cylinder pressure is equally valuable in connection with high speed traction service, where it may not be advisable to use a triple valve with quick action features, as in case of the cars operating singly, as well as in trains. The next step taken was therefore to incorporate this feature in the type T triple valve already described, the new valve being called the type M triple valve. A photograph of this valve is shown in Fig. 18. A detailed description of it is unnecessary inasmuch as it corresponds throughout with the type T triple valve except for the addition of the by-pass valve just explained in connection with the type L triple valve. In the type T triple valve, no higher brake-cylinder pressure could be obtained in emer-

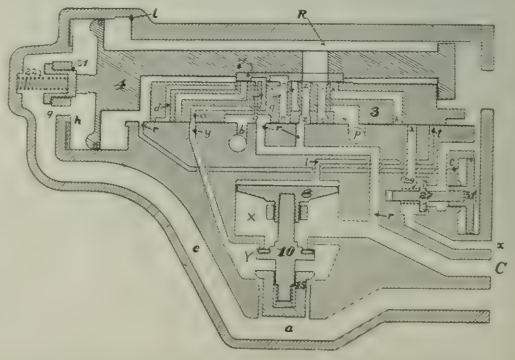


Fig. 17—Type L Triple Valve; Quick-Service Position.

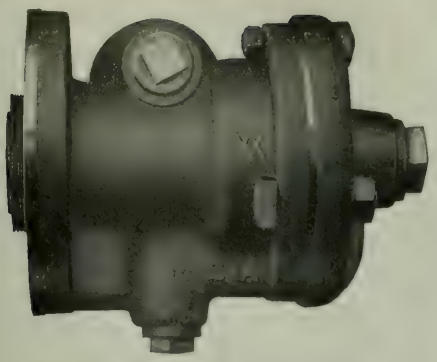


Fig. 18—Type M Triple Valve.

gency than in service operation; whereas with the type M triple valve, while the cylinder pressures obtained in service reductions are kept down to the required limits for flexibility at moderate speeds, a considerable increase in brake-cylinder pressure can be obtained when any occasion arises for making a quick stop from high speeds.

STRAIGHT-AIR, WITH AUTOMATIC EMERGENCY FEATURE.

One of the novel and ingenious developments in connection

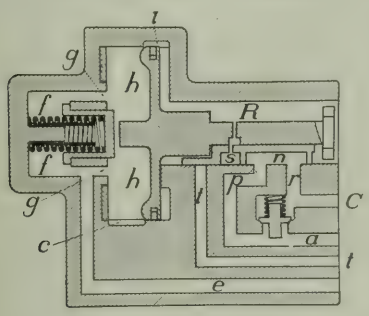
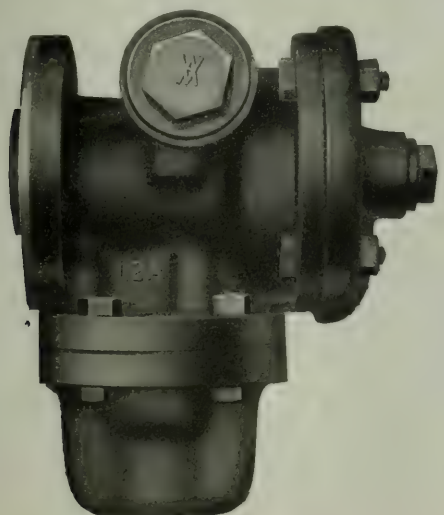


Fig. 19—Emergency Valve.

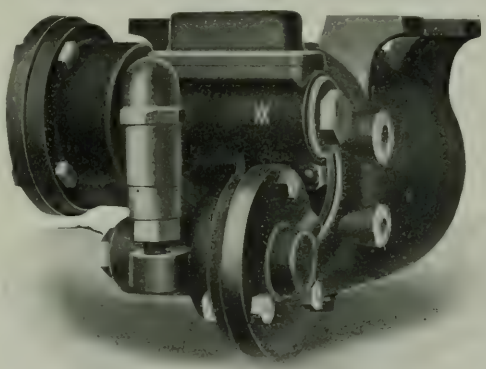
with the application of air brakes to traction service is what is known as the straight-air brake equipment with automatic emergency feature. During the time that electric traction service was confined entirely to single car operation, the straight air brake equipment met all reasonable demands and was largely adopted. But it soon became desirable to operate two cars together for either a portion of the time or continually. As has been already pointed out, good practice demands that in such cases, some safety feature



Type L Triple Valve.

be incorporated in the brake system, whereby, in case of a break-in-two or rupture in the piping, the brakes on both vehicles will be automatically applied. As the straight air system had already been made standard for such service and it was often not desirable to change over to a new system of operation, viz., the automatic, in order to secure the necessary safety feature, some method was required whereby the straight air system could be made to operate automatically in case of emergency. This was accomplished by the addition of a device called the emergency valve, shown in Fig. 19, and an additional pipe line. This latter is normally under pressure and connected to the emergency valve at *e*. Chamber R is connected to the main reservoir which is supplied with air by the compressor. In ordinary service operation, the air brake operates as a straight-air system, the air flowing directly to and from the brake cylinder from the brake valve through the usual straight-air pipe. But when an emergency application of the brakes is made by the motorman, or where a break in two or other accident causes any rupture of the piping system, a sudden reduction of pressure results in the pressure pipe, causing a reduction in port *e*, which communicates to the chamber *h*, behind the valve piston. The air being unable to flow fast enough from the reservoir side R of the piston through the feed grooves *i* and *c* to keep up the pressure, a differential pressure sufficient to move the piston and its attached slide valve is caused. This opens the port *r* leading from the main reservoir to the brake cylinder, and applies the brake automatically. The brakes would then be released through the brake valve in the ordinary manner.

This equipment, therefore, furnishes a system of straight-air



Distributing Valve; Chief Controlling Mechanism of the " E T" Locomotive Equipment.

control which gives perfect satisfaction in single or two car operation, for the particular kind of service outlined above, with the automatic application of the brakes always in reserve as a safety feature in case of necessity.

LOCOMOTIVE BRAKE EQUIPMENT.

The treatment of this subject of developments in air brake control apparatus would hardly be complete without mentioning the so-called "ET" locomotive brake equipment. This equipment has been so thoroughly described in the technical press and before various societies, that a detailed description of it here does not seem necessary. It need only be said that by it the installing and handling of locomotive brakes has been so simplified and improved that it is being quite generally adopted as standard equipment. Before its introduction, the value of the locomotive brake in developing a retarding effect on the train, as a whole, was very uncertain. The almost constant use of the locomotive, as well as the difficulty of getting at the apparatus, made its proper maintenance very difficult. As a result, excessive leakage and uneven adjustment often led to such losses in braking power as to render the stopping power of this most important unit in the train, of little value. With the ET equipment, however, not only is the engineer provided with a means of operating the locomotive brakes either in conjunction with or independently of the train brakes, as occasion arises, but the application resulting is always the same for any certain manipulation by the operator, and the cylinder pressure obtained is uniform in all cylinders on the locomotive and maintained during the application to the pressure first obtained, against such leakage as may exist. Many other features both of safety and convenience are incorporated in the details of this equipment in such a way that it has the good points of all previous equipments and eliminates their objectionable features.

The foregoing gives only the most important changes that have taken place in the art of train braking during the past two or

three years. It cannot by any means be said to cover the whole field of progress in this line, but will perhaps serve as an indication of its growth and development. It will, to some, bring home the fact that progress in one line of the mechanic arts compels a like growth in all other lines. The vast development of the resources and industrial establishments of this country have made a similar development of railroad rolling stock indispensable, which in turn has compelled such changes in all rolling stock auxiliaries as will enable them to keep pace with the requirements of the day. These changes are still going on as new conditions arise, so that this article is only a chapter of their history.

Electric Train Lighting.

A paper on electric train lighting containing considerable interesting data was presented at the April meeting of the Western Railway Club by O. W. Ott, of the mechanical department of the Burlington. The introductory portion of the paper describes the three principal systems—the storage battery, axle-light and head-end systems. Our readers are familiar with the general features of these. Following this is a comparison of first cost and cost of operation of the three systems. For this purpose an eight-car train is assumed as a basis, doubling back and forth over a 500-mile run over night and lying up in passenger yards during the day. A 14-hour schedule is assumed, with a pair of trains, one leaving each terminal at 6 p.m. and arriving at the other terminal at 8 o'clock the next morning; each train including a mail car, express car, combination baggage and smoker, chair car, coach, dining car, standard sleeper and observation state-room sleeper; the diners serving supper and breakfast running back and forth over a distance of 80 miles at each end of the run on a schedule time of two hours for the 80 miles.

For a well lighted train the standard lamp equipment for the various cars is about as follows: Sixty ft. baggage and express cars, 12-16 c.p. lamps; 60 ft. mail cars, 24-16 c.p. lamps; 70 ft. combination baggage and smoking cars, 4-8 c.p. lamps and 20-16 c.p. lamps; 70 ft. chair cars, 31-8 c.p. and 22-16 c.p. lamps; 70 ft. coaches, 40 8 c.p. lamps and 22-16 c.p. lamps; dining cars an average of 30-8 c.p. and 40-16 c.p. lamps; and sleepers an average of 40-8 c.p. and 32-16 c.p. lamps each. Using these figures for lamp equipment the sample train would contain 185-8 c.p. and 204-16 c.p. lamps, with a grand total of 389 lamps. Using a figure of ½ amp. at 110 volts for the current consumption of a 16 c.p. lamp, the total load would be 148-25 amp. at 110 volts, or 16.3 k.w.

From tests made on a train very similar to the sample train by Mr. Edward Wray, of the University of Wisconsin, the actual running load on our sample train would average as follows: Leaving the yards at 5.30 p.m. and until cutting out the dining car at 8 p.m., the load will average 16 k.w. From 8 p.m. until about 11 p.m., the load will average 14 k.w. From 11 p.m. until 8 a.m. the load will average about 7 k.w., as about 11 p.m. all the light except those on the night circuits are cut out. By multiplying the rates by the time in effect the round trip current consumption will be found to be 290 k.w. hours, this figure to be taken as the actual consumption of current at the lamps. As our pair of trains will make 365 round trips a year, this gives a yearly consumption of 105,850 k.w. hours.

The first cost of equipment for the pair of sample trains will be as follows:

Head-End System.

2 Curtis turbo-generators, 25 k.w. at $1,400	$2,800.00
Switchboards, instruments, steam fittings and piping, wiring and installing dynamos, complete, 2 cars at $400	800.00
4 sets of storage batteries (each 54 cells, 240 amp. hr. capacity, 216 cells at $20.50	4,428.00
Overhead train line (3-4 0 wire with Gibbs connectors), 16 cars at $130	2,080.00
Battery boxes and crates, 4 cars at $100	400.00
Wiring and fixtures, exclusive of train line, 2 chair cars, 2 coaches, 2 dining cars and 4 sleepers—10 cars at $300 av'g	3,000.00
Wiring and fixtures, exclusive of train line, 2 combination cars at $180	360.00
Wiring and fixtures, exclusive of train line, 2 mail cars, and 2 express cars, 4 cars at $30 average	120.00
Total for 16 cars	$13,988.00
Average per car	874.25

Storage Battery System.

Battery, 16 sets, 32-240 amp. hr. cells each set, 512 cells at $20.50	$10,496.00
Battery boxes and crates, 16 cars at $70	1,120.00
Overhead train line (3-4/0 wire with Gibbs connectors), 16 cars at $130	2,080.00
Wiring and fixtures, exclusive of train line, same as above 16 cars	3,480.00
Total for 16 cars	$17,176.00
Average per car	1,073.50

Axle Dynamo System.

Generators, regulators and suspensions, 16 cars at $670	$10,720.00
Battery, 32 cells, 240 amp. hr. per car, 512 cells at $20.50	10,496.00
Battery boxes and crates, 16 cars at $70	1,120.00
Wiring and fixtures, exclusive of train line, same as above, 16 cars	3,480.00
Application of axle dynamos to car, 16 cars at $60	960.00
Total for 16 cars	$26,776.00
Average per car	1,673.50

The figures given for wiring and fixtures on all the cars except mail and express will cover the cost of changing the Pintsch or acetylene into combination electric fixtures, the addition of bracket side fixtures and the laying of all wire in conduit. Where plain socket fixtures are placed along the under side of the lower deck crown mould with the wires run in the moulding and the oil or gas lamps left undisturbed, the cost exclusive of the train line would not be over $50 per car.

It will be noted that the train line has not been included in the axle dynamo system estimate, although to facilitate handling axle-lighted cars in head-end trains, it would be advantageous to have train lines applied. With the storage battery system the train line is absolutely essential for charging purposes. It will also be noted that 32 cells of 240 amp. hr. batteries have been specified for the axle dynamo cars. A smaller battery capacity than this has not been found satisfactory and in several instances 32 cells of larger capacity have been applied.

COST OF OPERATION.

Current Cost—Head-End System.—With the head-end system with a 4/0 wire train line it requires 114 volts at the generator to give 110 volts at the lamps on an eight-car train. This gives 96.4 per cent. efficiency of transmission. The storage batteries will be required to carry the lighting load for average periods of 12 minutes each at four engine changes and four dining car cuts in the train per round trip. Noting that two engine changes are made during periods of heavy load and two at the periods of the light load and that when the dining car cuts are made only the two rear cars—the sleepers—are lighted from the batteries, it will be found that the total battery discharge will be about 10 k.w. hrs. per round trip.

Assuming a watt efficiency for the batteries of 50 per cent., then to make up the current loss involved in using the batteries the total kilowatt hour consumption will be increased from 290 to 300 k.w. hrs. per round trip. Taking the efficiency of transmission into account to give 300 k.w. hours at the lamps the generator output will have to be 311.2 k.w. hrs. This means that for a lamp consumption of 105,850 k.w. hrs. per year the generators will be required to put up 113,588 k.w. hrs.

The tests conducted by Mr. Wray on a 25-k.w. turbo-generator set showed an average steam consumption of about 90 lbs. of steam per k.w. hr. with the load averaging around 15 k.w. and about 140 lbs. per k.w. hr. for a load of 7 k.w.; these figures both for a kilowatt hour delivered at the switch-board. Dividing the current consumption up we find that 55 per cent. will be generated at the 15 k.w. rate and 45 per cent. at the 7 k.w. rate. This gives a total steam consumption per year for the pair of trains of 12,778,650 lbs.

Tests on passenger runs similar to that of the sample train have shown an average evaporation of 5.5 lbs. of water per pound of coal actual, with coal at $2 per ton delivered at the locomotive. The total coal consumption per year would therefore be 2,323,390 lbs., or 1,161.69 tons, at a cost of $2,323.38.

CURRENT COST, STRAIGHT STORAGE SYSTEM.

For the straight storage system the current cost can perhaps be most accurately derived by assuming a value of 2½c. per k.w. hr., delivered at the passenger yards. This figure would perhaps be a trifle low for small isolated power plants. From the tests conducted by Mr. Wray on a storage battery lighted train which was equipped with batteries which were somewhat old and worn out, the average watt efficiency was found to be 49.2 per cent. In these tests readings were taken of input and output on four cars for a period of six days.

It would probably be more fair to assume a watt efficiency of 65 per cent. as representing average conditions, under which straight storage systems operate. With 65 per cent. efficiency 105,850 k.w. hrs. at the lamps would require 162,846 k.w. hrs. at the passenger yard terminals at a total cost of $4,071.15 per year.

CURRENT COST, AXLE DYNAMO SYSTEM.

For the axle dynamo system the current cost can be figured as follows: In the Wray tests previously referred to, covering five different cars having axle dynamos, the average total efficiency was 42.6 per cent. This efficiency was derived as follows: The lamp consumption divided by the total generator output was multiplied successively by the generator efficiency and the belt drive efficiency. The belt drive efficiency was assumed at 97 per cent., or 3 per cent. slip. It would probably be safe to assume 50 per cent. total efficiency as representing average conditions. Changing the total yearly consumption of 105,850 k.w. hrs. into horse-power we have 141,890 h.p. hrs. at the lamps. This figure divided by 50 per cent. efficiency gives a total of 283,780 h.p. hrs. taken from the wheels.

Let us figure only the extra coal required at the locomotive due to the increased train resistance, making allowance for power taken from the axles when the locomotive is drifting and not working steam. Tests on passenger locomotives on a very level division showed a ratio of 94 per cent. between total time using steam and total time in motion, while on a very hilly division this ratio was 76 per cent. As these two divisions will fairly represent the extreme conditions found on the average road, it would be safe to

place the figure for the sample train at 85 per cent., the average of the two.

A part of the time in motion while not using steam is due to the making of stops and hence a portion of the time the running speed will be below the critical speed of the axle dynamos. This critical speed is generally about 20 m.p.h. A figure of 90 per cent. would probably fairly represent the portion of the total power taken from the car axles while the locomotive is using steam. Therefore 90 per cent. of 283,780 h.p. hrs., or 255,402 h.p. hrs., will have to be accounted for by extra coal consumed at the locomotive. An average passenger locomotive will deliver a horse-power hour at the drawbar for 8 lbs. of coal at $2 per ton. This makes a total coal consumption of 2,043,216 lbs., or 1,021.6 tons, at a cost of $2,043.20 per year for the pair of trains.

Cost from Increased Weight of Train.

	Lbs.
Head-End System, Weights:	
2 turbo-generators, 25 k.w., at 3,600 lbs.	7,200
2 switchboards, piping, fittings, etc., at 600 lbs. per car.	1,200
216 cells of battery at 100 lbs.	21,600
4 cars battery boxes at 800 lbs. per car.	3,200
Total for 16 cars.	33,200
Average per car.	2,075
Storage Battery System, Weights:	Lbs.
Battery, 16 cars, 32 cells, each at 100 lbs.	51,200
Battery boxes and crates, 16 cars at 600 lbs.	9,600
Total for 16 cars	60,800
Average per car	3,800
Axle Dynamo System, Weights:	Lbs.
Generators, suspensions and regulators, 16 cars at 1,100 lbs.	17,600
Battery 16 cars, 32 cells, each at 100 lbs.	51,200
Battery boxes and crates, 16 cars at 600 lbs.	9,600
Total for 16 cars.	78,400
Average per car	4,900

Consider only the cost in coal at the locomotive for carrying this extra weight. From tests made on passenger trains which run on a schedule very close to that of our sample trains, about 20 lbs. of coal was consumed per 100 ton-miles, with coal at $2 per ton. As our assumed mileage was 500 miles between terminals we will have a total yearly mileage of 182,500 miles for each car. Then for the head-end system we would have 16.6 tons x 182,500 miles, or 3,029,500 ton-miles, with a coal consumption of 605,900 lbs., or 302.95 tons at a cost of $605.90 per year. For the storage battery system, remembering that the dining cars only run a distance of 80 miles at each end of the run, we would have 26.6 tons x 182,500 miles and 3.8 tons x 58,400 miles, or a total of 5,076,420 ton-miles, with a coal consumption of 507.64 tons at a cost of $1,015.28. For the axle dynamo system, using the same method of figuring we would have 6,545,910 ton-miles with a coal consumption of 654.59 tons at a cost of $1,309.18.

LAMP RENEWAL COST.

Head-End System.—As the battery charging for the sample trains under this system was figured as being done on the road by boosting the voltage on the night circuit lamps, the number of lamps burned out per month will be rather high. Records kept have shown a mortality of 25 per cent. per car per month. With our sample trains each having 389 lamp bulbs, or a total of 778 for the pair of trains, we would have to renew 194.5 lamps per month, having an average value of 20c. each. This would make the yearly lamp bill for the two trains $466.80.

Straight Storage System.—With this system the lamp mortality is a minimum as very seldom does the lamp voltage rise above normal. Records have shown a mortality of about 8 per cent. per car per month. Figuring as above, the lamp mortality for the two trains would be 746 bulbs at a cost of $149.20 per year.

Axle Dynamo System.—The tests conducted by Mr. Wray showed that even though a lamp resistance is employed when the lights are lighted from the generator, there are periods when the lamps are required to take an excessive voltage. This is especially evident when all but the night circuit lights are cut out and the dynamo is charging the batteries. Records have shown a lamp mortality for axle dynamo cars of practically the same figure as under the head-end system quoted above—25 per cent. per car per month. This gives a yearly bill of 2,334 lamp bulbs at a cost of $466.80 for the pair of trains.

BATTERY DEPRECIATION COST.

For the head-end system and the straight storage system the writer would estimate the life of the average storage battery to be five years of service for train lighting and then several more years' service as fan batteries or for private car work. Take depreciation at 15 per cent. for five years, and then 25 per cent. of the original cost as the scrap value of the batteries for fan service.

With the axle dynamo system the life of the batteries is an extremely variable quantity. Instances have occurred where batteries have gone to pieces in 18 months, while in other instances after three or four years of service the batteries were still in fair shape. Assume 20 per cent. depreciation for four years and a scrap value of 20 per cent. at the end of the four years for service as fan batteries.

MAINTENANCE COST.

Under this head include cost of electrical attendance on the road or in passenger yards, repairs, oil, waste, etc.

Head-End System.—The largest single item for this system will be train electrician attendance. On one road where the baggagemen run the dynamos and the trainmen are required to look after the train line connections between the cars, the baggagemen are paid $20 per month extra in addition to their regular rates as baggagemen. As our sample train would require a pool of four baggagemen, the attendance cost would be $80 per month, or $960 per year, if handled by baggagemen.

With regular train electricians the pair of trains would require 2½ men. By the fraction is meant that each of two regular train electricians would be relieved at regular intervals by a substitute from the yard electricians or an extra man. Then each regular electrician would make 146 round trips per year with 73 trips by the extra man. Figuring these men at $1,000 per year each, the attendance cost would be $2,500 per year for the two trains.

The yard attendance for the head-end system would be fairly placed at three hours per day at each terminal, or a total of six hours at 25c., or $1.50 per day. This makes a yearly bill of $547.50 for the pair of trains. This would include testing out the car circuits, renewing burned-out bulbs, flushing and cleaning batteries, etc. Repairs to the generator set, train line connectors, broken battery jars, etc., could be safely placed at $300 for the two trains per year.

Another item for the head-end system would be the steam hose cost. Assume that the generator is located in one end of the express car on the sample train. Then between the locomotive tender and the front end of the express car, remembering that there is a mail car intervening, there will be a total of four steam hose per train, subjected to steam pressures varying from 80 to sometimes 125 lbs. gage. The average life of hose under these conditions is about 1½ months. This means that each hose will have to be renewed eight times per year. Then the yearly bill would be 64 steam hose at a renewal cost of $1.25 each, or a total of $80.

With the generator set placed crosswise of the car the daily oil and waste bill would be 2 qts. engine oil, 1 qt. valve oil, and 1 lb. waste at a cost of 45c. per day, or $164.25 per year for the two trains. With the generator placed lengthwise of the car the oil bill would be cut in half.

Straight Storage System.—The largest single item under maintenance cost under this system would be the employment of a regular man at each terminal for charging purposes. However, this man could test out the car circuits, renew burned-out bulbs, flush and clean batteries and make all necessary repairs. Two men at $2.50 per day would give a yearly bill of $1,825. Broken battery jars, repairs to train line connectors, etc., would probably be safely covered by $100 per year for the two trains.

Axle Dynamo System.—For this system for yard attendance, 30 minutes per car for one electrician to test out the circuits, renew bulbs, test out the regulator, look over the batteries and the generator when necessary would probably be a safe figure. This for an eight-car train would mean four hours a day at each terminal, or a total of eight hours at 25c., or $2 per day, or $730 per year for the pair of trains. A figure of $5 per car per month would be conservative to cover all repairs to the generator, regulators and suspensions, also renewals of broken battery jars, lost belts, etc. The size of this bill will depend considerably upon the ability of the men handling the cars, both in the yards and on the road. An axle dynamo in careless or inexperienced hands is an expensive proposition, and there is no doubt whatever in the mind of the writer that a railroad will make a very serious mistake in employing cheap help to take care of axle dynamos. Using the figure of $5 per car per month, we have a yearly bill of $960 for the 16 cars in the two trains. For the axle dynamos on the sample train the oil bill would be about ½ pint of engine oil per car per round trip with oil at 45c. per gal. Then for the 16 cars the daily bill would be 2 qts. at a cost of 22½c. This would give a yearly bill of $82.12.

Before summarizing the various items under cost of operation it should be noted that there is one point of cost which cannot be estimated, namely, the value of the room displaced in the baggage car by the generator set under the head-end system. On one installation employing a high-speed reciprocating engine set, a distance of about 12 ft. at one end of a 60-ft. car was occupied, while on another road a 15 k.w. turbo-generator set was partitioned off with stanchions in one corner of the car in a space 3 ft. 6 in. x 8 ft. With a 25 k.w. turbo-generator set placed crosswise of the car a minimum distance of 6 ft. at one end of the car will be required. The same generator placed longitudinally will require 8 ft. 6 in.

DEPRECIATION COST OF ELECTRICAL EQUIPMENT.

As the wiring and fixtures are common to all three systems and are essentially a part of the car, no depreciation charge will be made on them.

With the head-end system the principal electrical equipment—the generator set and fittings—is enclosed from the weather in the baggage car and with regular train electricians receive the care which is their due. Therefore 5 per cent. would probably be a safe figure.

With the axle dynamo system the generator itself, which is the principal item of the electrical equipment, is carried in an extremely exposed place and is subject to varying conditions of weather and track. For the generator and suspension 15 per cent. depreciation, and for the regulator 5 per cent. depreciation, would be safe figures.

Instead of dividing the depreciation up the writer has assumed an average figure of 10 per cent. for the generator, regulator and suspension.

Cost of Operation.

Head-end System:	
Current cost	$2,323.38
Weight cost	605.90
Interest on investment at 5 per cent.	699.40
Depreciation on turbo-generator and fittings at 5 per cent.	180.00
Depreciation on batteries at 15 per cent.	664.29
Train electrician attendance	2,500.00
Yard electrician attendance	547.00
Lamp renewals	466.80
Oil and waste	164.25
Repairs	300.00
Steam hose cost	80.00
Total 16 cars	$8,530.93
Average for one car	533.18
Straight Storage System:	
Current cost	$4,071.15
Weight cost	1,015.28
Interest on investment, at 5 per cent.	858.80
Depreciation on batteries at 15 per cent.	1,574.40
Yard attendance	1,825.00
Lamp renewals	149.20
Repairs	100.00
Total for 16 cars	$9,593.83
Average per car	599.61
Axle Dynamo System:	
Current cost	$2,043.20
Weight cost	1,309.18
Interest on investment at 5 per cent.	1,338.80
Depreciation on axle dynamos, regulators and suspension, average at 10 per cent.	1,072.00
Depreciation on batteries at 20 per cent.	2,099.20
Yard attendance	730.00
Lamp renewals	466.80
Repairs	960.00
Oil	82.12
Total for 16 cars	$10,101.30
Average per car.	631.33

In conclusion, it will be noted that for the pair of sample trains chosen the order of preference as to first cost and cost of operation would be: First, the head-end system; second, the straight storage system, and third, the axle dynamo system. It does not necessarily follow, however, that in all cases the head-end system would be most advantageous. Instances have occurred where all three systems were used on one train.

An important feature of electric train lighting from the standpoint of the traveling public is uniformity of voltage at the lamps. A drop of a few volts below the normal voltage will cause a very annoying decrease in the candle-power of the lights. In respect to ability to maintain a constant lamp voltage the first choice undoubtedly rests with the head-end system, as with first-class electricians there is no reason why a predetermined voltage cannot be maintained. With the axle dynamo system the two main factors controlling the voltage at the lamps are the number of lights burning and the condition of battery charge. In some axle systems these factors are taken care of better than in others, but even in the best some variation in lamp voltage will result. From the nature of the storage battery itself the voltage at the lamps with the straight storage system is a maximum when the train first starts out and then gradually falls as the batteries discharge. The higher the capacity and the more fully charged the batteries are the less will be this voltage drop and resulting decrease in candle-power.

As the total tonnage of the modern passenger train is being steadily increased by the use of larger and heavier cars and more of them, it might be interesting to compare the additional load imposed upon the locomotive boiler, and consequently upon the fireman, by lighting the train electrically by the three systems under discussion. Using a one-way trip as a basis, the additional coal required will be made up of two items: that required to generate the current with the head-end and axle dynamo systems, and that required to pull the additional weight for all three systems, as follows:

	Coal for current — One way trip.	Coal for current — Per hr.	Coal for weight — One way trip.	Coal for weight — Per hr.	Total — One way trip.	Total — Per hr.
Head-end system	3,182 lbs	227 lbs.	850 lbs.	59 lbs.	4,032 lbs.	286 lbs.
Storage system	"	"	1,390 "	99 "	1,390 "	99 "
Axle dynamo system	2,800 "	200 "	1,793 "	128 "	4,593 "	328 "

For dining cars, parlor cars, mail cars, or any individual car for that matter that is to be electric lighted and is required to be used on more than one train or pair of trains, the writer would recommend the axle dynamo system. The main features of this system is that each car is a complete unit in itself and is not tied down to any given locality.

For the straight storage system the main features are simplicity of operation while on the road and the least number of parts to maintain.

An important field which will probably develop for the head-end system will be the lighting of suburban trains. As a rule no changes in locomotives or cars are made on suburban runs and hence no batteries would be necessary. A 15 k.w. turbo-generator could be placed on top of the locomotive boiler and run by the engineman with but little more trouble than the present electric headlight sets. For protection purposes an extra locomotive could be fitted up with the necessary wiring and piping and a suitable saddle casting so that in an emergency the turbo-generator could be readily transferred from the regular locomotive to this protection locomotive and the wiring and piping connected up in a short time. The first cost for fitting up a locomotive with a 15 k.w. turbo-generator would be about $1,420 and for the protection locomotive $160.

Using a 2/0 wire train line with plain and simple socket fixtures placed along the lower deck crown mould with the wires run in the moulding the cost for wiring the average 50 to 60-ft. suburban car would be about $150. Figuring one locomotive to six cars, the total cost per train of six cars would be $2,480, or an average of $413.33, which figure would compare very favorably with either Pintsch or acetylene gas.

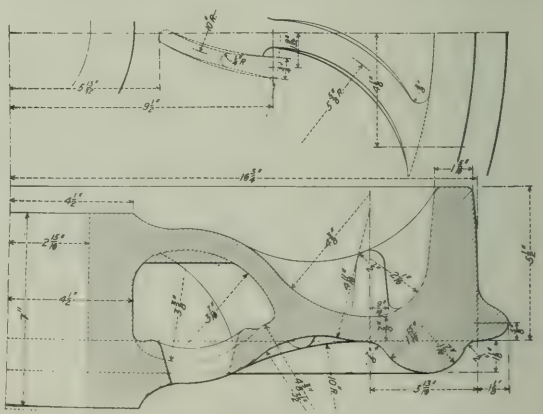
As to the cost of operation: With the turbo-generator on the locomotive full boiler pressure could be used with but a short length of pipe between the boiler and the inlet valve and thus some economy be effected in the steam consumption. With no batteries to maintain or cause trouble the main items of expense would be extra coal at the locomotive, lamp renewals, repairs to train line and turbo-generators, and some roundhouse electrician attendance. Assume a suburban train of six cars, each car having 24-16 c.p. lamps and burning the lamps for a period of six hours per day. A conservative estimate per car per year would be as follows:

Interest on investment at 5 per cent.	$20.65
Depreciation and repairs to locomotive, generator and equipment at 15 per cent.	35.50
Current cost—coal	49.25
Lamp renewals	4.80
Oil and waste	10.00
Yard electrician, attendance and repairs.	18.00
Total cost per car per year	$138.20

Reinforced Cast Iron Wheels for the Norfolk & Western.

The excessive stresses that have been put upon wheel flanges by high capacity cars and the breakages resulting therefrom, have led to a number of attempts to strengthen the flange by a modification of the form of the plates and brackets, and still retain the present form of the flange so that it will pass through the standard frogs and guard rails. Among these modifications is the one shown herewith, designed by Mr. John A. Pilcher, Mechanical Engineer of the Norfolk & Western, and from which satisfactory results in service are being obtained.

As will be seen from the engraving, the plates are thrown back to the inside of the wheel and the single plate, instead of coming



Reinforced Cast Iron Wheel; Norfolk & Western.

up to the rim beneath the center of the tread, rises so that its back face is flush with the back of the flange. At a point $3^{13}/_{16}$ in. below the tread it swells back, adding a thickness of $1\frac{1}{8}$ in. of metal back of the rim and thus increasing the amount of metal that must be broken through by a crack starting at the throat of the flange. At the flange itself the metal is no thicker than in the ordinary wheel, so that no trouble is experienced with frogs and guard rails.

The front lip of the rim is supported by brackets somewhat deeper and with a longer radius of curvature than those usually put at the back of the wheel. At the back of this wheel there are 15 ribs, as shown, spaced opposite the brackets on the front face, and having the same radius of curvature. In other respects this wheel does not differ in dimensions and form from the standard wheel.

GENERAL NEWS SECTION

NOTES.

The New York Public Utilities Bill was signed by Governor Hughes June 6, and goes into effect July 1.

On April 1, 1907, there were 63 steam shovels on the Isthmus, available for digging the Panama Canal, as against 15 on Jan. 1, 1906.

A tract of 33,000 acres of irrigated land near Huntley, Mont., will be opened to settlers June 26, and is being advertised by the Burlington.

Engineers and firemen on the Canadian division of the Michigan Central have been granted increases of pay ranging for the former from $7.50 to $15 per month.

Through securing the Uxbridge & Blackstone trolley line, June 8, the New York, New Haven & Hartford gained complete control of the traction facilities between Providence and Worcester.

While pursuing two Montana horse thieves, June 9, Sheriff Guy and a posse from Johnson County, Wyoming, shot and killed one of the robbers that held up a Northern Pacific passenger train at Welch Spur recently.

The strikers of the Rogers Locomotive Works, about 250 blacksmiths, have been notified by the American Locomotive Co. that unless the men return to work the company will shut down the Rogers works for all time.

It is said that an agreement has been reached by all the underground and electric railways in London for an advance in fares on July 1, and the motor bus companies are expected to follow suit. The existing rates have not been profitable.

The bill of complaint filed in the Federal courts June 8 upon which a receiver was appointed temporarily to take charge of the affairs of the Chicago-New York Air Line was dismissed June 10 as the result of an agreement between attorneys.

Owing to the ruling of the Interstate Commerce Commission that it is unlawful for express companies to issue franks to employees of railroads, officials of the Rock Island, by order of the President, have turned in their franks to his office.

The new schedule for increased pay of machinists, car men, maintenance of way employees, office men and others on the Intercolonial Railway, with the exception of trainmen, has been approved by the Railway Department, taking effect from April 1.

The Mississippi Railroad Commission has made an increase in valuation of the railroads of the state, approximately about $3,000,000. The Mobile, Jackson & Kansas City is increased from $3,500 and $5,000 to $7,500 per mile, new and old trackage the same.

The Texas Central has given notice to the state railroad commission that it has bought its own sleeping cars, to be delivered on July 1, and has applied for authority to adopt a rate of $1.50 for lower and $1 for upper berths between Waco and Rotan, 268 miles.

The general managers of Chicago have abandoned their attempt to increase their schedules for trains carrying packing-house products between the Missouri river and Chicago from 24 to 34 hours, on account of the packers' protests, and have compromised by making the time one hour longer.

C. V. Wood, who recently resigned as Superintendent of the Wheeling & Lake Erie and Wabash-Pittsburg Terminal at Canton, Ohio, now has charge of the development of the express and passenger business of the street railway lines in Massachusetts controlled by the New England Investment & Security Company for the New York, New Haven & Hartford.

L. F. Loree, President of the Delaware & Hudson, has urged railroad managers to join him in a petition to the Interstate Commerce Commission asking that body to postpone for one year the inauguration of the new uniform accounting system, on the ground it will make it impossible for the railroads to make comparisons in the results of their operation and those of the year previous.

At a hearing on the Baldwin full crew bill (New York) which provides that every freight train containing over 20 cars shall have three brakemen instead of two, it developed that the New York Central, with its signal system, would be put to an unnecessary expense as there would be nothing for the additional brakeman to do; so the Legislature recalled the bill to make the change in the proposed law.

The Pennsylvania Railroad gave notice at the office of the Ohio railroad commission June 7 that it would file the car service rules promulgated by the commission for all business whether interstate or intrastate. All the other railroads of the state have filed the new car service rules, as applying only to intrastate business, asserting that the state commission has nothing to do with demurrage on cars in interstate service.

Letters have been sent by the Interstate Commerce Commission to the officials of all the railroads in the country doing an interstate business requesting information as to the commissions or bonuses paid to those who solicit or route freight or passenger business. The commission is engaged in compiling information respecting these matters so that it may issue a rating covering the entire subject. It is desired that the information be in the hands of the Commission by June 15.

Following the action of the Atlantic Coast Line, noted last week, the Seaboard Air Line has obtained a temporary injunction restraining the Georgia railroad commission from putting into effect a reduction of 10 per cent. on freight rates of the Seaboard Air Line until the final hearing on June 27. As protest against such reduction, the road says that much of its mileage is new or else composed of weak local roads and that it will have to spend large sums of money for several years in putting equipment in order.

At a conference to-day of presidents and other executive officers of railroads in Illinois and other states it was decided that no special reductions in rates shall be made until the courts have decided whether the 2-cent fare laws recently enacted are valid. The presidents of the roads agreed to notify their attorneys to confer and decide at the earliest date possible upon the manner in which test cases shall be instituted to determine the constitutionality of the two-cent fare laws of Illinois, Indiana, Iowa, Nebraska, Arkansas and Missouri.

Wisconsin's Public Utility bill, which has the support of the two committees of the assembly and senate, was passed by the assembly June 7. The measure puts all public utilities, except the telegraph and telephone, under the control of the state railroad commission. This commission will have power to direct the nature of the service to be rendered, the rates to be charged, and the commission has the right to say whether or not new companies shall be allowed to begin business. The corporations did not oppose the measure, declaring that they desired efficient regulation, and would be glad to be able to keep out of politics.

Attorneys for the Great Northern, appealing from a fine of $15,000 for granting rebates, declare the passage of the Hepburn law estopped prosecutions or rebating under the provisions of the Elkins law. They hold that the Hepburn law repealed the Elkins law, and that the proviso enacted to the effect that suits then instituted and pending under the Elkins law are not to be affected by the passage of the Hepburn law constituted the sum total of the Government's rights to prosecute under the law. The Government contends that it is acting under the so-called "saving clause," which gives it a right to prosecute under the Elkins law violations which occurred during the period that law was in force.

By a decision of the Georgia railroad commission, announced June 7, a flat reduction in the railroad passenger rates of the state was made, Commissioners H. Warner Hill and O. B. Stevens favoring the flat reduction and Commissioner Joseph M. Brown making a minority report. The rates established by the decision are as follows:

Flat two-cent rate for the Atlanta & West Point and Western & Atlantic.

A flat two-and-a-quarter-cent rate for the Atlantic Coast Line and the Georgia Railroads.

A flat two-and-one-half-cent rate for the Central of Georgia, Southern, Seaboard Air Line, Georgia Southern and Florida and the Alabama Great Southern.

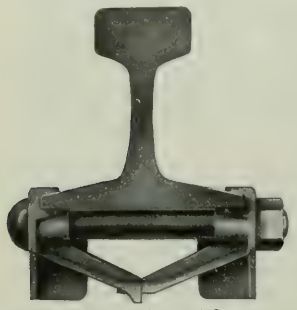
All other roads in the state, with few unimportant exceptions, will charge the present rate of three cents per mile.

A decision in the suit for a mandamus by the Pitcairn Coal Company of West Virginia to compel the Baltimore & Ohio and other companies to refrain from discriminating in distributing cars along the Monongah division of the road was given June 11 by Judge Morris in the United States Court. He stated that he would issue a mandamus requiring the railroad company to cease from excluding individual cars from its basis of computation in ascertaining the

number of cars to which each mine is entitled as its percentage of the car supply. On all other points the mandamus was denied. Judge Morris decided that the individual cars belonging to the coal mine operators and run regularly on the railroad should be counted in as part of the general supply of coal cars in ascertaining the pro rata distribution of cars to the different mines upon a percentage basis when there is a shortage of cars.

The "Vise-Grip" Rail Anti-Creeper.

The "Vise-grip" rail anti-creeper is illustrated herewith. In it the castings are simply carried downward to a meeting point under the rail, forming a fulcrum or foot, with the bolt pulling between it and the jaws above. This construction causes a tightening of the cross-bolt to put a direct and vise-like grip of the hook castings directly and squarely against the rail base, the extent of this grip being limited by the power applied to the bolt. The result is a direct, powerful and rigid clasp.

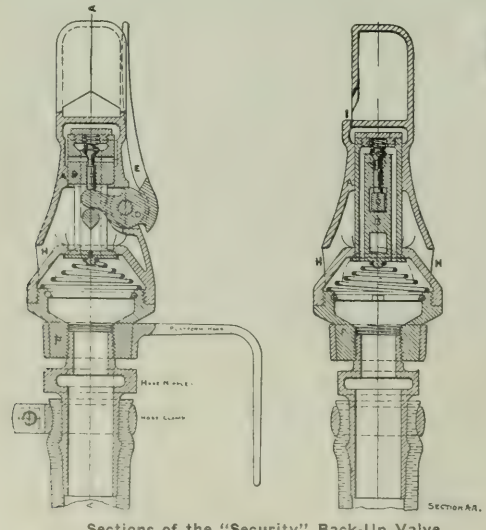


"Vise Grip" Rail Anti-Creeper.

The downward extension of the castings to unite underneath the rail forms a brace and truss support to the sides, adding stiffness and strength where needed, and permitting the extreme pressure of the bolt to be applied directly to the grip. Where the extension braces meet under the rail, a lug on the foot of one jaw engages in a socket in the other, holding both rigidly and in the right position for application. The device is claimed to combine the acme of holding power on the rail, the greatest tie surface and strength of grip, together with ease and quickness of application. It is patented by T. L. Paine, Milwaukee, Wis.

The "Security" Back-Up Valve.

A compact and positive-acting device for sounding a warning whistle, or applying the brakes from the rear platform when backing into terminals, is shown in the accompanying illustration. There are two valves in one, both worked with one handle. The brakes are set by the larger valve with a forward movement of the handle, and the whistle is controlled by the smaller valve with a backward movement of the handle. The whistle valve allows only a small amount of air to be used, and it is impossible to set the brakes unintentionally while blowing the whistle. The brake valve will apply the brakes as gradually as may be desired, and has ample exhaust area for a quick emergency application. Its action is at all times under perfect control.

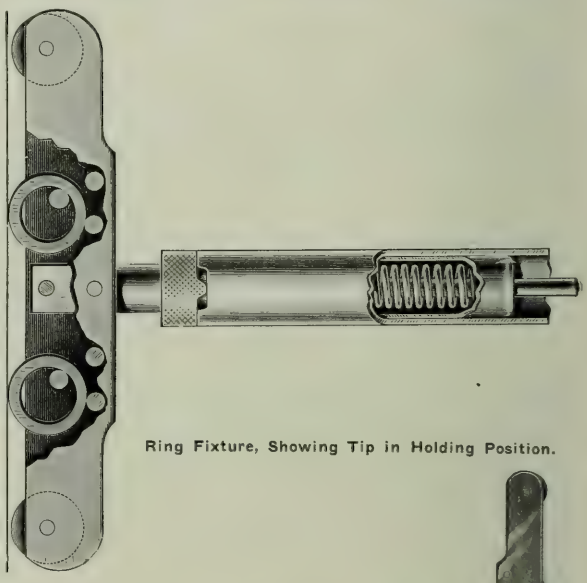


Sections of the "Security" Back-Up Valve.

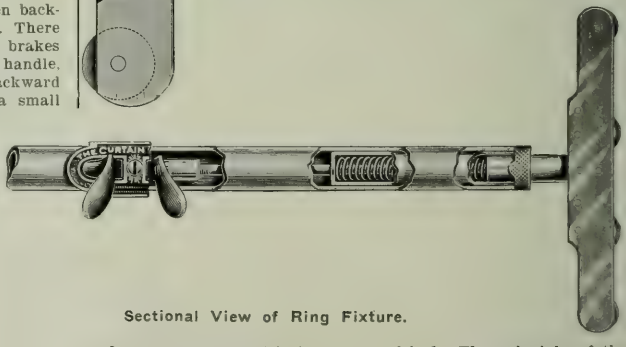
The ease and rapidity with which this valve can be manipulated is not possible with the plug-cock type of valve. It is simple and minimizes repair charges. For regular train service the back-up valve is attached to a section of hose with coupling, making it portable. For observation and private cars it may be connected permanently to the train pipe. It is useful as part of the regular caboose equipment on freight trains, as they often back through crowded stations. This valve is made and sold by Adreon & Co., St. Louis, Mo., and will be sent to railroads on 30 days trial.

The Ring Fixture for Car Curtains.

A new fixture for car curtains, for which simplicity and effectiveness are claimed, is illustrated in the accompanying engravings. It is called the "ring" fixture and is made by the Curtain Supply Co., Chicago. Its internal construction is the same as the Forsyth roller-tip fixture, including its adjustable and locking features. The ring fixture can be operated by grasping the curtain anywhere along the bottom and it is immaterial whether the grooves are rough or smooth, varnished or unvarnished. The principle of the ring fixture is new.



Ring Fixture, Showing Tip in Holding Position.



Sectional View of Ring Fixture.

One of the illustrations shows the head of this fixture in its holding position. The upward tendency of the curtain causes the two little rings in each shoe to rock or jam against the bottom of the grooves, and no jar or movement of the car can make the fixture creep upwards. At the same time the curtain can be pushed up or pulled down by the hand without injuring the fixture or forcing it out of the grooves. When the curtain is thus moved the little rings recede or rock away from the groove bottoms and the fixture then rests on the anti-friction rollers at each end of the shoes and is free to run in an easy manner. The moment the hand is taken away from the curtain the upward pull commences and the rings immediately rock against the groove bottoms and hold the fixture firmly in place. A large number of these fixtures have been in use during the past year and have apparently given entire satisfaction.

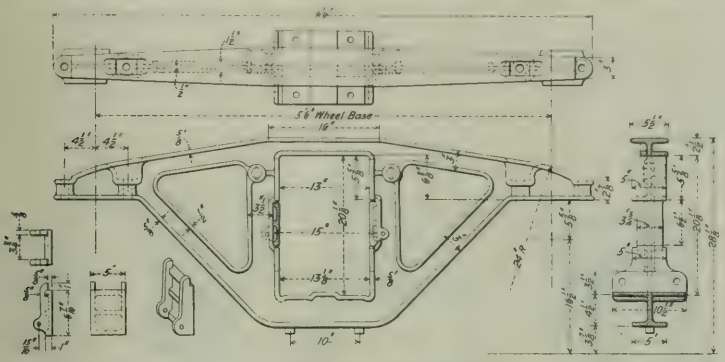
Two More Complaints Settled Out of Court.

The Interstate Commerce Commission in the case of E. M. Wilhoit vs. the Missouri, Kansas & Texas and the St. Louis & San Francisco alleging that the rate on refined oil from Erie, Kan., to Springfield, Mo., was unreasonable of itself and as compared with the rate on such commodity from Erie to St. Louis, Mo., and from

Neodesha, Kan., to Springfield, has dismissed the complaint, because after the hearing the defendants made the rate from Erie to Springfield the same as the rate from Neodesha to Springfield and from Erie to St. Louis. The Commission dismissed the complaint for the same reason in the case of Miller Brothers vs. the Atchison, Topeka & Santa Fe, alleging that rates on hogs and cattle from Bliss, Okla., to Kansas City and St. Joseph, Mo., were unreasonable.

A New Cast Steel Truck Side Frame.

The accompanying drawing shows a new design of cast steel truck side frame which has been applied in large numbers under Pittsburg & Lake Erie cars. The opening in the center is recessed 1 in. on each side to permit the bolster being put in or taken out without dismantling the truck or taking down the sand plank. When



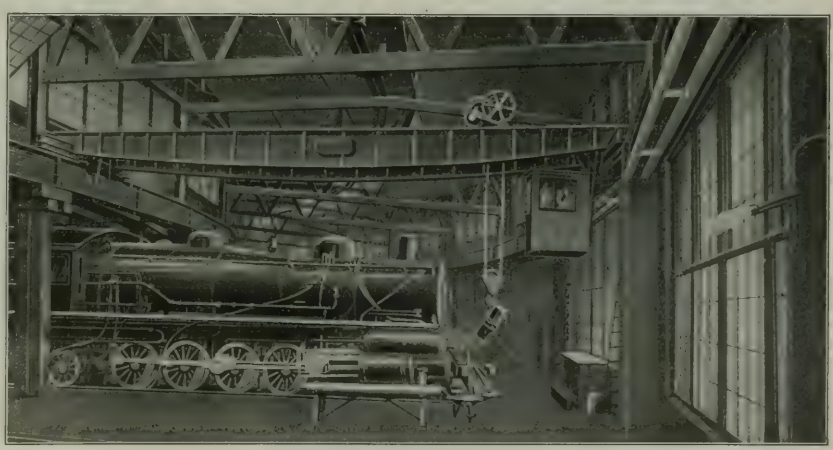
Cast Steel Truck Side Frame.

the bolster and springs are in place these recesses are closed by small fillers, shown in detail, which are locked into place and further held against displacement by a small cotter. To remove the bolster, the springs are taken out, the fillers unlocked and the bolster passed through the widened opening. The frame can be applied to any archbar truck and is suited for any type of bolster. On the Pittsburg & Lake Erie the two angles forming the sand plank are riveted to the under side of the frame instead of being bolted on as is necessary with other designs. The Pittsburg Steel Foundry, Pittsburg, Pa., is the maker.

Electric Overhead Traveling Crane for Roundhouses.

The Atchison, Topeka & Santa Fe has had in service at two of its roundhouses for almost a year the type of overhead electric traveling crane shown in the accompanying illustration. It has all of the functions of the ordinary shop crane of similar type, and spans the house from inner to outer wall. The capacity is 7½ tons and the speeds of the different movements at this loading are: hoisting, 10 f. p. m.; bridge travel, 200 f. p. m. at outer end; trolley travel, 100 f. p. m. The span of the bridge is 45 ft. 11 in.

The special feature of the crane is the provision for proper relative travel of the inner and outer ends of the bridge. This must be in exact proportion to the ratio of the radii of the inner and outer rails, and is therefore accomplished by having the gearing ratios of the two ends in inverse proportion to the ratio of these radii. Horizontal rollers on the trucks of the outer end, bearing against the rail head, prevent possible severe flanging due to imperfections of curvature of tracks or difference in traction conditions. In other respects the crane follows the standard construction of the builder, the Whiting Foundry Equipment Co., Harvey (Chicago), Ill. The essential features of the crane are covered by patents issued to this company. The two cranes referred to are in service at Raton, N. Mex., and Needles, Cal., respectively. Three more are being built for other roundhouses on the Santa Fe system.



Traveling Roundhouse Crane in Roton Shops; Atchison Topeka & Santa Fe.

New York Two-Cent Bill Vetoed.

On June 11 Governor Hughes vetoed the two-cent bill, which had passed the Senate and Assembly, with comment which ought to be read and digested by every state legislative body in the Union.

The Governor in his veto says:

This bill, with specified exceptions, provides for a maximum passenger fare of two cents a mile upon the railroads in this state. Steam railroads less than 150 miles in length which are not within the counties of New York and Kings (or within the limits of any incorporated city) are permitted a higher maximum charge of three, four and five cents a mile, according to length of line, unless through consolidation, lease or control they form part of a system whose combined lines exceed 150 miles, in which case the provision for a maximum rate of two cents a mile is applicable.

The passage of the bill was not preceded by legislative investigation or suitable inquiry under the authority of the state. Nor is the fixing of this rate predicated on reports or statistics officially collated which would permit a fair conclusion as to the justice of its operation with reference to the railroads within its purview. It plainly reflects dissatisfaction with existing conditions and an effort to provide a remedy through arbitrary action. It seems largely to have been the result of annoying requirements and discriminations in connection with the sale of mileage books on certain roads.

The bill represents a policy seriously mistaken and pregnant with disaster. It is of the utmost importance that the management of our railroad corporations should be subject to strict supervision by the state, and that regulations compelling the observance of the law and proper and adequate service should be rigidly enforced. It is the duty of these corporations to provide transportation of passengers and goods at reasonable rates, and the state should compel the performance of this obligation.

But injustice on the part of railroad corporations toward the public does not justify injustice on the part of the state toward the railroad corporations. The action of government should be fair and impartial, and upon this every citizen, whatever his interest, is entitled to insist. We shall make matters no better, but worse, if to cure one wrong we establish another. The fact that those in control of railroad corporations have been guilty of grossly improper financiering and of illegal and injurious discriminations in charges points clearly to the necessity of effective state action, but does not require or warrant arbitrary reprisals. In dealing with these questions democracy must demonstrate its capacity to act upon deliberation and to deal justly.

It is of the greatest importance not only that railroad corpora-

tions should be compelled to respect their public obligations, but also that they should be permitted to operate under conditions which will give a fair return for their service. Upon this depends not simply the security of investors but the security of their employees and the protection of every form of industry and commerce through the maintenance and extension of necessary transportation facilities. Nothing could be more opposed to the interests of the community as a whole than to cripple transportation corporations by arbitrary reduction of earnings.

It may be said that a two-cent passenger rate is not so extreme as to have a very injurious result. But this is a debatable question. Large and prosperous suburban communities have been built up through the offer of commutation rates much less than the proposed maximum. Upon the maintenance of these rates many thousands of our citizens rely. Considerable differences exist between the railroad corporations with respect to the territory they serve and the cost of service, and it is manifest that what would be fair for one might be far from fair for another.

An arbitrary dislocation of tariffs by the fiat of the legislature without investigation is a matter of serious concern. The best that could be said for such legislation would be that it should be regarded as an isolated case and not as a precedent. For if flat freight rates, either for all commodities or for different kinds of commodities, were similarly to be fixed by the legislature without investigation or proper ascertainment of their justice our railroad business and our industrial and commercial interests would be thrown into confusion.

I do not mean to be understood as saying that a maximum two-cent passenger rate would be unreasonably low. It might be high enough in many cases. Possibly it would be high enough in all cases. I fully appreciate the fact that those who have promoted this bill believe that such a rate would be fair. But I deem it most important that the policy of dealing with matters of this sort arbitrarily by legislative rule of general application without reference to the demands of justice in particular cases should be condemned. Every workingman, every tradesman and every citizen believing himself to have aught at stake in the prosperity of the country should determinedly oppose it. For it not only threatens the stability of business enterprises which makes our prosperity possible, but it substitutes unreason for sound judgment, the ill-considered demands of resentment for the spirit of fair play and makes impossible patient and honorable effort to correct abuses.

There is a better way. It has already been pointed out in the legislature of this state. It is practically impossible, in view of the nature of the problems and the many questions requiring consideration, for the legislature to deal directly with railroad rates in a satisfactory manner. Where a matter requires investigation in order that a just result may be reached, the obvious course is to create a body which can investigate with expert assistance as summarily as possible and which shall have adequate power to make appropriate orders. Such a body has been created in this state through the Public Service Commissions law, recently enacted.

Provision is made for inquiry into matters of freight rates and passenger fares and for the fixing of such rates as shall be found just and reasonable. If a passenger rate of two cents a mile is just and reasonable it can be fixed. If it is not just and reasonable it should not be fixed.

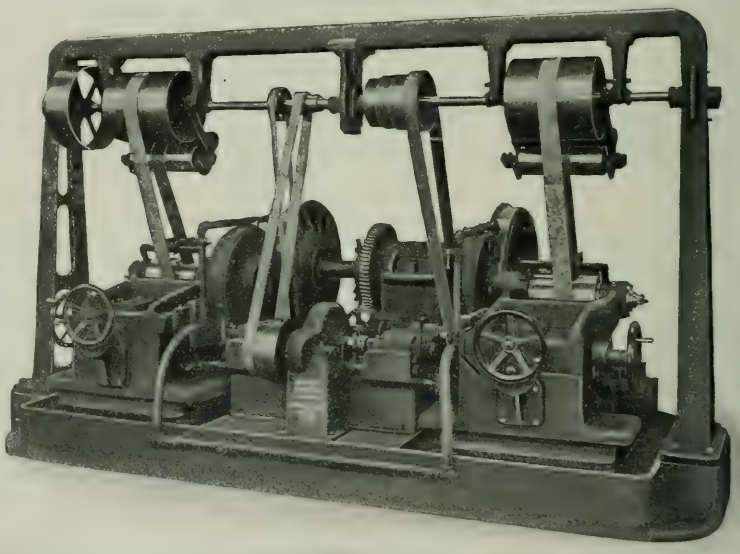
It will be said that this requires time and investigation. But it will not require any longer time or any more protracted investigation than is necessary to reach a right result. The interests of the country are so great and our individual interests are so closely interwoven that it is to the highest degree dangerous to give encouragement to the spirit of impatience with the orderly processes of inquiry.

It may also be said that many other states have adopted similar legislation. If the principle of that legislation be sound we could readily follow the precedent; but if it be unsound there is the greater reason why it should not be followed. The state of New York has provided machinery to settle these questions justly to all with as much despatch as possible. It is to the interest of all that this machinery should be made as perfect and effective as possible. It is to the interest of none that it should be discarded because of preference for arbitrary legislative action.

If this bill were to become a law it would most probably lead in many cases, on account of pretended or real necessity, to economies in service and to readjustment of rates now lower to the annoyance and injury of considerable numbers of the traveling public, for which the gain to others would not necessarily compensate. Again, the validity of such a statute would almost certainly be contested in protracted litigation, the result of which, to say the least, would be in doubt. At a critical time, when the interests of all demand that reason and judgment should control in dealing with such matters, we should have abandoned our true line of action and facilitated still wider departures.

The Norton Car Wheel Grinder.

The accompanying illustration shows a car wheel grinder made by the Norton Grinding Co., Worcester, Mass. This machine will grind car wheels up to 44 in. diameter, and engine truck wheels up to 36 in. diameter. It is arranged with water pump and tank to supply 80 gallons of water a minute, 40 gallons on each wheel. The wheels are ground, while revolving on their own journals, to within .003 in. of true. The machine grinds both new and old wheels, either chilled or steel, at the rate of from 20 to 25 pairs in a 10 hour day. While it is intended particularly for wheels for passenger service, it is claimed that freight wheels ground in this way will cost little if any more than when ground by the old methods. The method of grinding and the rigidity of the machine



Norton Car Wheel Grinder.

secures accuracy with minimum expenditure of power and maximum economy of time. The machine is furnished belted complete as shown in the engraving; also with it two grinding wheels that are made especially for this work. The arrangement of overhead works is such that a crane can pass over the machine and the pair of wheels lifted in and out of the journals. The grinding wheel spindles, boxes and wheel head are made particularly heavy to suit the service they are called on to perform.

The operation of that part of the wheel slide that travels parallel with the face of the car wheel is automatic. There is an arrangement to prevent the operator from stopping the slide in the wrong position as related to the flange on the car wheel. The traverse of the grinding wheel across the face of the car wheel is stopped by turning a small handle, shown near the water hose at the left. There is one of these handles at either side of the center for either slide. The revolution of the car wheel can be stopped accurately in the right position for removing it from the worm wheel or drive bearing. The uprights for carrying the car axles while grinding are adjustable for either car wheels or engine truck wheels. The machine can also be built to grind wheels that are not on axles. For this purpose, it is supplied with an expanding arbor; two wheels are mounted, one on either end of the arbor, and both are ground simultaneously. If individual electric drive is used a 30 h.p. constant speed motor is mounted on the overhead works bar, driving the overhead works shaft through a Morse chain and sprockets. The grinder is built for wheels for standard gage road and cannot be changed for other gages. It weighs 31,000 lbs., and is being exhibited at Atlantic City.

The Armbrust Brake Shoe.

A new type of brake shoe for locomotives, tenders and passenger and freight cars is shown in the accompanying illustrations. New principles are embodied in its construction, chief of which are: (1) the shoe is scored at the center to insure the occurrence of accidental breakage at that point where it is least objectionable; (2) spacing lugs on the back of the shoe to space same properly



Car Shoe.



Driver Shoe.

from the brake-head, and (3) a steel connector, which is placed in these spacing lugs instead of in the body of the shoe, which it would weaken. This connector is to hold broken parts—should accidental breakage occur at any point other than the center—firmly in place until worn out, thereby obviating the danger of broken shoes falling on the track.

The scoring of the shoe at the center permits it to adjust itself to the tread of the wheel, insuring good service on the tires and adding to the life of the shoe. Also, it enables the shoe to fit the brake-head at the four points of contact, taking the strain off the shoe and throwing it onto the brake-head where it properly belongs. It is claimed that the body of this shoe, either car or driver, can be worn out right down to the steel connector, and is as safe at the last ¼ in. stage of wear as at the first. The scrap remaining amounts to about 3 lbs. in the car shoe and about 10 lbs. in the driver shoe.

The car shoe is said to be especially well suited to high-speed trains with the heavy air pressure used in this service. Also, provision for holding broken parts, above mentioned, makes it a desirable shoe for elevated roads, since it prevents broken shoes from falling to the street.

The driver shoe is pinned to the brake-head the same as the car shoe, although where desired it can be made to bolt and hook onto the brake-head. On account of the form of construction it is not necessary to have rights and lefts, therefore so large a stock need not be carried; also, as there are no rights and lefts, the shoe, when worn more on one end than on the other, can be turned the same as with car shoes.

This design of shoe, known as the Armbrust, has been adopted as standard by several roads. It is made by the Love Brake Shoe Co., Chicago.

The Law of Supply and Demand.

After centuries of such vain effort to establish the just price for a loaf of bread, for the wages of servants, the rent of land, the rate of interest and many other things, the attempt was generally abandoned before the adoption of our present form of government, since which time prices have been left to the free play of the law of supply and demand. It is to my mind very astonishing that the Congress of the United States should, with practical unanimity, take this distinct step backward, for it will certainly hinder and delay, if it does not in some places absolutely prevent, the development of the West and South through the establishment of new jobbing centers.

It would also seem that under the new law we are to have a valuation of the railroads for the purpose of ascertaining whether or not any of them, and, if so, which, are overcapitalized, and this, apparently, to the end of fixing just rates for railroad freights and fares in proportion to a true valuation. If such valuation were possible, which I doubt, and the fixing in advance by any governmental agency of a just rate were possible, which I deny emphatically, the result will probably be that no railroads will be built in the undeveloped parts of this country, except at the risk and with the capital of existing lines. We are likely to have from the law of 1906 precisely the same experience as was had from that part of the law of 1887 forbidding pooling, from which it has resulted that since 1887 no railroads have been built for a share in the pools, and the only builders of railroads of any magnitude during the last twenty years have been directly or indirectly the large systems then existing or since brought together.—*Stuyvesant Fish.*

Davis Brake-Beam Testing Machine.

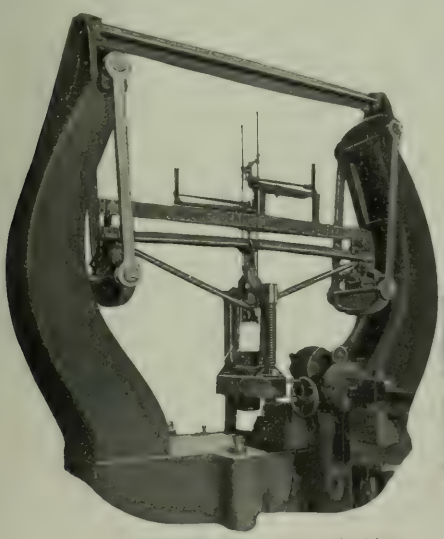
The machine shown in the accompanying illustration was designed with the view of supporting a brake-beam for test under true conditions. The columns on each end of the table of the machine are supplied with bearings at their tops, grooved to receive knife edges which are inserted in the lower edge of the top casting of each swinging link. Similar knife edges are inserted in the top edges of the lower castings of the swinging links, and these knife edges support bearing blocks grooved on the under side to receive them. These bearings in turn carry bearings which support the brake heads, and are adjustable at any fixed angle. The whole adjustment of links is such that a line drawn through the lower and upper knife edges of each link is at right angles with the cone of the center of the tread of the wheel. All the friction being eliminated, the load applied in the line of the pull of the brake-beam develops the outward forces.

Within each column opposite the lower swinging link casting, the arrangement is such that these swinging links can be held rigidly, showing the difference between testing beams on rigid blocks, and swinging links.

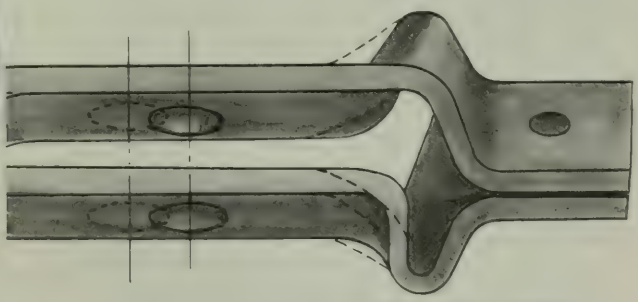
A special frame is arranged with knife edges at either end to rest on the top of brake heads or on the top of an I-beam section, as the case may be, carrying two deflectometers, one deflectometer resting on the center of the top of the beam at mid-span so as to measure the deflection at this point. A second deflectometer carries a cross head with two adjusting screw rods which run downward connecting with a similar cross head at their lower ends, with adjusting screws in the center of each cross head.

By this arrangement, deflections can be taken simultaneously both above and below the pin-hole. Investigations with this apparatus demonstrate that while there is practically no change under the load with the truss beams so far tested, it does show a marked increased deflection on I-beams.

A fulcrum such as is used in brake-beams made of I and similar sections is also shown. Investigation shows that in addition to the measurement taken on the top of such beams, there is additional deflection when measured under the fulcrum for the reason that the fulcrum springs within its length from the center of the pin-hole to the top of the under flange of the beam. The same effect is observable whether the fulcrum is made of malleable iron or forged steel. The machine is being exhibited at Atlantic City by the Davis Solid Truss Brake Beam Co., Wilmington, Del.



Davis Brake-Beam Testing Machine.



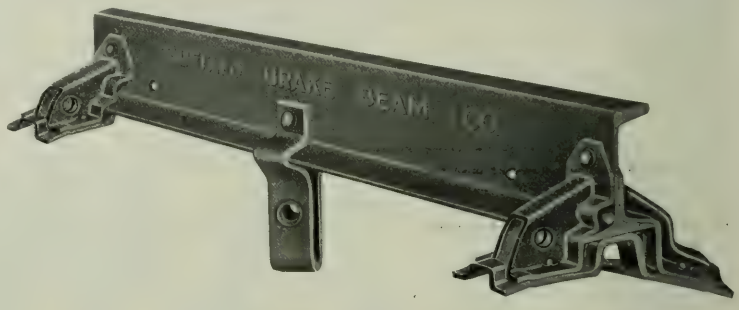
Form of Fulcrum Used in Testing I-Beam Sections.

Terms of Morse Steamship Consolidation.

Announcement has been made that the stock of the New York & Cuba Mail Steamship Company (Ward Line) may be exchanged for a like amount par value of the 4 per cent. collateral trust bonds of the Consolidated Steamship Company, and also the same amount of stock of that company. Similar terms are offered to all stockholders of the New York & Porto Rico Steamship Company. Most of these stocks have already been exchanged. Shareholders of the Clyde Steamship Company, the Mallory Steamship Company and the Metropolitan Steamship Company were offered these terms some time ago. It is probable that the Hudson Navigation Company will not be taken over by the Consolidated Steamship Company.

Forged Steel Brake Head.

The Buffalo Brake Beam Co., New York, has recently put on the market a new improvement in brake beams. It is a forged steel brake head which conforms to the M. C. B. standards and has the advantages of safety and economy. It frequently happens with the malleable iron head that the key lugs break and let the shoe drop down on the track, usually with serious consequences. With the forged steel head, as will be seen from the illustration, there are no lugs to break, the face of the head forming the bearing surface for the key. An important saving effected by the steel head is the small cost of replacing the separable face plate of the head if it is worn down by contact with the wheel due to the shoe breaking or wearing away; it is not necessary to scrap the entire head. With the introduction of this new feature the company now offers a brake beam every part of which is made of steel—a rolled steel section, forged head, fulcrum, chain clip and wheel guard. Every piece is securely riveted to the brake beam with no loose parts such as bolts, nuts, hooks or keys to work off.



Buffalo Brake Beam With Forged Steel Head.

INTERSTATE COMMERCE COMMISSION RULINGS.

Lower Rates on Peaches; Transportation Cannot be Refused.

The Interstate Commerce Commission, in an opinion by Commissioner Clements, has announced decision in the case of J. J. Waxelbaum against the Atlantic Coast Line and other carriers forming through lines to northeastern destinations from Macon and Atlanta, Ga. The complainant is a commission merchant of Macon, Ga., engaged in buying and selling fruit, especially peaches, and shipping them from points in Georgia to various markets in the North and Northeast. Complaint was made against the carriers' charges from Macon and Atlanta, Ga., to Philadelphia, New York, Washington and Baltimore, including both the charge for carriage and the charge for refrigeration.

The Commission holds that the carriers' charges per 100 lbs. for the transportation of peaches, other than refrigeration, from Macon and Atlanta, of 81 cents to Philadelphia and New York and 78 cents to Baltimore and Washington, and their refrigeration charge of 12½ cents per crate of 42 lbs., minimum carload 550 crates, between such points, are unreasonable and unjust; and that the carriers' practices in using one minimum carload requirement for transportation service other than refrigeration and a different minimum carload for refrigeration service, is also unreasonable and unjust. The Commission holds further that the rate for transportation other than refrigeration to Philadelphia and New York on carload shipments should not exceed 76 cents per 100 lbs., and to Baltimore and Washington 73 cents per 100 lbs., such rates to apply on a carload minimum of 20,000 lbs. for 36-ft. cars and 22,500 lbs. for 40-ft. cars, and that refrigeration charges on such shipments should not exceed 11 cents per crate of 42 lbs. and apply on a carload minimum of 474 crates for 36-ft. cars and 535 crates for 40-ft. cars. The carriers are ordered to make such rates effective on or before July 15, and permission is granted to put them in force on one day's notice. The Commission finds that the carriers' demurrage charge of $5 per day for detention of refrigerator cars by shippers, after expiration of 24 hours free time, and their present rates on less than carload shipments, are not unreasonable or unjust.

The Commission further holds in this decision that under the Rate Law carriers may not lawfully refuse transportation as therein defined, but must on reasonable request afford the same on established rates filed and kept posted as required by law; and that the jurisdiction of the Commission and the purposes of the law cannot be defeated by the omission or failure of carriers to include in their schedules and to keep posted and open to public inspection the rates, fares and charges for the entire service, both transportation and refrigeration, which under the law they are bound to provide.

Reconsigning Charge at Kansas City Upheld.

The Interstate Commerce Commission in an opinion by Commissioner Clark has announced decision in the case of the Board of Trade of Kansas City, Missouri, vs. the Chicago, Burlington & Quincy, Missouri Pacific, Atchison, Topeka & Santa Fe, and Chicago, Rock Island & Pacific. On complaint that the carriers' reconsigning charge of $2 a car on grain shipped to Kansas City and from Kansas City to other markets, is unreasonable and unjust as compared with the reconsigning practices at St. Louis, Minneapolis and Chicago, it appeared that the cars are held by the carriers bringing grain into Kansas City on their "hold tracks" for inspection, sale and reconsignment order, with 48 hours free time before demurrage accrues; that this involves additional service, labor and expense to the carriers and is a valuable privilege to Kansas City dealers, involving also withholding cars from other shipments for the time so detained; that this charge is absorbed by the carrier when reconsigned over its own line, and by other carriers when reconsigned over their lines, when the destination is a competitive point with another line from Kansas City, except by the Chicago, Rock Island & Pacific, which makes no distinction as between competitive and non-competitive destinations; that when grain is milled or consumed in Kansas City the milling is used by shippers to claim absorption of the charge on some other car that does go forward from Kansas City; that any reconsignment charge not absorbed by the carrier is charged back, by the Kansas City dealer, against the country shipper of the grain; that some roads do make a reconsignment charge at St. Louis and Chicago, and that at Minneapolis a charge of $2 a car, called a "running through charge," is assessed, when a car is set at an elevator or a mill and is ordered to another destination without being unloaded. The Commissioner holds that the reconsignment privilege is apparently wholly in the interest of the grain dealers and of Kansas City as a market, and that the reconsignment charge of $2 a car as applied by the carriers is not excessive, unjust or discriminatory.

Local Differentials in New Jersey.

The Interstate Commerce Commission in an opinion by Chairman Knapp has announced decision in the case of Eber De Cou vs. Pennsylvania Railroad; Pennsylvania Company, and Pittsburg, Cincinnati, Chicago & St. Louis. It appears from the evidence that the present difference in through rates per 100 lbs. on grain, flour and feed, carloads, from Chicago and other western points to Mount Holly and Pemberton, N. J., is 5 cents, Mount Holly taking the rate to New York and Pemberton, six miles east, the New York rate plus 5 cents. Prior to February, 1903, the Mount Holly rate was the New York rate plus 3 cents, and for a long period the differential against Pemberton in favor of Mount Holly was 2 cents. The Mount Holly rate was reduced on account of developed water competition. Under the 5 cent differential, complainant could save about 2.5 cents per 100 lbs. by shipping to Mount Holly and teaming to Pemberton. Since the hearing the Pennsylvania Railroad has put in a tariff naming a reconsignment charge on the traffic of 2.5 cents (50 cents per ton) from Mount Holly to Pemberton. The Commission holds that the present through rate to Pemberton as compared with the rate to Mount Holly is excessive and subjects Pemberton to unreasonable prejudice and disadvantage, that the through rate to Pemberton should not exceed the New York rate plus 2 cents per 100 lbs., and should not be at any time more than 2 cents above the rate to Mount Holly.

Manufacturing and Business.

The Dayton Pneumatic Tool Co., Dayton, Ohio, has received a large order for "Dayton" pneumatic chipping and riveting hammers from Sweden. Orders have also been received recently from Eng-

land, Italy and Canada, all of which indicates a satisfactory increase in foreign business.

Dodge & Day, Engineers and Constructors, Philadelphia, are putting up new buildings to be entirely of reinforced concrete for S. L. Allen & Co., at Fifth and Glenwood avenues, Philadelphia. The centering has already been removed from the two lower floors so that machinery can now be installed.

At a special meeting of the directors of the Joseph Dixon Crucible Company, Jersey City, N. J., on May 31, to take action on the death of Vice-President and Treasurer John A. Walker, George T. Smith was elected Vice-President, George E. Long Treasurer, and Harry Dailey a Director and Secretary.

The Westinghouse Automatic Air & Steam Coupler Co., St. Louis, Mo., is exhibiting its device in space No. 1,233 on the steel pier at the M. M. and M. C. B. conventions at Atlantic City. This equipment for automatic coupling of air and steam lines on cars has been fully described in the *Railroad Gazette*.

At the Master Mechanics' Convention at Atlantic City the Goldschmidt Thermit Company, New York, exhibits three sizes of its new fire-brick molds for welding locomotive frames. These molds do away entirely with the services of molders and pattern-makers, allowing the repair to be made in the roundhouse or repair shop. Daily demonstrations of the welding of locomotive frames are given in connection with the exhibit.

About 15,000 tenders, coaches and freight cars are now equipped with Harvey friction draft springs, made by the Frost Railway Supply Company, Detroit, Mich. The roads using them include: Chesapeake & Ohio; Delaware, Lackawanna & Western; Hocking Valley; Illinois Central; Missouri, Kansas & Texas; Chicago, Milwaukee & St. Paul; Chicago, Rock Island & Pacific; New York, Ontario & Western; Pittsburg, Shawmut & Northern, and Bessemer & Lake Erie.

The Chicago, Burlington & Quincy, on June 10, opened a new city ticket office in the Commercial Bank building at 211 Clark street, corner Adams street, Chicago. The walls of the room from floor to ceiling are panelled with mahogany with a panelling of the same wood around the ceiling. Three electric sunburst ceiling lights each 6 ft. in diameter made of bronze and fitted with opalescent glass furnish the general illumination. This is one of the best appointed ticket offices in the country.

The American Car & Equipment Co. has its shops at Chicago Heights, Ill., in full operation and is doing a large amount of repair and rebuilding work. The plant has a good location, being at Twenty-sixth street and East End avenue, directly on the tracks of the Chicago & Eastern Illinois and the Chicago Heights Terminal Transfer Railroad, which connects with all the trunk and belt lines entering Chicago. Although these shops have been in operation but a short time a large amount of business is booked and the company is preparing to double its capacity.

Alfred R. Kipp, formerly Master Mechanic of the Wisconsin Central, recently joined the engineering staff of The Arnold Company, Chicago. Mr. Kipp is a specialist in railroad shop work. He graduated from Purdue University in 1886 and received the degree of M.E. from the same institution in 1899. He served his apprenticeship on the Pennsylvania Lines from 1896 to 1900 and was then made assistant engineer of motive power of the Pennsylvania Lines, Southwest System, at Columbus, Ohio. In February, 1901, he was made general foreman of locomotive repairs at Dennison, Ohio. In June of the same year he went to the Wisconsin Central as Master Mechanic at Fond du Lac, where he remained until entering the employ of the Arnold Company. He is a member of the American Society of Mechanical Engineers, Railway Master Mechanics Association and the Western Railway Club.

Iron and Steel.

Bids are wanted June 25 by the National Transcontinental Railway Commission of Canada for furnishing 65,371 tons of 80-lb. rails, open hearth or Bessemer, and the necessary fastenings to be used on the Grand Trunk Pacific. Bids are also asked on the same date for the construction and erection of five steel bridges.

OBITUARY NOTICES.

John A. Grant, formerly Vice-President and General Manager of the Texas & Pacific, died at his home at Atlanta, Ga., on June 7. Mr. Grant was 70 years old.

Alexander W. Mackenzie, Treasurer of the Canadian Northern, the Canadian Northern Ontario, the Canadian Northern Quebec, the Halifax & Southwestern and the Inverness Railway & Coal Company, and the son of William Mackenzie, President of the Canadian Northern, died at Toronto on June 5 from heart failure following an operation for appendicitis. He was 30 years old.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

The Engineers' Club of Philadelphia.

At a meeting of this club June 1 a paper was read on "Ball and Roller Bearings in Practical Operation," by Mr. S. S. Eveland. The paper was discussed by Messrs. Christie and Hering.

American Society for Testing Materials.

This society, affiliated with the International Association for Testing Materials, will hold its tenth annual meeting at Atlantic City, N. J., June 20 to 22. Headquarters will be at the Hotel Chalfonte. Special hotel rates to members of the society and guests have been secured at $3.50 a day, or $5 with bath, for one person in a room. For two persons sharing a room, the rate will be $3 a day, or $4 with bath, from June 19 to June 23, inclusive.

The programme includes committee reports as follows:

Raw Material Supply. By Messrs. P. H. Knight and C. E. Skinner.
Standard Specifications for Coke. C. H. Zehnder, Chairman.
Purchase of Coal under Specifications and Method of Testing. S. S. Voorhees.
Cast Iron. Some Causes of Failure in Service. Robert Job.
Notes on Brick Pier Test. J. E. Howard.
On Standard Specifications for the Grading of Structural Timber. Hermann von Schrenk, Chairman.
Effect of Moisture on the Strength and Stiffness of Wood. H. D. Tiemann.
The Enforcement of Specifications.
Tests of Concrete Columns. A. N. Talbot.
Notes on Tests of Concrete Columns. J. E. Howard.
Testing of Wooden and Reinforced Concrete Telegraph Poles. R. A. Cummings.
Corrosion of Iron. Allerton S. Cushman.
Influence of Stress upon the Corrosion of Iron. Messrs W. H. Walker and Colby Dill.

CEMENT.

On Standard Specifications for Cement. George F. Swain, Chairman.
Avoidable Causes of Variation in Cement Testing. E. B. McCready.
Some Problems of a Cement Inspecting Laboratory. R. S. Greenman.
Specific Gravity of Portland Cement. R. K. Meade.
Control of Physical Test Results in Portland Cement. W. A. Aiken.
Effect of Oil on Concrete. R. C. Carpenter.
Structural Materials Testing Laboratories, U. S. Geological Survey; Progress During the Year Ending June 30, 1907. R. L. Humphrey.

PRESERVATIVE COATINGS AND LUBRICANTS.

Preservative Coatings for Iron and Steel. S. S. Voorhees, Chairman.
Priming Coats for Metal Surfaces, Linseed Oil vs. Paint. F. P. Cheesman.
Deleterious Ingredients in Paints. L. S. Hughes. Discussion to be opened by G. W. Thompson and F. P. Cheesman.
The Physical Properties of Paint Films. R. S. Perry.
Physical Testing of Varnishes. J. C. Smith. Discussion to be opened by C. B. Dudley, Robert Job and A. H. Sabin.
Paint Legislation. E. F. Ladd.
Standard Tests for Lubricants. A. H. Gill, Chairman.

IRON AND STEEL.

Standard Specifications for Iron and Steel. W. R. Webster, Chairman.
General discussion on Modern American Steel Rails. Discussion is to be opened by representatives of leading railroads, rail manufacturers, locomotive builders, car-wheel manufacturers, and inspecting engineers.
Segregation in Steel Ingots. H. M. Howe.
Effect of Conditions of Rolling on Certain Properties of Steel. H. M. Howe and William Campbell.
The Heat Treatment of Steel. William Campbell.
Mechanical Experiences with Limber and Stiff Rail Sections. P. H. Dudley.
Standard Specifications for Staybolt Iron. H. V. Wille, Chairman.
Results of Tests of Staybolt Iron. E. L. Hancock.
Tempering and Testing of Steel Springs and Standard Specifications for Spring Steel. J. A. Kinkead, Chairman.
Uniform Speed in Commercial Testing. Paul Kreuzpointner, Chairman.
The History and Development of the Alloy Practice in the United States as Applied to Railroad Bearings. G. H. Clamer.
Compressive and Transverse Tests of Steel Connecting Rods for Locomotives. Gaetano Lanza.
Tension Tests of Steel Angles. F. P. McKibben.

CONCRETE, FIREPROOFING AND WATERPROOFING MATERIALS.

Reinforced Concrete. F. E. Turneaure, Chairman.
On Fireproofing Materials. Ira H. Woolson, Chairman.
Investigation of the Thermal Conductivity of Different Concrete Mixtures, and the Effect of Heat upon their Strength and Elastic Properties. Ira H. Woolson.
Effect of Time Element in Loading Reinforced Concrete Beams. W. K. Hatt.
Tests of Twisted Steel Square Rods for Concrete Reinforcement. J. J. Shuman.
Tests of Bond between Steel and Concrete. T. L. Condron.
On Waterproofing Materials. W. A. Aiken, Chairman.

TESTING MACHINES AND APPARATUS.

Standard Methods of Testing. Gaetano Lanza, Chairman.
National Bureau of Standards. S. W. Stratton.
White-Souther Endurance Machine. H. Souther.
Notes on the Endurance of Steels under Repeated Alternate Stresses. J. E. Howard.
Effect of Combined Stresses on the Elastic Properties of Steel. E. L. Hancock.
A New Impact Machine. L. W. Page.
Development of the Penetrometer as Used in the Determination of the Consistency of Semi-Solid Bitumens. Clifford Richardson and C. N. Forrest.
Multiplying Dividers for Locating Yield Point. J. A. Capp.
An Instrument for Measuring Deformation in Tests of Materials. H. F. Moore.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Birmingham & Atlantic.—S. H. Marsh has been elected Vice-President.

Delaware & Hudson.—Cornelius Vanderbilt has been elected a Member of the Board of Managers, succeeding Frank E. Smith, who was elected temporarily at the annual meeting last month.

Abel I. Culver, Second Vice-President, has resigned.

C. S. Sims, General Manager, has been elected also Second Vice-President, succeeding Mr. Culver.

Flint River & Gulf.—T. E. Lovejoy has been elected President, with office at Hawkinsville, Ga.

Licking River.—The officers of this company are as follows: President, H. R. Stone; Vice-President, R. H. Lanyon; Secretary, M. M. Snow, and General Manager, J. W. Morrison.

Live Oak, Perry & Gulf.—J. L. Ensign, Second Vice-President, has been elected President. R. P. Hopkins, General Freight and Passenger Agent, has been appointed Traffic Manager. S. T. Grimshaw has been appointed Superintendent. The offices of all are at Live Oak, Cal.

New York, New Haven & Hartford.—Henry K. McHarg, of Stamford; Frederick F. Brewster, of New Haven; A. Heaton Robertson, of New Haven; Lewis Cass Ledyard, of New York; Charles M. Pratt, of New York, and Richard Olney, of Boston, have been elected Directors, increasing the number of members of the Board from 19 to 25.

Norfolk & Western.—William G. MacDowell, who was recently elected First Vice-President, was born in 1845 at Philadelphia, Pa. He began railroad work in 1858 as a clerk in the Auditor's office of the Empire Transportation Company. He was made Auditor of this company in 1873, and in a few months his authority was extended over the Erie & Western Transportation Company. In 1879 he was made Assistant Treasurer of the Shenandoah Valley, now part of the Norfolk & Western, and was later made Treasurer. Two years later he was made also Treasurer of the Norfolk & Western. In 1883 he was appointed Comptroller of both roads, and in 1887 Treasurer of the Norfolk & Western and affiliated companies. In 1905 he was elected Vice-President and has now been made First Vice-President.

Thomas S. Davant, who was recently elected Vice-President and Traffic Manager, effective July 1, was born at Gillisonville, S. C., and began railroad work in 1865 as station agent on the Charlotte & South Carolina, now part of the Southern. After serving on the Columbia & Augusta and the Charleston, Columbia & Augusta, which are also now parts of the Southern, he was, in 1871, made chief clerk in the General Passenger Agent's office of the last named company. Three years later he was made General Freight and Passenger Agent of the Port Royal Railroad, now part of the Charleston & Western Carolina, and in 1877 went to the Memphis & Charleston as Assistant General Freight and Passenger Agent, and in 1886 was made General Freight Agent of the East Tennessee, Virginia & Georgia; both these roads are now part of the Southern. Four years later he went to the Norfolk & Western as General Freight Agent. In 1903 he was made Freight Traffic Manager, from which position he is now to be promoted.

Rock Island Company.—A. S. Greig, who was recently appointed Assistant to the Chairman of the Board, began railroad work in 1885 on the Denver & Rio Grande. After serving as secretary to the Purchasing Agent he was made secretary to the Superintendent of Machinery, and later was transferred to the operating department as secretary to the General Superintendent; he was made chief clerk and then assistant to the General Superintendent. In 1896 he was appointed Trainmaster of the Santa Fe, Prescott & Phoenix. Two years later he was appointed Superintendent of the El Paso & Northeastern. He was later made General Superintendent and Traffic Manager of that same road, and finally Assistant General Manager, which position he held until March, 1903. During the rest of that year he was out of railroad work, and was engaged in making plans for a new sanitarium in New Mexico. In January, 1904, he returned to railroad work and performed special duties in the office of the President of the Chicago, Rock Island & Pacific until the spring of 1906, when he was appointed Assistant to the President of the St. Louis & San Francisco. This position he now leaves to become Assistant to B. F. Yoakum, Chairman of the Executive Committee of the St. Louis & San Francisco and of the Chicago, Rock Island & Pacific, and Chairman of the Board of the Rock Island Company.



A. S. Greig.

Operating Officers.

Birmingham & Atlantic.—George Dunglinson, Auditor and Assistant Treasurer, has been appointed also Superintendent.

Canadian Northern.—E. A. James, General Manager, who was recently given extended leave of absence on account of ill health, has resigned.

Canadian Pacific.—The Western division has been reorganized into three operating districts, as follows: First district: Medicine Hat, Calgary and Lethbridge sections, including Lethbridge terminal, J. S. Lawrence, previously Superintendent at Nelson, B. C., Superintendent, with office at Medicine Hat, Alb., and A. Hobkirk, Trainmaster, with office at Lethbridge, Alb. Second district: Laggan section, including Calgary terminals, Edmondton section, Wetaskiwin and Lacombe branches, J. Niblock, Superintendent, with office at Calgary, Alb.; E. L. Chudleigh, Assistant Superintendent, with office at Strathcona, Alb., instead of Calgary as previously, and T. R. Fleth, Trainmaster, with office at Calgary. Third district: Sirdar, Cranbrook, Crows Nest and Macleod sections, Curzon and Kimberly branches, G. Erickson, Superintendent, with office at Cranbrook, B. C.; J. R. McNabb, Trainmaster, with office at Macleod, Alb.

D. C. Coleman has been appointed Superintendent, with office at Nelson, B. C., succeediug J. S. Lawrence, transferred as above.

Central of Georgia.—C. F. Groves has been appointed Car Accountant, with office at Savannah, Ga., succeeding Theodore Wells, now Superintendent of the Northern Kansas division.

Cleveland, Cincinnati, Chicago & St. Louis.—See Lake Shore & Michigan Southern.

Colorado Southern, New Orleans & Pacific.—The office of General Superintendent has been abolished, and three division superintendents appointed. D. T. Forbes, heretofore General Superintendent, has been appointed Superintendent at Beaumont, Tex. F. S. James has been appointed Superintendent at Opelousas, La. W. W. Yateman has been appointed Superintendent at Orange.

Flint River & Gulf.—H. E. Rodes has been appointed General Manager, with office at Hawkinsville, Ga.

Illinois Central.—T. E. Hill, roadmaster of the Louisiana division, has been appointed Superintendent of the same division, with office at McComb, Miss., succeeding J. F. Porterfield, resigned to go to the Yazoo & Mississippi Valley. T. L. Dubbs, Trainmaster of the Fulton district of the Tennessee division at Fulton, Ky., has been appointed Superintendent of the Nashville division, with office at Nashville, Tenn., succeeding H. J. Scheuing, resigned. G. E. Gallaway succeeds Mr. Dubbs, with office at Fulton, Ky.

Lake Shore & Michigan Southern.—Albert S. Ingalls, Superintendent of the Cleveland, Cincinnati, Chicago & St. Louis at Cleveland, Ohio, has been appointed Assistant General Superintendent, with office at Cleveland, succeeding S. W. Brown, now General Superintendent of the Michigan Central.

Mexican International.—W. F. Sheridan, Superintendent of Transportation, has been appointed to the new office of General Superintendent, with office at C. Porfirio Diaz, Coahuila. M. A. Needham, Trainmaster at Torreon, Coahuila, has been appointed to the new office of Superintendent of the Southern division. J. H. Smith succeeds Mr. Needham. R. J. Schmalhausen, Trainmaster at Monclova, Coahuila, has been appointed to the new office of Superintendent of the Northern division. J. M. Thompson, Assistant Trainmaster at Monclova, succeeds Mr. Schmalhausen.

Missouri, Kansas & Texas of Texas.—R. J. Sullivan, Superintendent of the Fort Worth, Dallas, Denton and Henrietta divisions, and the Sherman, Bonham and Cleburne branches, has been appointed Superintendent of the Shreveport and Mineola divisions and the McKinney branch, with office at Greenville, Tex., succeeding C. H. Scott, Acting Superintendent. Mr. Scott in turn succeeds Mr. Sullivan. A. M. Acheson has been appointed Superintendent at Trinity, Tex., succeeding C. Hammond, assigned to other duties.

New York & Ottawa.—George H. Phillips, General Freight and Passenger Agent, has been appointed Superintendent, succeeding to the duties of S. F. Beamish, Acting Superintendent.

Sierra-California.—B. J. Bouchard, Acting Superintendent, has been appointed Superintendent, with office at Jamestown, Cal.

Southern.—W. R. Hudson, Superintendent of Terminals at Spencer, N. C., has been appointed Superintendent of the Danville divi-

sion, with office at Greensboro, N. C., succeeding C. S. Lake. J. W. Wassum succeeds Mr. Hudson.

Wichita Valley.—O. E. Maer has been appointed Superintendent, succeeding M. E. Jones.

Yazoo & Mississippi Valley.—J. F. Porterfield, Superintendent of the Louisiana division of the Illinois Central, has been appointed Superintendent of the Memphis division of the Yazoo & Mississippi Valley, with office at Memphis, Tenn., succeeding John J. Flynn, resigned to go to the Trinity & Brazos Valley.

Traffic Officers.

Bangor & Aroostook.—The office of R. K. Nickerson, Assistant General Freight Agent, has been removed from Bangor, Me., to Houlton.

Birmingham & Atlantic.—W. M. Tarpley, Assistant General Freight and Passenger Agent, has been appointed General Freight and Passenger Agent.

Chicago, Indianapolis & Louisville.—J. T. Green has been appointed General Agent at Atlanta, Ga., succeeding R. Jackson, resigned.

Denver & Rio Grande.—W. H. Cundey, Traveling Passenger Agent at Denver, Colo., has been appointed General Agent of the Passenger Department at Colorado Springs, Colo., succeeding J. M. Ellison, assigned to other duties.

Great Northern.—The Traffic Department has been reorganized, and the offices of Freight Traffic Manager and Passenger Traffic Manager have been abolished. A. L. Craig, Passenger Traffic Manager, becomes General Passenger Agent, with office at St. Paul, Minn. The office of Freight Traffic Manager has been vacant since the promotion of W. W. Broughton to the office of Traffic Manager.

Missouri, Kansas & Texas.—E. D. Chadwick, commercial agent at Shreveport, La., has been appointed General Agent at Galveston, Tex., succeeding C. L. Fontaine. See Wichita Falls Railway.

Missouri Pacific.—C. McD. Adams, General Agent at St. Louis, has been appointed General Agent at Memphis, Tenn. Charles Rippin succeeds Mr. Adams.

Southern Pacific.—J. T. Keefe has been appointed Assistant General Passenger Agent.

Washington, Idaho & Montana.—Isaac Wilson has been appointed General Freight and Passenger Agent, with office at Potlatch, Idaho, succeeding C. E. Cline, resigned.

Wichita Falls Railway.—C. L. Fontaine, General Agent of the Missouri, Kansas & Texas at Galveston, Tex., has been appointed General Freight and Passenger Agent of the Wichita Falls Railway, with office at Wichita Falls, Tex.

Engineering and Rolling Stock Officers.

Atchison, Topeka & Santa Fe.—J. F. Whiteford is General Roundhouse Inspector, with office at Albuquerque, N. Mex. In the *Railroad Gazette* of May 24, it was stated that J. E. Whiteford, general foreman at Fort Madison, Iowa, had been appointed to the new office. This was an error; J. E. Whiteford remains at Fort Madison.

Baltimore & Ohio.—W. S. Bouton, chief bridge draftsman, has been appointed Assistant Engineer of Bridges and Buildings, with office at Baltimore, Md., succeeding William Graham, resigned.

Canadian Pacific.—E. E. Austin has been appointed Master Mechanic of the Third district, with office at Nelson, B. C.

Central of Georgia.—R. M. Boldridge, formerly Master Mechanic of the Mississippi Central, has been appointed Master Mechanic of the Central of Georgia, with office at Cedartown, Ga.

Chicago Great Western.—W. A. Christian has been appointed Assistant Engineer, with office at St. Paul, Minn.

El Paso & Southwestern.—C. A. Snyder, Master Mechanic of the Gulf, Colorado & Santa Fe at Cleburne, Tex., has been appointed Master Mechanic of the El Paso & Southwestern at Douglas, Ariz.

Gulf, Colorado & Santa Fe.—See El Paso & Southwestern.

Kansas City, Mexico & Orient.—Frederick Mertsheimer, formerly Superintendent of Machinery of the Kansas City Southern, has been appointed Superintendent of Motive Power and Rolling Stock of the Kansas City, Mexico & Orient, with office at Sweetwater, Tex.

Richmond, Fredericksburg & Potomac.—C. W. Haines, Chief Engineer, has resigned, and the office has been abolished.

St. Louis, Brownsville & Mexico.—E. C. Burgess, Acting Chief Engineer, has been appointed Chief Engineer, with office at Corpus Christi, Tex.

John Nicholson, foreman of shops at Kingsville, Tex., has been appointed Superintendent of Motive Power, with office at that place, succeeding H. H. Kendall, resigned.

Toledo, St. Louis & Western.—A. A. Shane, Superintendent of Bridges and Buildings, has resigned. C. L. Kinney has been appointed Acting Superintendent of Bridges and Buildings.

Washington Terminal Company.—C. M. Harris has been appointed Master Mechanic, with office at Washington, D. C.

Western Maryland.—William Miller, formerly Master Mechanic of the Denver & Rio Grande at Denver, Colo., has been appointed Superintendent of Motive Power of the Western Maryland, with office at Union Bridge, Md., succeeding I. N. Kalbaugh, resigned.

Wichita Valley.—W. E. Bogart, Chief Engineer, has resigned to go to the Kansas, Mexico & Orient.

Purchasing Agents.

Isthmian Canal Commission.—David W. Ross, Chief Purchasing Officer, has resigned, effective on appointment of his successor.

Special Officers.

New York, New Haven & Hartford.—A. A. Maxwell, Attorney at Boston, has been appointed Commissioner of Real Estate, succeeding F. C. Fiske, deceased.

LOCOMOTIVE BUILDING.

The St. Louis-Southwestern is asking bids on 25 locomotives.

The Chicago, Rock Island & Pacific is asking bids on 11 consolidation (2-8-0) locomotives similar to the 30 engines ordered to be built at the Brooks Works of the American Locomotive Company last fall.

The Lake Superior Terminal & Transfer has ordered two simple eight-wheel switching locomotives from the Baldwin Locomotive Works for September delivery. The specifications are as follows:

General Dimensions.

Type of locomotive	Switching
Weight, total	150,000 lbs.
Diameter of drivers	50 in.
Cylinders	20 in. x 26 in.
Boiler, type	Straight top
" working steam pressure	200 lbs.
" number of tubes	262
" material of tubes	Charcoal iron
" diameter of tubes	2 in.
" length of tubes	13 ft. 5 in.
Firebox, length	44 "
" width	60 "
" grate area	52 sq. ft.
Heating surface, total	2,100 "
Tank capacity	4,500 gals.
Coal capacity	5 tons

Special Equipment.

Air brakes	Westinghouse
Tires, driving wheel	Midvale

CAR BUILDING.

The Consolidated Railway (N. Y., N. H. & H. Electric Lines) has ordered 79 cars.

The Atchison, Topeka & Santa Fe has ordered three café cars from the Pullman Co.

The Duluth, Rainy Lake & Winnipeg is asking bids on 100 box cars of 80,000 lbs. capacity.

The Toledo, Port Clinton & Lakeside has ordered five flat cars from the Hicks Locomotive & Car Works.

The Buffalo & Lake Erie Traction Company has ordered some interurban cars from the Cincinnati Car Company.

The Chicago Great Western, as reported in the *Railroad Gazette* of May 31, has ordered 1,000 wooden box cars from the Pullman Co.

The Dairy Shippers Despatch, Chicago, as reported in the *Railroad Gazette* of May 23, has ordered 50 refrigerator cars of 60,000 lbs. capacity from the Ryan Car Company.

The Union Railroad, as reported in the *Railroad Gazette* of May 3, has ordered 500 patent steel dump cars and 800 steel hopper cars from the Standard Steel Car Company, and 1,500 steel hopper cars from the Pressed Steel Car Company.

The Detroit & Toledo Construction Co., Harvey, Ill., successor to the Chicago & Southern Traction Co., has ordered 19 ballast cars from the Hicks Locomotive & Car Works in addition to the cars reported in the *Railroad Gazette* of June 7.

The Houston Electric Company, Houston, Tex., as reported in the *Railroad Gazette* of May 24, has ordered 10 semi-convertible passenger cars from the St. Louis Car Company for October delivery.

These cars will measure 28 ft. long, 8 ft. 9 in. wide and 9 ft. 6 in. high, inside measurements.

The Dairy Shippers Despatch, Chicago, has ordered 50 refrigerator cars of 60,000 lbs. capacity from the Ryan Car Co., for August delivery. These cars will be 36 ft. long, 9 ft. wide and 7 ft. 5 in. high, outside measurements. The special equipment includes:

Bolsters	Bettendorf
Brake-beams	Chicago Railway Equipment Co.
Brakes	Westinghouse
Couplers	Major
Draft rigging	Farlow
Journal boxes	Symington

The Canadian Northern, as reported in the *Railroad Gazette* of May 17, has ordered 50 steel ore cars of 100,000 lbs. capacity from the Dominion Car & Foundry Company for July delivery. These cars will measure 26 ft. 7⅛ in. long and 9 ft. 6 in. wide, inside measurements, and 28 ft. 8 in. long, over all. Bodies and underframes will be of steel. The special equipment includes:

Bolsters	Simplex
Brake-beams	Simplex
Brake-shoes	Steel backed
Brakes	Westinghouse
Brasses	Camel
Couplers	Latrobe
Draft-rigging	Miner
Journal boxes	McCord
Paint	Graphite

RAILROAD STRUCTURES.

Chanute, Kan.—The Missouri, Kansas & Texas, it is said, has plans ready for putting up a passenger station here to cost $25,000.

Evansville, Ind.—According to J. O. Crockett, of the Evansville & Terre Haute, plans for a new railroad bridge to be built over the Ohio river at this place are being made, to cost about $2,000,000.

Portland, Ore.—The American Bridge Company has orders from the Pacific Railway & Navigation Company for bridges to be built over the Miami, Kiches and Wilson rivers, to cost about $60,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Atchison, Topeka & Santa Fe.—The Kiowa & Lake City division of the Denver, Enid & Gulf has been extended from Lake City, Kan., northwest to Belvidere, 17 miles.

Bakersfield & Ventura.—An officer writes that this company has finished 20 miles of its line projected from San Francisco, Cal., southeast via San Jose, McKittrick, Sunset and Santa Paula, thence southwest via Saticoy and Montelvo to Ventura, on the Pacific coast. A branch is to be built northeast from Sunset to Bakersfield, also a branch from Saticoy south via Oxnard, to Hueneme, on the Pacific coast, a total of 370 miles. A branch is projected from Santa Paula southeast to Santa Monica, thence east to Los Angeles, 50 miles. Contracts for grading and bridges may be let early this fall. The work will include several tunnels and eight or ten bridges. T. B. Blackburn, Chief Engineer, Los Angeles, Cal.

Baton Rouge, Hammond & Eastern.—See Illinois Central.

Brazos Valley, Brenham & Gulf.—This company, incorporated in Texas to build from Brenham northwest to Waco, 131 miles, has given contracts for some of the work. D. E. Teague, of Brenham, is advertising for men to carry out the work, which is to be started this week. (April 26, p. 598.)

Bullfrog-Goldfield.—This road has been extended from Springdale, Nev., south to Beatty, nine miles.

Cairo & Tennessee River.—An officer writes that the projected route of this line is from Wickliffe, Ky., three miles east of Cairo, Ill., east through or near Mayfield, Dexter, Canton, Cadiz, Gracey, Hopkinsville, Elkton, Franklin, Scottsville, Tompkinsville, Albany, Monticello, and Jellico in Kentucky, to Newcomb, Tenn., unless built through Bell County, and Middlesboro, Ky., the road will pass through or near county seats in Tennessee as follows: Jacksboro, Tazeville, Sneedsville, Rogersville and Blountville to Bristol, approximately 465 miles. Underwriting is partially completed for building the three sections from Wickliffe east to Hopkinsville, Ky., 108 miles, and these three sections will probably be finished and put in operation within one year. A large amount of terminal property has been bought and most of the right of way secured and surveys made for 425 miles. Contracts let for the three sections to the Atlantic & Cairo Construction Company, which will probably sublet most of the work, which is ordinary level construction for most of the way to Hopkinsville, with little or no rock work. There are to be two bridges, one about 1,600 ft. or 1,800 ft. long over the Tennessee river, the other about 1,000 ft. long over the Cumberland river. Maximum grades one-half of 1 per cent., maximum curves 3 deg. L. W. Goode, President, 111 Broadway, New York; Charles H. Delano, General Manager at Mayfield, Ky., and E. C. Weston, Assistant General Manager, Wickliffe, Ky.

Cananea, Yaqui River & Pacific.—The Cananea division of this road has been extended from Fundicion southward to Novojoa, 24 miles.

Cleveland, Cincinnati, Chicago & St. Louis.—Local reports state that the old tunnel between Parker, Ill., and Vienna is to be abandoned. New surveys are being made south from Stone Fort and west of the old tunnel, also west of Vienna. The present line extends through the east section of Vienna.

Chicago & North-Western.—On June 3 the line of the Chicago & North-Western, which is being built under the charter of the Pierre, Rapid City & Northwestern from Pierre, S. Dak., west to Rapid City, was opened for traffic from Midland. The road was already in operation from Pierre west to Philip, about 25 miles. The western end of the new line is in operation from Rapid City east to Wasta, 45 miles.

Chicago, Indianapolis & Evansville.—Contract let to the Carter Construction Co. to build this projected road from Chicago south through Indianapolis to Evansville, Ind. J. B. Carter and William Kemfick are the promoters.

Grand Rapids Terminal Belt.—An officer writes that this company, which proposes to build a 14-mile belt line around Grand Rapids, Mich., will let contracts in about 30 days for some of the work. The company proposes to finish the first 3½ miles this summer. Samuel Lazarus, President, St. Louis, Mo., and Edward H. Christ, Chief Engineer, Grand Rapids, Mich.

Great Northern.—The extension of the branch from Neche, N. Dak., near the international boundary, northwest to Portage La Prairie, 78 miles, has been opened.

Gulf, Colorado & Santa Fe.—On the Jasper & Eastern extension from De Ridder, La., east 45 miles, which was built as far as Cravens last year, grading has been finished on the remaining 25 miles to Oakdale, and track laying is to be started at once. (Mar. 15, p. 384.)

Illinois Central.—Freight service was recently started on the new connecting line under construction for about two years from Herrin in Williamson County, Ill., north to Ziegler in Franklin County. About 4½ miles of the line was finished last year. The line connects the coal fields of Williamson County with the main line of the Illinois Central at Duquoin. Passenger service will shortly be started over the line.

The Roundaway district of the Memphis division of the Yazoo & Mississippi Valley has been extended from Roundaway, Miss., south to Lombardy, eight miles.

The Baton Rouge, Hammond & Eastern, projected from Baton Rouge, La., east thence northeast to Merrill, Miss., it is said, has been bought by the Illinois Central. L. S. Berg, of Baton Rouge, President of the company, will have charge of building the line from Baton Rouge east to Hammond, 41 miles, for which contract has been let to John Scott & Sons, of St. Louis. (May 24, p. 727.)

Imperial Valley.—Incorporated in Texas with $100,000 capital and office at Sartartia. The company proposes to build a line from Sugarland, in Fort Ben County, Tex., northwest paralleling the Brazos river through the counties of Fort Ben and Waller to a junction with the Houston & Texas Central near Hempstead, about 60 miles.

Jasper & Eastern.—See Gulf, Colorado & Santa Fe.

Lake Charles & Southern.—See Shreveport, Alexandria & Southwestern System.

Louisville & Nashville.—The Morganfield branch of the St. Louis & Henderson division from Providence, Ky., north to Morganfield, 26 miles, has been opened for business.

Louisiana & Pacific.—See Shreveport, Alexandria & Southwestern System.

Mississippi River & Bonne Terre.—The Gumbo branch from Elvins, Mo., south to Mitchell, four miles, has been opened for business.

Missouri, Oklahoma & Gulf.—This company has its road in operation from Wagner, Ind. T., south to the Henrietta coal fields and across the Canadian river to Dustin, Ind. T., 75 miles; also a short branch to the coal mines at Karl and at McDonald, two miles. Announcement is made that money has been secured to build the proposed extension from Dustin south to Denison, Tex., 128 miles. The company has also projected an extension north to Joplin, Mo., 120 miles, and a branch west to Shawnee, Okla., 50 miles. (Mar. 15, p. 387.)

Missouri Pacific.—The Springfield branch of the White River division of the St. Louis, Iron Mountain & Southern from Crane, Mo., northward to Springfield, 34 miles, has been opened for business.

Mount Hood Railway & Power Company.—See Portland Eastern.

NEW ORLEANS GREAT NORTHERN.—On the line which this company is building from Slidell, La., north to Jackson, Miss., 150 miles, with branches to Tylertown, Miss., 44 miles, and to Abita Springs, La., 26 miles, track has been laid from Slidell north on the main line for 69 miles to Columbia Junction; also for 34 miles on the Tylertown branch, and nine miles on the Abita Springs branch. The company last year built 44 miles in Louisiana and 14 miles in Mississippi. Grading is in progress on the balance of the line.

NEW PARK & FAWN GROVE.—See Stewartstown.

OREGON SHORT LINE.—Work on the extension of the Yellowstone Park Railroad from St. Anthony, Idaho, to the Madison river entrance at the southwest corner of the park, 70 miles, is more than half finished, and it is intended to have the track laid this year on the entire line. There is a gap of about 15 miles yet to be built to reach the terminus at the Madison river. Through Rea's Pass the line has an elevation of 7,000 ft., and for a long stretch in the Warm River canyon, about 25 miles from St. Anthony, the work was very heavy. The cost of building this line will be about $1,500,000. (Mar. 15, p. 389.)

PACIFIC RAILWAY & NAVIGATION COMPANY.—Contracts, it is said, will soon be let by this company for building 10 miles of railroad from mile post 20 northeast of Tillamook, Ore. The work includes some heavy earth work, trestles and a tunnel. Contract for the tunnel has already been let. The Astoria branch has been located for about 60 miles. (May 3, p. 632.)

PORTLAND EASTERN.—Incorporated in Oregon with $5,000,000 capital by the promoters of the Mount Hood Railway & Power Company, organized to build a line to Mount Hood. The new company is to build a line from Portland, Ore., east to Clear lake at the base of Mount Hood by way of the Salmon river and through Frog Lake Pass in Wasco County, about 65 miles. The incorporators include: A. H. Fleming, of Los Angeles; E. B. Colwell, R. T. Linney and S. W. Miller.

PRESCOTT & NORTHWESTERN.—The Cheney branch from Helbig, Ark., to Cheney, 10 miles, and the Caddo & Choctaw branch from Rosoboro, Ark., to Spears, six miles, have been opened to business.

ST. LOUIS, BROWNSVILLE & MEXICO.—The main line of this road (Third division) has been extended from Bay City, Tex., northward to Algoa, 60 miles.

SHREVEPORT, ALEXANDRIA & SOUTHWESTERN SYSTEM.—An officer of the Louisiana & Pacific writes that this company has built a line from De Ridder toward Lake Charles to a crossing of the Colorado Southern, New Orleans & Pacific at Fulton, 26 miles from De Ridder. The proposed route is via Bon Ami and Longville to Lake Charles. The Lake Charles & Southern, which is a Southern Pacific project, is building a line from Lake Charles to Fulton, and will probably absorb the Louisiana & Pacific. Contracts for all the work from Lake Charles to De Ridder have been let. The work includes a bridge over the Calcasieu river.

SOUTHERN.—Work is reported under way, laying second track on sections of this road between Washington and Atlanta. About 200 miles of the 650 miles have been finished and a large amount of grading has been done on the remaining 450 miles.

SPOKANE INTERNATIONAL.—Passenger service between Spokane, Wash., and Eastport, Idaho, 141 miles, has been begun on this line, which is allied with the Canadian Pacific, giving that road entrance into Spokane.

STEWARTSTOWN.—An officer of the New Park & Fawn Grove writes that this company, which last year extended its road east to Fawn Grove in York County, Pa., will probably extend the line east seven miles this summer to Delta. No definite action has yet been taken. John H. Anderson, President, New York; S. M. Manifold, Chief Engineer, York, Pa.

TERRE HAUTE-MEROM TRACTION.—Incorporated in Indiana with $250,000 capital to build an electric line from Terre Haute south via Prairietown, Fairbanks and Staffordshire to Merom, 35 miles. The directors include: H. L. Marlett, F. S. Lewis, J. F. Roebuck, L. Brown, A. E. Hays, R. L. Ruby and V. Pounds.

UNION PACIFIC.—The Stromsburg branch of the Nebraska division has been extended from Hordville, Neb., west to Central City, 23 miles.

WATERLOO, PERLA & SOUTHWESTERN.—Surveys under way and rights of way being secured for this proposed line from Waterloo, Iowa, on the Chicago Great Western, and Chicago, Rock Island & Pacific, southwest via Traer, Tama, Grinnell, Pella and Knoxville to Chariton, on the Chicago, Burlington & Quincy, 125 miles. Contracts will probably be let in September. B. F. Keables, President; J. L. Blank, Chief Engineer, Pella.

WAYNESBURG & MONONGAHELA.—Incorporated in Pennsylvania with $84,000 capital to build a line from Waynesburg, Pa., northeast to Monongahela, 25 miles. J. L. Rose, President; W. P. Ely, W. A. Titus, E. L. Dewey and S. M. Scott, directors.

WICHITA FALLS & NORTHWESTERN.—The Wichita Falls & Northwestern Railway of Texas has been opened for business from Wichita Falls, Tex., to Burkburnett, 14 miles.

YELLOWSTONE PARK.—See Oregon Short Line.

YORK COUNTY TRACTION COMPANY.—Dodge & Day, Engineers and Constructors, Philadelphia, have begun work on an extension of the York, Pa., Street Railway from York southwest to Hanover, 20 miles. Rapid progress is being made with this extension.

RAILROAD CORPORATION NEWS.

ATLANTA, BIRMINGHAM & ATLANTIC.—This company has been given permission to issue $10,648,600 additional capital stock, making the total outstanding $35,000,000, of which $25,000,000 will be common and $10,000,000 preferred. There is now outstanding $16,170,700 common and $8,180,700 preferred stock. The proceeds from the sale of the new stock will be used to pay for construction now under way and for additional equipment. It is expected that the terminal now being built at Atlanta, Ga., will be finished by October 1, by which date the road is to be completed into Atlanta.

BOSTON & MAINE.—The Secretary of the Boston Merchants' Association says that at the conference of the committee of the association, the Chamber of Commerce and the Associated Board of Trade of Boston, President Mellen, of the New York, New Haven & Hartford, definitely and specifically made the following pledges:

"That his road would utilize to its fullest capacity the Commonwealth docks and other waterfront property controlled by it to the end of developing the foreign commerce of the city and port of Boston.

"That there should be no diminution in the freight and passenger facilities now provided by the New York, New Haven & Hartford and Boston & Maine systems in Boston, but that these facilities should be largely increased.

"That he would work for and felt that there could be secured the abolition of the existing differentials on freight destined for shipment abroad, and that he would work for the removal of all existing differentials on domestic freight, making the through rate between Boston and Western and Southern points no greater than those to and from New York, and had no doubt of his ability to produce that result.

"That under the proposed consolidation his road would make such changes in the terminal facilities of Boston as shall make the present south terminal a union station, from which all through trains shall start, retaining at the same time the present north station, with its facilities for traffic from the north side of the city, the purpose eventually being to construct tunnel connections between the two stations.

"That there shall be no advance in existing freight and passenger rates charged by either of these railroads without the consent of the Massachusetts Railroad Commissioners and the approval of the commercial organizations represented at this conference, and that he [President Mellen] will appear before the Massachusetts Legislature, if asked so to do, favoring a bill embodying these propositions."

Secretary Wolcott adds: "Mr. Mellen also stated during the conference that he would extend to the Canadian Pacific all of the facilities they now enjoy on the Boston & Maine system, and that his efforts would be directed toward increasing them as much as possible with the idea of developing the traffic both ways."

The principal opposition to the taking over of the Boston & Maine by the New York, New Haven & Hartford thus far has come from the Lawrence estate, which holds a large amount of Boston & Maine stock. A bill has been introduced in the interest of this estate, making it unlawful for the New York, New Haven & Hartford to control directly or indirectly or attempt to control the Boston & Maine, and directing it to dispose of its holdings. It forbids any official of the New Haven to act for the Boston & Maine, and prevents any company interested in the New Haven Company from controlling the Boston & Maine; forbids dividends on the Boston & Maine stock held in violation of the act; makes void any issue of New Haven stock in exchange for Boston & Maine, and gives the Supreme Court of Massachusetts jurisdiction to enforce its proposals. It is probable that President Mellen will appear at the legislative hearing on the consolidation.

The correspondence between President Mellen, of the New York, New Haven & Hartford, and Governor Guild, of Massachusetts, in regard to the acquisition for the New Haven of the Boston & Maine appears in full on page 861.

See New York, New Haven & Hartford.

Buffalo, Rochester & Pittsburg.—This company recently issued about $700,000 equipment trust bonds, series F. When the $35,000,000 consolidated mortgage, 4 per cent. bonds were authorized in April, $3,000,000 was made issuable to provide for construction under way or projected and equipment not otherwise provided for. (Apr. 26, p. 600.)

Chicago City Railway.—The dividend of this company has been reduced from 9 per cent. to 6 per cent. The reduction was made to bring the fixed charges of the company within the income which may be expected under the new franchise ordinance requiring a division of the net income with the city. The company paid 12 per cent. dividends from 1891 to 1901 and has since paid 9 per cent.

Detroit United.—See Lake Shore Electric.

Erie.—The Erie has sold $3,000,000 6 per cent., three year notes secured by $4,000,000 Erie & Jersey Railroad bonds. This is a low grade cut-off line from Highland Falls, north via Campbell Hall to Guymard, 40 miles, on which work was stopped not long ago, but has since been resumed, and is to be finished in 1908.

See Genesee River Railroad.

Genesee River Railroad.—This company has been authorized to issue $6,000,000 first mortgage bonds. The company, which is a subsidiary of the Erie, is building a line from Hunts, N. Y., to Cuba, 30 miles.

Great Northern.—Approximate gross earnings of the Great Northern for May were $5,639,541, an increase of $1,258,518 over the same month of 1906. For the 10 months ended May 31, gross earnings were $50,781,938, an increase of $3,196,079.

Joliet & Northern Indiana.—See Michigan Central.

Kanawha & Michigan.—The stockholders have authorized an issue of $2,500,000 second mortgage, 20-year, 5 per cent. bonds to pay off the floating debt. (May 24, p. 728.)

Lake Shore Electric.—It is reported that by an arrangement between this company and the Detroit United, through electric trains will soon be put in service between Cleveland and Detroit, 180 miles. The running time will be six hours. This is said to be the longest interurban limited run in the country.

Lehigh Valley.—See Lehigh Valley of New York.

Lehigh Valley of New York.—This company, which owns the Lehigh Valley's 281 miles of road in New York state, has been given permission to increase its capital stock from $11,200,000 to $13,543,000. The proceeds of the sale of the additional stock are to be used for improvements of terminals at Buffalo.

Michigan Central.—This company has sold to Moffat & White and Clark, Dodge & Co., New York, $1,500,000 4 per cent., 50 year, first mortgage bonds which are part of an authorized issue of $3,000,000 and are secured by a first mortgage on the Joliet & Northern Indiana, a belt line leased to the Michigan Central and running from Lake, Ind., to Joliet, Ill., 45 miles. The proceeds will be used to refund an issue of $800,000 Joliet & Northern Indiana 7 per cent. bonds guaranteed by the Michigan Central and to pay for elevating tracks in Joliet and other improvements.

Missouri, Oklahoma & Gulf.—It is reported that over $1,000,000 in bonds of this company has been bought by the French-American Bank of Paris. The road is already in operation from Wagoner, Ind. T., southwest through Muskogee to Dustin, 75 miles, with a two-mile branch. The company reports extensions under construction from Wagoner north to Joplin, Mo., 120 miles, and from Dustin south to Denison, Tex., 128 miles.

New York Central & Hudson River.—It is understood that in connection with the granting of trackage rights to the New Haven over certain Boston & Albany lines, the New Haven gave the New York Central an option on the controling interest which the New Haven holds in the capital stock of the New York, Ontario & Western.

New York Central Lines.—Gross earnings for May were as follows:

	1907.	Inc. or dec.
New York Central & Hudson River	$8,418,605	Inc. $1,168,364
Lake Shore & Michigan Southern	3,770,661	" 118,550
Lake Erie & Western	415,449	" 15,004
Chicago, Indiana & Southern	244,806	" 76,257
New York, Chicago & St. Louis	891,092	" 46,566
Michigan Central	2,371,460	" 272,374
Cleveland, Cincinnati, Chicago & St. Louis	2,292,469	" 302,806
Peoria & Eastern	253,431	" 15,856
Cincinnati Northern	86,263	Dec. 40
Pittsburg & Lake Erie	1,300,194	" 14,339
Rutland	272,169	Inc. 45,049
	$20,316,509	Inc. $2,046,647

New York Connecting.—The State Railroad Commission has approved the increase of the capital stock of this road, which is to be built by the Pennsylvania to furnish a connection between its Long Island Railroad and the New York, New Haven & Hartford, from $1,000,000 to $3,000,000.

New York, New Haven & Hartford.—The New York, New Haven & Hartford has made an arrangement for trackage rights over several parts of the Boston & Albany and part of the Harlem division of the New York Central. These are as follows:

1. Boston to Ashland, 24 miles. Boston & Albany.
2. Pittsfield, Mass., to North Adams, 21 miles. Boston & Albany.
3. Boston Corners, N. Y., to Chatham, 28 miles. Harlem.
4. Springfield, Mass., to Albany, N. Y., 103 miles. Boston & Albany.

The first of these will connect two branches of the New York, New Haven & Hartford from Framingham north to Lowell and Fitchburg with Boston instead of having this traffic carried by the Boston & Albany between South Framingham and Boston as at present. It will also connect the branch line now connecting at Ashland directly with Boston, and will make possible closer and better connections from northern points over the Boston & Maine into Boston.

The Pittsfield-North Adams trackage will bring the New Haven line from the south now connecting at Pittsfield north to North Adams on the Fitchburg division of the Boston & Maine.

The Boston Corners-Chatham line will connect the Central New England with the Boston & Albany.

The most important of all of these is the 100-mile stretch of track from Albany to Springfield. This, besides connecting with the Central New England over line No. 3 just mentioned, will give the New York, New Haven & Hartford a new outlet for traffic from all its southern and eastern lines through the Albany gateway. By the acquisition of these trackage rights from the New York Central following so closely the purchase of the control of the Boston & Maine, the New Haven is given a very strong and efficient monopoly over New England traffic.

See Boston & Maine; also New York Central & Hudson River.

New York, Ontario & Western.—An annual dividend of 2 per cent. has been declared. This is the same amount which was paid in 1906. See New York Central & Hudson River.

Pennsylvania.—See New York, Connecting.

St. Louis, Brownsville & Mexico.—It is denied that this road has been bought in the interest of some of the Harriman railroads.

Southern Pacific.—With an increase of 213 miles operated, gross earnings for the month of April were $10,334,295 against $8,662,723. Expenses and taxes were $7,457,242 against $5,785,943. This increase resulted mostly from the continued congestion of traffic caused by the severe storms and washouts in March, which added largely to payments for overtime and also to the increase in the per diem rate and in station and yard forces due to congestion at the expense of a larger traffic together with a higher price of fuel and larger wage schedule. The increase in gross earnings after expenses and taxes was in each case a little over $1,671,000, so that net earnings after taxes were larger by only a nominal sum ($273) than in 1906. For the 10 months ended April 30, however, with 141 more average miles of road than in 1906, gross earnings were about $15,300,000; the expenses and taxes about $8,800,000, and net earnings after taxes about $6,500,000.

Tennessee & Carolina Southern.—This company, which is owned by the Southern, has given a trust deed to the Standard Trust Co. to secure an issue of $2,000,000 first mortgage 4 per cent. bonds due Jan. 1, 1957. The amount outstanding is $938,000. The proceeds from the bonds are being used in building an extension from Marysville, Tenn., toward Bushnell. Tracklaying has been begun.

Toledo Railway & Terminal Company.—The Ohio Savings Bank & Trust Company has filed a petition in the United States Circuit Court asking that the sale of the Toledo Railway & Terminal Company recently made at public auction for $2,000,000 to a committee representing the bondholders be vacated. It is charged that the road might have been sold for a larger price.

Trenton, Lakewood & Atlantic.—John M. Dickinson, of Trenton, has been appointed receiver of this company.

Virginia Railway.—An issue of $33,500,000 50-year, 5 per cent. mortgage bonds has been authorized. Of this amount $20,000,000 is to be issued at once to refund the debts of the Deepwater Railway and the Tidewater Railway, which have been merged in the above company. The remainder may be issued for new construction at the rate of $75,000 per mile of main line first track, and $50,000 per mile of branch line single track, or main line second track.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns OUR OWN opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:
- Station Inspectors on the B. & O. 884
- Punishment of Tramps 884
- Two Good Vetoes 884
- Master Mechanics' Convention 882
- A Defective Accounting System 883

ILLUSTRATED.
- New Office and Freight Building at Toledo for the Toledo, St. Louis & Western 885
- Master Car Builders' Reports 887
- The Denver & Interurban's Electrification Plans 900
- The Great Interior Trunk Line of China.. 908

CONTRIBUTIONS:
- The Profitable Weight and Speed of Freight Trains 884

MISCELLANEOUS:
- Address of Secretary Moseley to the M. C. B. Convention 886
- Additional Exhibits at the Atlantic City Conventions 899
- The Master Mechanics' Convention 901
- Topical Discussions 906
- Prosecution of Anthracite Coal Carriers.. 908
- Missouri Rate Laws 912
- Foreign Railroad Notes 885

GENERAL NEWS SECTION:
- Notes 913
- Interstate Commerce Commission Rulings 914
- Meetings and Announcements 915
- Elections and Appointments 915
- Locomotive Building 916
- Car Building 916
- Railroad Structures 916
- Railroad Construction 917
- Railroad Corporation News 918

VOL. XLII., No. 25. FRIDAY, JUNE 21, 1907.

In the appointment of two experienced agents as inspectors of station service, and two experienced yardmasters as inspectors of yards, the general manager of the Baltimore & Ohio has wisely provided that these new officers shall report to himself direct. An inspector must be a good deal of a fault finder and it is of the first importance that he shall be free to name the person who is at fault—and that may be the superintendent. We hope that these inspectors have four pairs of eyes apiece, for if the B. & O. is at all like several other big roads which we could name there will be a great variety of things which an inspector ought to see. Moreover, the plan of having inspectors report to the general manager should not be looked upon as a reflection on the character of the officers below him. So far as we know, the superintendents of the B. & O. are as efficient as any in the world. But unless they are decidedly better than any others in America, the inspectors can do them a service, especially by telling Superintendent *A* of the good practices, unknown to *A*, which are to be seen on Division *B*. In commending the general manager for what he has done we do not wish to discourage any superintendent whose general manager persistently neglects to do this favor for the superintendents. Any superintendent who can find two or three men of the right sort, and the money to pay their salaries, can readily find the faults in his service, without the help of the manager. The grit to cure the faults, when they are discovered, must, in any event, be found without the aid of the general manager!

The vagrancy problem in the United States has been discussed at the National Conference of Charities and Corrections at Minneapolis, and the well known fact that trespassers constitute about half the total number of persons killed on American railroads was made the text of an appeal to the public to cure the barbarous conditions which lead to this result. The other well known fact, that the principal railroads are ready to do their part toward arresting and punishing tramps was also brought out, letters from a number of presidents being read. But the appeal for action to check the drain on society caused by the tramp nuisance appears to have been engineered by someone who does not clearly see the seat of the trouble. According to the press despatches, "efforts are to be made throughout the country to enlist the co-operation of railroads, state boards of charities, local charitable societies and individuals in obtaining more adequate trespass laws and more adequate enforcement of these laws." Why not appeal more directly to the persons who are near enough to the evil to realize its magnitude? These are the local magistrates and police officers. Policemen and constables are lukewarm, or worse, because the police courts do not show hearty approval of their work by inflicting vigorous punishment when tramps are arrested. In some places the police are inefficient from less creditable causes; and in most small cities and all towns the forces are inadequate and are not encouraged to activity by the proper money stimulus; still the excuse that the magistrates undo their work is a general and plausible defense. The magistrates themselves also have a plausible excuse. They let culprits off with easy punishment, or none at all, because they grudge the expense of keeping such a horde of lazy and worthless men in workhouses; and in this reluctance to spend the public money they reflect the opinions of the taxpayers or, at least, they think they do. But where the taxpayers are unduly stingy in this matter the magistrates, realizing the nature and extent of the evil, are the men who ought to enlighten the public; and the National Charities people would do well to direct their agitation that way. Action by local and state charity boards is all well enough, but a single hustling police magistrate who should stir up aldermen, mayors and prosecuting officers, could do ten times as much good, for he could enliven his appeal with the tragic facts of intimate experience with this great blot on society.

The noteworthy comment made by Governor Hughes on his veto of the 2-cent bill, which comment was printed in the News Section of the *Railroad Gazette* last week, was based on three principal grounds: first, the passage of the bill was not preceded by anything like legislative investigation of the subject; second, injustice on the part of railroad corporations toward the public does not justify injustice on the part of the state toward railroad corporations; third, the security of the investors and of employees and the protection of every form of industry and commerce necessitates that railroads should be permitted to operate under conditions which will give fair return for their services. We quote the governor almost word for word in rehearsing these three principles, which are so self-evident

that they need absolutely no explanation. Yet there is scarcely another state in the length and breadth of the Union which is in position to affirm that its anti-railroad legislation of 1907 was enacted on the plain lines of common sense here indicated. A Pennsylvania legislative committee is reported to have said to representatives of the Pennsylvania Railroad during the recent session, "We do not want statistics; we want a 2-cent fare!" Whether it did say so or not, this point of view, extended to cover reciprocal demurrage, provisions that the conductor of a freight train may be fined for failure to carry passengers in the caboose, that a railroad company must be absolutely responsible for freight to destination, and so on through an infinite series of variations, has everywhere manifested itself this spring. It is greatly to be desired, although scarcely to be hoped, that every legislator in every state will read and digest Governor Hughes' observation that if the New York 2-cent bill had become a law, the result would have been that "at a critical time when the interests of all demand that reason and judgment should control in dealing with such matters, we should have abandoned our true line of action and facilitated still wider departures," and also that " in dealing with these questions, democracy must demonstrate its capacity to act upon deliberation and to deal justly." Legislation for revenge is not going to work any better to-day than it worked in the Granger states in the seventies.

Governor Hughes on Saturday last vetoed the train-crew bill, a measure which was even more vicious than the 2-cent fare bill, for it had no substantial purpose whatever, except to please those labor leaders who seem to think that the securing of a law of this kind is the best way to provide positions for more brotherhood brakemen. The New York legislature had followed Indiana, Kansas, Texas and South Dakota in this matter, the same as it followed the western states in the fare legislation, for no other reason, apparently, than that the action of these other states indicated that probably the railroads would peacefully submit. In his veto, quoted below,* the governor clearly shows up the real animus of the movement. Wherever railroads run trains with insufficient crews the damage is mainly a financial one—loss to the company by delays. The damage to the lives or the health of employees, which is the only damage that could possibly justify such an arbitrary law as that here proposed, is too remote and shadowy to be considered. Inconvenience to passengers (by delays to freight trains) is probably a greater grievance than the damage to firemen's health; and to redress this an investigation by the new State Railroad Commission is the proper procedure. The last paragraph of the governor's memorandum, where it speaks of "arbitrary exaction," should remind the brotherhood leaders of the many times that they have extorted from railroad managers rules as vicious as that proposed by this bill—and with as little regard for due process of law.

THE MASTER MECHANICS' CONVENTION.

Again the annual convention of the American Railway Master Mechanics' Association has been held, and, as usually happens, notable and valuable work has been done; notable in that it indicates the trend of opinion and progress, and valuable in the record of achievement that it contains. Prominent among the subjects that were discussed is one that was listed on the program as a topical discussion, but which was so absorbing in its interest that it overran its allotted time and was taken up again the next day with undiminished interest and finally referred to a committee for further report. This all-absorbing topic was presented as an individual paper by two gentlemen who made their bow to the association in this production, and who were so eager to have their paper discussed that they wrote personal letters prior to the meeting to a number of friends asking that something be said. But there was small need of that, for hardly had the president announced the subject before the house for discussion when the ball was thrown and was kept in the air until absolute lack of time compelled closure. And this subject that men were so eager to talk about and learn of was one not of physics and mechanics, but of men, young men, apprentices, and was hung on the system that has been so successfully organized on the New York Central Lines to meet and fill that most crying need of the times, the need for skilled mechanics. The success of this system at the end of the first year of its existence gave an added interest to what would have attracted attention and aroused discussion under any circumstances, and the railroad world is to be congratulated that a system has at last been developed that promises to be of permanent and widespread importance. It possesses the peculiar value that it compels the apprentice to go to school during shop hours, and pays him for so doing, that it looks after his interests and sees that he is taught his trade in the shops and not allowed merely to drift through his time to add another to the list of incompetents at the end, but is aroused to a healthy interest in his life's work from the start.

In the discussion there was commendation of what had been done; words of encouragement and hope of a final and larger success of the scheme; manifestation of an earnest interest to learn all that there was to be learned of the plan, and a recital of personal experience in similar attempts that had been more or less successful. In only two instances did speakers offer adverse criticisms. One stamped the plan as that of a kindly and paternal benevolence; the other thought that while it might afford a fairly satisfactory breeding place for captains and leaders, it would not make workmen. The promptness with which these adverse opinions were contradicted must have been almost startling to those who broached them. It was declared that far from being a benevolent institution, this apprenticeship system of the New York Central was a hard-headed business proposition based on purely commercial principles, and that it was already paying dividends in that the boys were doing more work during their shortened hours than it had been possible to get them to do in the whole day before. The objection that the plan did not tend to make workmen was controverted by the statement that it did, and that past experience goes to corroborate the fact that skill does not produce discontent, and that the man so skilled can and will work at the trade which he has learned. In short, the subject appealed to the interests of all, and it seems likely that the influence of the example that has been set will be far reaching and beneficial in its results.

As a brief record of what has been done and the golden opinions that this improvement has won from all sorts of men in its brief stay among us, the paper on the Walschaert gear was notable, as well as because it is a straw indicating the tendency of present locomotive development. The discussion was brief and was a mere experience meeting, strongly resembling other experience meetings in which the speakers were moved to rise and testify what it had done for them. There was no adverse testimony, no story of backsliding, but a unanimous record of accomplishment. In short, the association has set its seal of approval on this new arrival, and to those who bear in mind the age of the device, the wonder is that recognition has been delayed for so many years, until the recollection comes of the conditions that prevailed until recently, and then—but that is another story.

These two subjects may be taken as the landmarks of the work of the association for the year, and they exceeded all others in the interest aroused. But other examples of improved practice appeared which may be made the subject of investigation in the future, while still others are coming to be accepted as a standard of good if not of common usage. The superheater stands pre-eminent as an example of the latter. The story of the successful introduction of this device on the Canadian Pacific is of more than passing interest, resting on belief in the theoretical accuracy of a system followed by forcing it to a successful consummation through almost insuperable mechanical difficulties. It is a finer story of persistence in the pursuit of an object than appears in the simple statements of the paper that was presented. And, to those who read between the lines, it has a significance far beyond the mere state-

* This bill provides that it shall be unlawful for any railroad company in the state of New York that runs more than four freight trains in twenty-four hours to run over any part of its road outside of yard limits any freight train composed of more than 20 cars with less than a full crew of six persons, or a light engine without cars without a crew composed of one engineer, one fireman, one conductor, or flagman, when running a distance of ten miles or more from starting point.

"Freight trains are very generally operated with a crew of five persons, and the object of this bill is to compel the employment of an additional brakeman. The necessity for this is said to lie in the fact that without three brakemen the freight trains are insufficiently manned and that the firemen are compelled to leave their places in all kinds of weather to throw switches when the two brakemen are required respectively to go ahead of and behind the train.

"This bill, however, upon the facts developed before me upon the hearing and undisputed is clearly unconstitutional. Such a measure should define the service required with suitable reference to circumstances and conditions so that the law would apply in proper cases and not otherwise. The bill takes no account of the differences between the different roads and parts of roads, in track and switching facilities, and of the fact that what may be necessary in the case of some railroads may be wholly unnecessary in others.

"In the case of the New York Central it was shown that the track and switching facilities on its main lines were of such a character as to make unnecessary the employment of a third brakeman. This was frankly conceded by supporters of the bill.

"To require the expenditure of a very large amount of money (estimated at several hundred thousand dollars annually), without necessity for the outlay, is simply arbitrary exaction and taking of property without due process of law. The bill does not refer its requirements to any proper standard of necessity or provide any criterion by which its proper application under varying conditions is to be determined. It contains an absolute requirement which, upon the facts conceded before me, cannot be justified."

ment of the fact that the superheater can be applied to a locomotive and be made to show an economy of operation when considered as a whole. It shows a tendency on the part of at least one railroad to take the initiative in the introduction of an improvement. Up to the present time it must be admitted by even the most ardent admirer of American railroads that the great majority of the improvements that have been made have been introduced as the result of the persistent efforts of the supply man and not because the railroad official has been convinced of the scientific soundness of an improvement and then has proceeded to make it a working practical success on his own initiative. Perhaps this experience on the Canadian Pacific will mark the opening of a new era in this respect.

Unfortunately the mechanical stoker is still quiescent and the association is in the attitude of expectant waiting, with nothing to turn to that offers a final solution to the problem of the firing of large engines, though the candidates for favor are still at work with some prospect of ultimate success.

Details of practice still continue, and probably always will continue to occupy part of the time of the convention, and some of these that are now coming up will probably eventually settle down to a standard or recommended practice as others have done in the past, while others that have been regarded as settled will recur again and again as new conditions arise demanding a reconsideration of an old subject. That of tire shrinkage allowance may be taken as a sample. The establishment of the $^1/_{16}$ in. to the foot of diameter corresponds closely to the $^1/_{1000}$ allowance used on European railroads, where the question now is not so much that of actual shrinkage allowance as of the proper support in the wheel center to sustain the stresses that are imposed by the cooling of the tire.

Other details, such as the proper spacing of tubes, the use of corrugated tubes, and the best methods of applying hub liners, are touched on so as to keep practice up to the requirements of modern heavy service. In and through all this there was the thoroughness and high standards that have characterized all of the past work of the association.

A DEFECTIVE ACCOUNTING SYSTEM.

Under date of May 10 the Division of Statistics and Accounts of the Interstate Commerce Commission issued a circular in which it acknowledged the report submitted by the Association of American Railway Accounting Officers dated April 26, 1907, relative to operating revenue accounts, operating expense accounts, outside operations, train, engine and car miles and construction and equipment expenditures. The Commission announced that it was not yet ready to promulgate a final order, but recognized the necessity of advising carriers of its intentions in regard to the primary operating accounts to be put in force July 1, 1907, and sought to define the objects and scope of these accounts. This circular is familiar to most of our readers, and it will not be necessary for us to quote it at length. The connection of the Accountants' Association with the work of the commission arose from the fact that the association was in convention when the rate-law was passed, and a committee was appointed to take up the matter of uniform accounts with the Interstate Commerce Commission. It seems that this committee of 25 men has met every three months during the last year, while a sub-committee of seven was appointed to compile and classify the mass of detail. The work of the sub-committee was approved by the entire committee and submitted to the association April 24 at Atlantic City. The association made certain changes, and recommended the result to the Interstate Commerce Commission for adoption.

The whole matter of the accountants' recommendations and the adoption of them by the Interstate Commerce Commission, apparently without much consideration, serves to illustrate how easy it is for railroad regulation to go astray and make mistakes unless the persons doing the regulating possess the broadest kind of an outlook of the entire situation. It is well known that railroad operating accounts have two primary uses, one being to prevent unauthorized expenditures and locate properly all sums received; the other, to afford a measure by which executive officers can watch and control their properties. The recommendations drawn up by the accountants and adopted by the Interstate Commerce Commission provide very nicely for the first of these two considerations, but leave much to be desired in their provision for the second; in fact, should the order be promulgated and carried through strictly on the lines now indicated, it would work a great deal of harm to a large group of railroads.

The objections to the order may be summarized under several heads. It has been pointed out by a railroad officer who regards the entire order as a very bad one, that the system is entirely without balance, and the accounts are badly arranged, mixing in expenditures for labor and for material indiscriminately. Nearly half the cost of maintaining permanent way is lumped into one account (roadway and track) with the result that in the places where supervision and control could best be exerted by executive officers, the expense is bulked so large as to obscure all the essential facts, while in accounts where control can be but slightly exerted, the divisions are so minute as to be burdensome. Inconsistencies can also to be pointed out. Thus the rent of tracks, yards and terminals is charged and credited to expenses, while the rent of cars is charged to expenses and credited to earnings. It is pertinently asked, upon what ground it can be ruled that when A rents a track to B it works a reduction in his expenses, but that when he rents a car it swells his earnings.

An effective objection to the new accounts is also found in the fact that the proposed system interrupts the continuity of railroad statistics at a time when statistical details are most needed to point the way to necessary economies and to test the efficiency of operating methods.

The requirement that a specific charge be made to provide for depreciation, reported monthly, is likely to make a great deal of trouble for roads in the newer and less developed parts of the country. In the circular of May 10 a direct charge for depreciation is made under the head "Maintenance of Equipment." The item of depreciation, as applied to way and structures, is not yet specifically set forth, and the Commission says that it has not arrived at any final conclusion in the matter, but it says very definitely that its list of operating expenses must not be burdened with expenditures for additions, the purposes of which are to improve the property operated. Charging betterments to operation has, as a matter of fact, taken the place of a specific depreciation charge in American practice, with the important distinction that it has been wholly flexible, permitting advantage to be taken of good years and allowing such work to be passed over in bad years, without stirring up hostile comment.

After a railroad running in a densely populated section of the country has put itself in first-class shape for handling continuously heavy traffic, a rule like this works no particular injustice, from which it follows that the northern and eastern roads are not, as a whole, opposed to it, but in the undeveloped parts of the country, as, for example the Southwest, the situation is entirely different. The roads in the Southwest and other parts of the country, where the growth of population and resources is a new thing which has by no means attained its maximum, have never found it possible to provide for their old age out of their youthful earnings. They have held, and held rightly enough as events have proved, that the country was growing up around them, and that their first need and duty was to serve and develop that country in the best way they could, and it has been well said that there has never been a railroad built through an undeveloped part of the Southwest that, from the beginning of its operations, could have included in current operating expenses, charges for depreciation and obsolescence without showing a deficit.

From the standpoint of their relations with the investing public it was right and natural that these roads should desire to count among their assets the growth in business which was continually coming to them, at least to the extent that the assets be not written off year by year. As the development of these younger parts of the country has progressed, the roads have, as a matter of fact, provided adequately for depreciation through the replacement of small and old equipment with new and heavy equipment, and through the rebuilding of those portions of their lines which were the weakest and least adapted for the needs of through traffic. A long list of roads, like the Atchison, could be cited which are now charging to the upkeep of track, structures and equipment, something like double their strict necessities.

It has been the usual tendency of American railroad practice, especially during the last decade, to leave the property each year, not only in as good condition as it was the year before, but materially better, from expenditure charged to earnings. The new arrangements proposed by the Interstate Commerce Commission do not tend to improve this existing practice, but only to create an arbitrary charge, which cannot be expected to accomplish any better results than are now achieved with the flexible charge.

A hopeful feature of the situation lies in the intimation that

the depreciation charge will not at first be obligatory against way and structures, but only against equipment. The process by which a good many roads now provide for the replacement of old equipment with new does not differ very materially from the plan laid down by the accountants, although in this case, too, it is the weaker who must bear the burden. The Northern Pacific, the Pennsylvania, the Baltimore & Ohio, the Norfolk & Western and a number of other strong companies now use a system of accounting depreciation of equipment similar to that prescribed by the Commission. But these roads adopted their present systems in line with an effort to conform to the previous classification adopted by the Interstate Commerce Commission, a classification in many ways defective. If a change is to be made, it is surely of first-class importance that it be made correctly, and that the new accounts for which the railroad companies are to be held rigidly responsible be adopted only after the fullest conference between the Interstate Commerce Commission, the accountants—who are responsible for the exact records of funds—and also the executive officers, who use the accounts as a measure of efficiency of management.

How rigidly the railroads will be restricted, may be judged from the undated order of the Interstate Commerce Commission issued several weeks ago to the effect that it will be unlawful for any steam rail carrier or for the receiver or operating trustee of any such carrier to keep any account or record or memorandum of any operating expense item "except in the manner and form in said third revised issue set forth and hereby prescribed and except as hereinafter authorized." In order that the basis of comparison between the fiscal year ending June 30, 1908, and previous years be not destroyed, carriers will be allowed, during that year, to keep whatever accounts they desire in addition to the required ones, and they may also keep temporary or experimental accounts "the purpose of which is to develop the efficiency of operations," provided that such temporary or experimental accounts shall not impair the integrity of any general or primary account prescribed, and that any such temporary or experimental accounts shall be open to inspection by the Commission.

But these privileges are apparently to cease after 1908. When it is realized that the committee of the accounting officers was not a unit in itself, and that its recommendations concealed many differences of opinion, while severe restrictions prevent railroad managers from developing statistical systems especially adapted to their own needs, it goes without saying that a hasty, half-baked accounting system, designed to meet only one of the two purposes of accounts and not vised by the officers most concerned, nor even carefully considered by the Interstate Commerce Commission, should not be given the force of a ruling. There is every reason why the postponement of a year, so earnestly sought by a large group of executive officers, should be allowed in the interests not only of common fairness, but of an eventual system of accounts which will do what it is intended to do.

CONTRIBUTIONS

The Profitable Weight and Speed of Freight Trains.

Baltimore, Md., May 27, 1907.

To the Editor of the Railroad Gazette:

With regard to Mr. W. A. Worthington's letter in your issue of May 17, I have not at any time sought to dispute the obvious conclusion from my figures that the ton-mile cost under quicker movement would rise. All that I have ventured on this point is a speculation that delays, damages, injuries and wear and tear are so extensive under present methods that a critical analysis of all a railroad company's expenses might show a lower ton-mile cost for the faster movement with the lighter load. I would repeat to Mr. Worthington the question I put to him in my letter of April 8 in your issue of April 12. "What does it matter what is the cost of completing and paying for a period of railroad transportation provided the net revenue at the end of the period is more and provided that all the implements of operation have been maintained in proper working order?" I would ask him to consider that question, keeping before him at the same time the third paragraph of Mr. C. F. Noyes's letter of February 23d in your issue of March 8, viz.: "Most operating officers base their loading and movement of trains on the showing a single train can make between any two terminals." Mr. Worthington still adheres to the hypothesis that had the railroads sufficient locomotives, cars and tracks it would be better to operate on present basis. The point I am trying to bring out is that the railroads are not getting the best possible service out of the locomotives, cars and tracks already in existence, and thus we circle round and round.

I do not quite see the point Mr. W. A. Worthington seeks to make in attaching any importance to the 2,000,000 loaded car miles I took for my original table; I might just as well have taken 20,000,000, or, in fact, the entire ton mileage of the railroads in the United States. I was seeking to illustrate a principle and possibly the best way to drive home on him the import of that principle would have been to take this total ton mileage of the United States and show how much more ton mileage could have been accomplished had the business been moved in lighter load at faster rates of speed.

In a discussion of the proper point at which to compromise between load and speed I see no force whatever in his comparison of the increase in ton mileage and in the tractive power of locomotives in 1905 over 1902. The argument being that the engines are too heavily loaded to get the greatest amount of net revenue out of them, Mr. Worthington's comparison, if it has any value in the argument at all, inclines rather to support the view that the increased tractive power of locomotives has led to a weight of load that has brought about the slow movement which I am endeavoring to show is less profitable in the long run than a faster movement with lighter loads.

Mr. W. A. Worthington seeks to invalidate my original statement by pointing out that as my speeds are inclusive speeds it is physically impossible to carry the relative loads shown in the table at the given speeds because it is necessary to secure higher exclusive speeds to secure the inclusive speeds. It would no doubt have been better had I constructed the table to emphasize this undoubtedly important distinction, but the fact that I did not do so by no means invalidates the figures because each line of the statement requires a similar adjustment. In order to substantiate this I submit the following comparison based on Mr. B. A. Worthington's 15 miles running speed and nine miles inclusive speed, and on the reductions he says I should make in the load in order to secure the stated running speeds on a four-tenths of 1 per cent. grade (see his letter of February 8 in your issue of the 15th idem).

	Per hour operation—		
	9 to 15 miles.	15 to 20 miles	15 to 20 miles
Value of car-mile	10 cents.	10 cents.	8 cents.
Miles per hour inclusive of delays	9	15	15
Miles per hour exclusive of delays	15	20	20
Cars per train mile	40	33	33
No. of train-miles	50,000	60,606	60,606
Value of train miles	$4.00	$3.30	$2.64
Gross revenue	$200,000	$200,000	$160,000
No. hours in which accumulated	5,555	4,040	4,040
Cost, per train-mile	75c.	69c.	55c.
Total cost	$37,500	$41,818	$33,333
Net revenue	$162,500	$158,182	$126,667
Train mileage in hrs. gained over slow movement	.....	22,725	22,725
Revenue in hrs. gained	.....	$74,993	$59,994
Cost of additional train miles	.....	$15,680	$12,499
Net revenue from addit'l train-miles	.....	$59,313	$47,495
Total net revenue in 5,555 hrs.	$162,500	$217,495	$174,162
Increase in car mileage for the faster movement in 5,555 hrs.	749,925 or 37 per cent.		

It will be noted that for the faster operation the load is reduced 17 per cent. As stated this is based on Mr. B. A. Worthington's table showing that an increase in speed from 15 miles to 20 miles an hour requires a reduction of load to that extent, but in addition to this in the 8 cent per car-mile example it will be observed I have cut the load in the car 20 per cent., which will surely meet the requirements of Mr. Worthington's curves.

It will be said that an inclusive speed of 15 miles an hour with the lighter load cannot be secured on account of increased number of trains and consequently meeting places. My opponents laid great stress on this but I endeavored to show by the time-tables in my letter of the 4th inst. in your issue of the 10th idem that what is lost in the larger number of meetings is much more than made up in quicker movement along the road. In addition to this there can be no doubt that on crowded lines despatching delays to a train capable of moving at 20 miles an hour must be considerably less than to one moving at 15 miles an hour only, and consideration of this fact should make it evident that the table at the end of Mr. W. A. Worthington's letter in your issue of the 17th inst., in which he attributes as much delay to a quick moving train as to a slow moving one sets forth a highly improbable if not impossible condition of affairs.

I shall be challenged without doubt also on the reduction in cost from 75 cents to 55 cents per train-mile. The greater portion of this is made up of reduced cost for car repairs. Forty cars at 8 mills per car-mile is 32 cents per train-mile, but 33 cars at 5 mills (see mine of April 8th in your issue of the 12th idem) is 16.5 cents per train-mile. Thus car repairs alone reduce the cost to 58.5 cents per train-mile, leaving 3.5 cents to represent the reduction in locomotive cost and in overtime, so that I do not think it can be said I am unduly straining the figures in reducing the expense 20 cents per train-mile.

Mr. W. A. Worthington is evidently of the opinion that there is less safety to operation in increasing the number of trains to handle a given traffic. I doubt if he is justified in this opinion considering the numerous accidents that happen to the long, heavy trains of to-day and the way in which slow-moving freight trains are forced on to the time of passenger trains, both on single and

double track roads. No railroad man can travel even a few miles on the main lines of the country without experiencing those numerous stops which to the uninitiated are so unaccountable.

Should it be my good fortune to have set forth in this letter figures which my critics are more ready to accept I do not know that I can say anything more on the subject. My single aim in opening the discussion was to elicit expression of opinion as to whether our present ideas and practices relative to units of weight are resulting satisfactorily. In view of the very heavy increases in mortality and injuries both to passengers and employees (much of which according to the Interstate Commerce Commission is not reported and so escapes the official returns), in view of the difficulty of securing an adequate supply of men of the right sort to operate the trains, in view of the dilemma in relation to the rail, in view of the apparently insurmountable difficulty of making 100,000-lb. cars pivot with due safety on their trucks, and in view of sundry other important conditions which it is not necessary to detail here, it would appear that this discussion is of very great importance and demands the most serious consideration of all thinking minds in the engineering world. It may take some courage to admit that anxiety to "produce results" has led to the invasion of proper factors of safety, but if engineers are of the opinion that this has been done it seems to me that it is their imperative duty to insist on some retracement of the path that has been followed, even if indeed this should involve an order to reduce the loading 10 per cent. to 20 per cent. My own contribution to the discussion as far as it has gone is nothing more than an endeavor to show that such an order need not necessarily prove disastrous to profits.

M. B. WILD.

Foreign Railroad Notes.

The Swedish efforts to remedy the lack of fuel by substituting electricity are said to be likely to be realized, estimates having been made that five waterfalls will yield motive power enough to work all the State Railroads in southern Sweden, at a cost of $16,000,000 for installation.

The International Sleeping Car Co., the European Pullman, earned gross in 1906 $4,062,778, and net $1,536,200 from its sleeping car service. It has besides sleeping cars a large number of fine winter resort hotels, which in the aggregate yield no profit. A dividend of 16¼ per cent. was paid, and this absorbed a little less than one-half of the net earnings.

The Swiss State Railroads contemplate establishing at Renen car works for building new cars. The existing car works in Switzerland are said to have more than they can do to supply the private and street railroads. No State Railroads heretofore have attempted to build their own rolling stock.

The Austrian State Railroads have provided that on excursions of the children of the public schools the pupils will be charged only half fare, and two children under 10 may travel on one-half fare ticket; further, that for every 10 paying pupils one child who can't pay will be taken along free.

The traffic through the Simplon Tunnel during the first six months since its opening is reported to have been 230,000 passengers, and only 24,930 tons of freight, an average of 69 tons each way daily. It was hardly worth the while to excavate a tunnel 12½ miles long for such a traffic; but it is expected to do better hereafter.

New Office and Freight Building at Toledo for the Toledo, St. Louis & Western.

The Toledo, St. Louis & Western (Clover Leaf) has built at Toledo, Ohio, a new office building and freight house with the necessary track facilities to handle the business at that important terminal. The office building is at the corner of Erie and Krauss streets, the main entrance being on the former. It is a stone and brick building with three stories and a basement, the latter and all foundations being concrete. The interior of the building is finished in marble and hard wood. The first floor contains the local freight office, with quarters for the freight agent, cashier and general agent, telegraph and telephone exchanges, also a large room for stationery supplies. The entrance to the freight office is on Krauss street. The second floor has the offices of the president and general manager; second vice-president and general traffic manager; purchasing agent; general freight and passenger agent; assistant general freight agent, and their forces. The general auditor's and the freight claim departments occupy the third floor. On each floor, including the basement, is a fireproof vault 18 ft. x 22 ft. The basement contains the heating apparatus and extra storage rooms.



General Office Building and Freight House at Toledo, Ohio; Toledo, St. Louis & Western.

The freight house is immediately back of and adjoins the office building. It is 352 ft. long and 52 ft. wide. It is of wood construction and is enclosed with large automatic lifting doors. There is an open platform at the end of the building for handling oils and such commodities, and at one corner of same is a 20-ton pillar crane for moving heavy stuff. There are ten tracks, four of which are house tracks and the remainder team tracks holding between 90 and 100 cars.

The new facilities replace a freight house 22 ft. x 200 ft., which had been outgrown.

Address of Secretary Moseley to the M. C. B. Convention.

Since your last convention the question of car shortage has attracted a large share of public attention. If the enforcement of your rules unnecessarily delays the movement of cars, the rules should be altered. On the other hand, if detention is caused by the non-observance of rules which, if lived up to, would clearly facilitate the movement of cars, then some method should be devised to bring about enforcement of those rules at the April meeting of the Western Railway Club. W. E. Beecham, of the C., M. & St. P., cited cases where three roads paid $72.50 for the privilege of juggling two empty foreign cars between them, equivalent to throwing so much money away, while the cars were held out of service for two months. Mr. Beecham spoke particularly of Chicago, but the condition he points out prevails at all large terminals, and it is mighty expensive for the railroads. And the important point is that the condition is due to failure to observe the M. C. B. rules. As Mr. Beecham well says: "It is apparent that we don't need any more rules or agreements to meet the situation, and that failure to observe the rules and agreements now in effect is the cause of the trouble."

I have called attention to this matter because the charge has been made that because of its unnecessary severity in enforcing the Safety Appliance Law the Interstate Commerce Commission is largely responsible for the car shortage, and I want to refute that charge. I have never yet heard of a car being held up and juggled back and forth between two roads on account of safety appliance defects for which neither road cared to assume responsibility. It is true that cars are frequently sent back for penalty defects, but in all such cases the defects are promptly repaired and the cars again sent forward. I do not believe an inspector would take chances on treating penalty defect cars in that manner. He would fear that if he did so his road might be called upon to pay penalties in addition to per diem and he would be asked by his superiors for an explanation that might be hard for him to make. If all M. C. B. defects were covered by the Safety Appliance Law there would be much less complaint about delay to cars at terminals than there is now. With knowledge that the handling of cars with those defects laid the roads liable to a penalty would come an adequate system for promptly and efficiently repairing them.

Neither is it true that the Commission has exercised undue severity in its enforcement of this law. Copies of our inspection reports are regularly sent to the managing officers of all roads, so that they may observe whether improvement or the reverse has taken place. We have never yet entered suit without giving fair warning and ample opportunity to correct any unfavorable condition that was shown to exist. It is not the purpose of the Commission to enter on a crusade for the collection of penalties, and its inspectors are instructed to use the utmost care and circumspection in filing reports of violations. They have been impressed with the idea that the carrying out of the statute is what we are seeking to obtain, and not the imposition of penalties. The Commission has always discouraged the idea that the measure of an inspector's efficiency is the number of violations he may file against carriers, and it is a matter of supreme satisfaction both to the Commission and its inspectors when the ends of the statute can be obtained without prosecutions. I think I may safely say that the members of this Association have had sufficient experience in dealing with the Commission to know that carriers who are honestly and conscientiously endeavoring to comply with the law have no reason to complain that the Commission is unduly severe in its enforcement.

But there will be no slackening of effort. The uniform success that has attended prosecutions demonstrates the care which our inspectors have taken to secure correct information. In a case decided less than a fortnight past a judge from the bench paid a high compliment to two of our inspectors for their intelligence, and the lucid testimony they furnished on the witness stand. Out of prosecutions for 927 violations of the statute to date, adverse decisions (involving four penalties) have been rendered in but one court. These cases are now pending on appeal to the Circuit Court of Appeals for the Eighth Circuit. Four hundred and twenty-eight cases are now on the trial dockets, and penalties have been paid for 350 violations.

Of the various defects constituting the basis of prosecution, inoperative uncoupling mechanism constitute a large majority. There are 672 cases of this character. In 22 cases the chain had become kinked and wedged in the body of the coupler, thus rendering it impossible to lift the lock block. In 92 cases the lock block was either broken or missing. In five cases the chain connecting the lock block to the lever was too long, rendering it impossible to lift the lock block. In 76 cases the lever was missing. In 23 cases the lever was broken. In 433 cases the uncoupling chain was disconnected from the lock block, caused by broken links in chain, broken or missing clevis or missing clevis pins. There were 15 cases of link and pin coupler; 21 of inoperative driving wheel brakes on locomotives; 66 cases of failure to have the required percentage of air-brakes; two broken couplers; 102 missing or insecure grab irons; 21 cases of drawbars either greater or less than the standard height, and 27 cases of cars (without couplers) fastened together with chains.

In many instances carriers have paid out hundreds of dollars in penalties which could have been entirely avoided by the expenditure of a few cents in labor and materials for repairs. One road paid $1,400 for defects that could have been repaired at a cost of $6.45; another paid $1,300 for defects that could have been repaired for $2.45; another paid $600 for defects that 80 cents would have fixed; another paid $300 which could have been avoided by the expenditure of 15 cents. A total of 282 violations, involving fines amounting to $28.200, could have been avoided by the expenditure of $68.03, or an average cost per violation of 24 cents. These estimates have been made with considerable care from the scale of prices furnished by this association. Beyond any question it is cheaper to repair safety appliances than to pay penalties.

There is still considerable unnecessary handling of chained up cars. The Commission has no power to modify the terms of the statute in any particular. Carriers must in all cases judge for themselves whether or not a particular act is in violation of the law. There is now such a large body of court decisions to refer to that little difficulty should be experienced in arriving at a correct understanding of a carrier's rights under the law in most cases that may chance to arise. The movement of chained up cars has been declared unlawful by Judges McPherson, Wolverton, Trieber and McCall. The substance of the holding of these four judges is that the carriers of the country cannot localize all repairs at one shop of their entire system, but that they must have men and material which can make all these safety appliance repairs wherever there is any likelihood of defects occurring. As Judge Purnell said in his decision in the Atlantic Coast Line case, "The United States is entitled to recover the statutory penalty for violation of the Federal Safety Appliance Act under all circumstances where an injured employee has under that statute the benefit of denial of 'assumption of risk.'" From this it would appear that the government has a right to recover penalties for any and all movements whatsoever of defective equipment. As the employee does not assume the risk attending the movement of equipment not complying with the requirements of the law even to a repair point, such risk must be borne by the carrier and not by the employee.

Complaints continue numerous respecting the bad condition of hand-brakes. With the rapid increase in the use of air the hand-brake has been neglected. Many employees have suffered serious injuries in gravity yards because of defective hand-brakes, and to this cause may be attributed much of the damage to cars and their contents which is commonly laid to rough usage or carelessness in switching. Our inspectors still find many hand-brakes working opposite to the air-brakes. This is extremely dangerous and it has been so repeatedly condemned that it is somewhat surprising to find such a condition existing in any degree at this time.

There is still much to be accomplished in the direction of securing uniform compliance with the association's standards. Recognizing the need of uniformity, the Commission has endorsed your standards and endeavored to uphold them in every possible way. Its attitude has practically given your standards for the protection of trainmen the force of law. In view of this condition it seems as though it should be a matter of pride with every member to adhere strictly to standards which have been agreed to after the most careful consideration. But we find many cases where individuals have adopted their own ideas in opposition to standards, although employed by members of this association who have signified their approval of those standards. This lack of uniformity is particularly noticeable with respect to the application of grab irons. In many cases the practice seems to be to stick them on any old way, just so they are got onto the car, and it is not unusual to find grab irons applied differently on opposite ends of the same car. Uniformity in these matters is greatly to be desired. It is of more importance than the comparative merit of different devices or methods of application. Conceding that a particular method advocated by an individual may be, considered by itself, superior to the standard in point of both safety and convenience, still it cannot be approved if it destroys uniformity. What trainmen want is uniform application. They want to know, when they attempt to use a grab iron, a sill step, ladder or uncoupling lever on any car, that they will find the device in the same location, and applied in the same manner as they would expect to find it on every other car of the same class. This is especially important for the protection of men in switching cars at night, particularly in gravity yards and terminals where large numbers of cars have to be handled with the greatest possible despatch.

There is need of a standard uncoupling arrangement for passenger cars. The old style of platform arrangement has been found inadequate, because it involves the practice of disconnecting the

uncoupling chains in many cases where sharp curves exist, to prevent trains from parting while in motion; also, to obviate the danger of trains parting by the action of passengers or other unauthorized persons meddling with the levers. To comply with the law it has been deemed necessary to adopt some device that can be operated by a man standing on the ground at the side of the car and which will obviate the necessity of disconnecting chains, and in meeting this need devices of various constructions and applications are used. In the interest of uniformity and safety, a standard should be adopted.

While interchange rule No. 36 in conjunction with the Safety Appliance Law has brought about a considerable increase in the number of air-brakes in use during the past year, it is noted that there has been some decrease in the efficiency with which air-brake equipment is maintained. The cleaning and oiling of triples is frequently done in a perfunctory manner. In several instances it has been complained to our inspectors, though no positive evidence has been obtained by us that the complaint is well founded, that in certain test yards it is the practice to re-stencil triples that pass the test without cleaning. Too little attention is paid to the adjustment of piston travel. The renewal of leaky packing leathers also needs greater attention.

In some portions of the western territory our inspectors have observed that in repairing safety appliance defects preference is given to penalty and per diem cars—that is, cars of other roads. This frequently results in the neglect of other equipment and such other equipment is handled about yards, delivered to industries and interchange tracks, and sometimes permitted to go forward in trains with safety appliances in defective condition. The remedy for this appears to be increase in the repair force.

The tendency of federal legislation is to increase the financial responsibility of carriers for personal injury to their employees. This was attempted in the Safety Appliance Law. The government in effect said to the railroads: "Here are certain standards of equipment which you must maintain. Failure to observe any one of these requirements will subject you to a penalty of $100, and in addition thereto, if an employee is injured or killed through the use of equipment in violation of law, you cannot avail yourselves of the common law defense of assumed risk to avoid financial responsibility therefor."

The enforcement of the $100 penalty has brought about a wonderful improvement in railroad equipment and greatly increased the safety of employees. Experience with regard to the indirect penalty of increased liability for damages has not been so entirely satisfactory. Previous to the enactment of the Safety Appliance Law, the defense of assumed risk was very effective and was much employed in personal injury cases. Deprived of this defense, the railroads fell back upon another equally effective, namely, contributory negligence. While in legal theory assumed risk and contributory negligence are separate and distinct doctrines, it is nevertheless true that there is sufficient analogy between them to make it sometimes difficult to distinguish one from the other.

The difficulty in securing adequate enforcement of Section 8 of the Safety Appliance Law undoubtedly hastened the enactment of the Employers' Liability Law of June 11, 1906, Section 2 of which defines the rights of employees when charged with contributory negligence in personal injury cases and limits the extent to which this defense can be used by employers. The necessity for a law of this character has long been felt. All progressive countries have recognized the need for a modification of the archaic and inhuman common law rules governing the relations of master and servant and have enacted far more drastic legislation than has ever been attempted in this country to govern those relations. It is true that many of the states have enacted employers' liability laws, but they have lacked uniformity, and by reason of their essential limitations they are not applicable to interstate employments. As a consequence, the great body of railroad employees have been subjected to the injustice and inhumanity of common law rules. The constitutionality of this law has been vigorously attacked by the railroads. * * *

Were it not for the earnest co-operation which the Commission has received from members of your association in its efforts to secure the ends of the Safety Appliance Law, the extremely favorable conditions now prevailing would not exist. Our inspectors have always been treated with the greatest consideration by the master car builders; we have never yet received a complaint that the attitude of any member of your association was anything less than cordial and helpful. Were the matter of maintenance of equipment so as to preserve the conditions contemplated by the law left entirely in the hands of the master car builders, I feel confident in asserting that prosecutions for violation of the statute would be extremely rare.

Through its action in increasing the appropriations, the government has signified a determination to continue its policy of vigorous enforcement of the law, and it is but fair to say that it is the Commission's intention, if possible, to demonstrate to the railroads that it is a measure not only of economy but of humanity to keep equipment in such a condition of repair that prosecutions in court will be no longer necessary; in other words, that it will be cheaper to repair equipment than to pay penalties for violation of the law. * * *

Master Car Builders' Reports.

The committee reports of the Master Car Builders' Association are quite up to the standard of previous years. We have given considerable space to the report on Tests of M. C. B. Couplers, and have made an abstract of such of the others as are important for record.

REVISION OF STANDARDS AND RECOMMENDED PRACTICE.

The following is a list of the important recommendations of the committee:

Standards.

Standard 5 by 9 Journal Box.—That the inside dust guard be restored at the top, and that it be joined to the inside side wall with a 3-in. radius, with the center located 1 in. above the horizontal center line of the box, and (b) that the opening in the outside wall be enlarged at the side and struck with a 4-in. radius all around. The dimension 5⅛ in. increased to $5^{3}/_{16}$ in. from the center of the box to the inside of the lug for the journal-bearing key, located in the top wall of the box, and that the width of the inside side lugs for the journal bearings be narrowed up from 2¾ in. to 2⅝ in. Fig. 1 shows the lines which are modified by the above suggestions, the dotted lines showing present openings in the back of the box and full lines the approved suggestions.

Standard 5½ by 10 Journal Box.—Similar changes should be made in the 5½ by 10-in. box, Sheet 17, the dimensions being as follows: Inside dust guard wall to be restored at the top, joined to the inside side wall with a 3-in. radius, center located 1½ in. above center line. Opening in outside back wall to be two 4-in. radii, the lower one-half to have its center line on center line of box, the center of the upper one-half to be ⅛ in. above center line of box.

The dimension 5⅝ in. from center of box to wedge face to be changed to $5^{11}/_{16}$ in. Width of inside lugs be changed from 3¾ in. to 2⅝ in. Fig. 2 shows the lines which are modified by the above suggestions, the dotted lines showing present openings in the back of the box and full lines the approved changes.

Axles.—The committee recommends that Sheet 7 be revised as follows: Axles A, B and C, that the radius between the wheel seat and the rough collar on the inside of the hub of the wheel be changed from ⅛ in. to ¾ in., as shown on axle D, with the center from which the radius is struck coincident with the inside face of the hub of the wheel, instead of being located inside of the face of the hub, as is the case on axle D. The axle D also to be changed in this regard, and also that the radii between the dust guard and the wheel seat of axles A, B and C be changed from ⅛ in. to ¼ in., as in axle D.

Brake Head and Shoe.—The brake head shown on Sheet 8 is a cast-iron pattern as adapted for wooden brake-beams. Owing to the large number of metal brake-beams in use, it is apparent that the only dimensions which should be considered are those governing the face and lugs for the attachment of the shoe. The committee submits and recommends a new drawing showing only the essential standard dimensions of the brake head, these same lines to be used in the combined drawing of the brake head and shoe. Also the shoe drawing revised to that (in part) shown in the report of the committee on brake-beams of 1906. We recommend the abolition of the sectional views A-B and C-D and the substitution therefor of the section X-X and the cut showing relation of ends of head and shoe. The section X-X differs from the present M. C. B. standard in rounding the outer edges of the shoe with a ⅜-in. radius on each side and making the face straight instead of tapered to one side. If thus made, shoes are not required to be right and left; cannot be wrongly applied; will take full bearing after a very few miles' run, and in a measure prevent overheating of the throat of the flange. Mr. Muhlfeld, G. S. M. P., of the Baltimore & Ohio, also suggests as follows:

> "With reference to the question of brake-beams, we would recommend that the bearing in the head of the brake-hanger be made with a curved surface, with a radius approximately equal to the length of the brake-hanger. This is to provide for the endwise motion of the brake-beam which, in the present form of brake-hanger bearing, with the flat surface, produces a pinching and bending of the hanger, and results in the failure of the hangers and the beams dropping on the tracks. By this change in the brake-head and the use of a brake-hanger with a curved bearing for the brake-head it will provide a rocking motion to the hangers and beams, and relieve the bending action of the hangers."

The committee also recommends the adoption of the brake head gage there shown. The recommended new Sheet 8 is shown in Fig. 3.

Brake-Beams.—The report of the special committee on brake-

beams to the 1906 convention recommends for [illegible] brake-beams which are already standards and no statement of this is made, probably for the reason that they further recommend that beam No. 1 of the 7,500-lb. capacity with $^{1}/_{10}$-in. deflection shall not be put on cars weighing over 30,000 lbs. Braking at 30 per cent. of the light weight would impose a braking load of 5,250 lbs. on each of the four brake-beams. Too low a limit of weight has been imposed and it would be safe to place the No. 1 beam under cars weighing not over 35,000 lbs., which would impose a load of 6,125 lbs. per beam when braking at 70 per cent.

Specifications for Brake-Beams.—Changing distance to center of brake heads from 60½ to 60¼ in. is approved. Distance gage for brake heads is also approved. That all

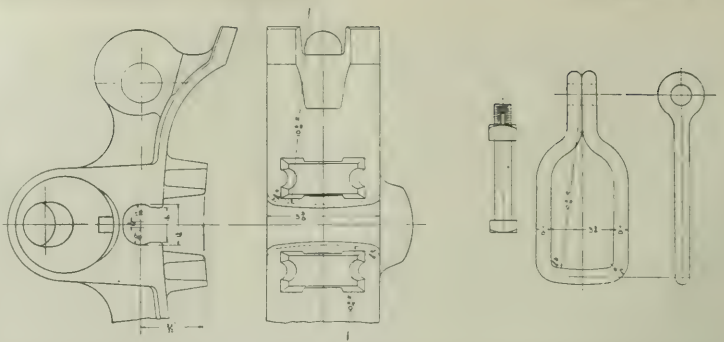


Fig. 3 Recommended M. C. B. Standard Brake Head and Shoe, Brake-Shoe Key and Brake-Head Gage.

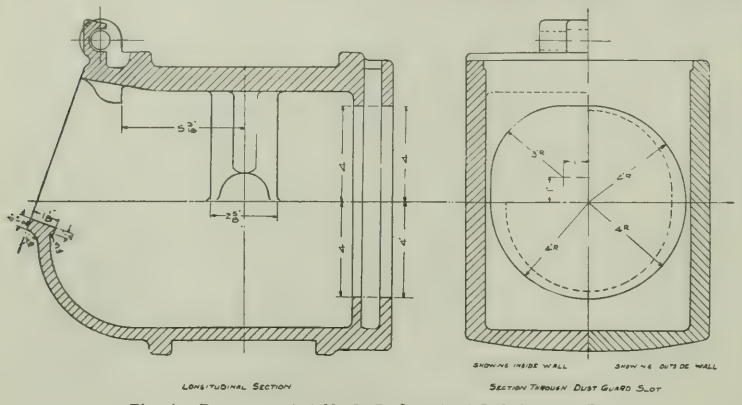


Fig. 1—Recommended M. C. B. Standard 5x9 Journal Box.

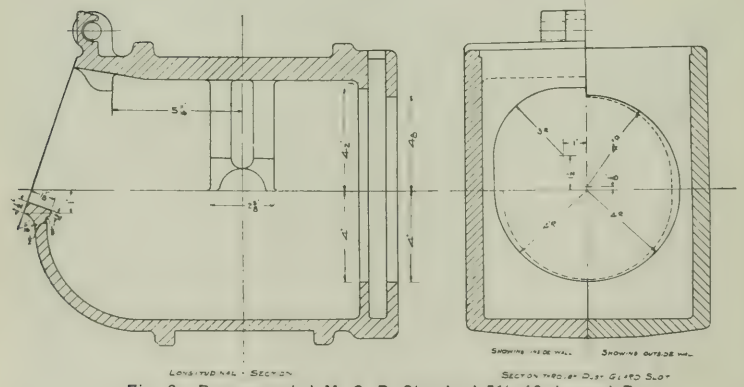


Fig. 2—Recommended M. C. B. Standard 5½x10 Journal Box.

not more than $1^{3}/_{32}$-in. diameter is not approved. The standards for air-brakes on freight cars show pins $1^{5}/_{32}$-in. diameter and all holes for such pins 1⅛ in., and same dimensions should rule with brake-beam fulcrum holes. The committee recommends an addition to this item of the specification, to read as follows: "Holes to be made straight and true by drilling, reaming or broaching." The pin-hole gage is recommended for adoption.

The maximum of 9½ in. from the lever pin-hole to extreme back of beam is objected to by some manufacturers, and the committee can see no good reason in the restriction, and this recommendation is not approved. Test paragraphs are approved.

Recommended Practice for Brake-Beams.—That all beams be inside hung is approved, provided it will be construed as not recommending present outside hung brakes to be changed except where it can be conveniently and economically accomplished. That all beams be hung 13 in. from the rail is not approved, as the present standard for outside hung beams is 14½ in. from the rail. That brake hangers shall be attached to the brake head at the center and just back of the central brake-shoe lug is not approved. Such a hanging contributes to the unbalancing of beams so that they will drag shoes on the wheels unless held by a third suspension hanger; with "solid" beams such hanging makes a weak brake head construction or else makes an excessive depth of beam over all measured from the pin-hole; there is no special advantage apparent in the longer hanger required. A generally better hanging of freight brake-beams will be obtained with the hanger opening 3 in. above the center, and the committee recommends this as the principal location; at the center and alternate location to be used as may be desired. That brake-beam hangers shall be ⅞-in. diameter, is approved, provided the recommendations made in reference to brake heads and shoes, revised sheet 8, are accepted. Center to center of safety hangers to be 51 in. is approved. Angle of the lever fulcrum is already a standard of the Association and should be so stated.

The lever pin-hole 3 in. in front of the top of the brake head lugs is a dimension which is excessive, and will result in the weight of the lever overbalancing many types of beams and causing tops of brake-shoes to drag on the wheels. A very considerable number are in favor of a reduced distance, the various amounts recommended being 1½, 1¾, 2, 2¼, 2½ and 2¾ in. In view of the range of practice it is not feasible to obtain a single standard and therefore, as a step in that direction, the committee proposes two standards, namely, 2 in. and 3 in. from lever pin-hole to top of brake head lugs.

Lever pin-holes to be not less than $1^{3}/_{32}$ in.,

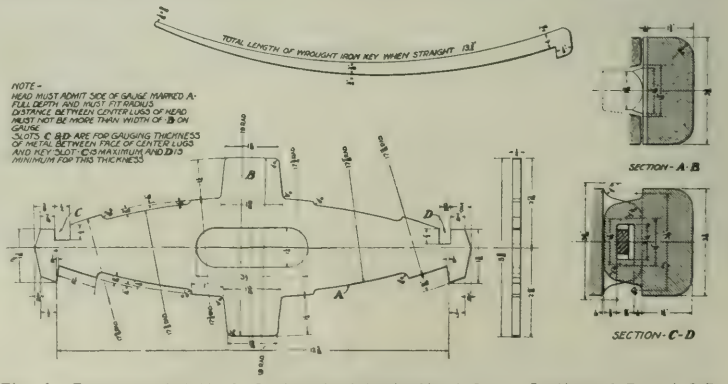


Fig. 4—Recommended M. C. B. Standard Brake-Head Gage; Sections A-B and C-D to be Abolished

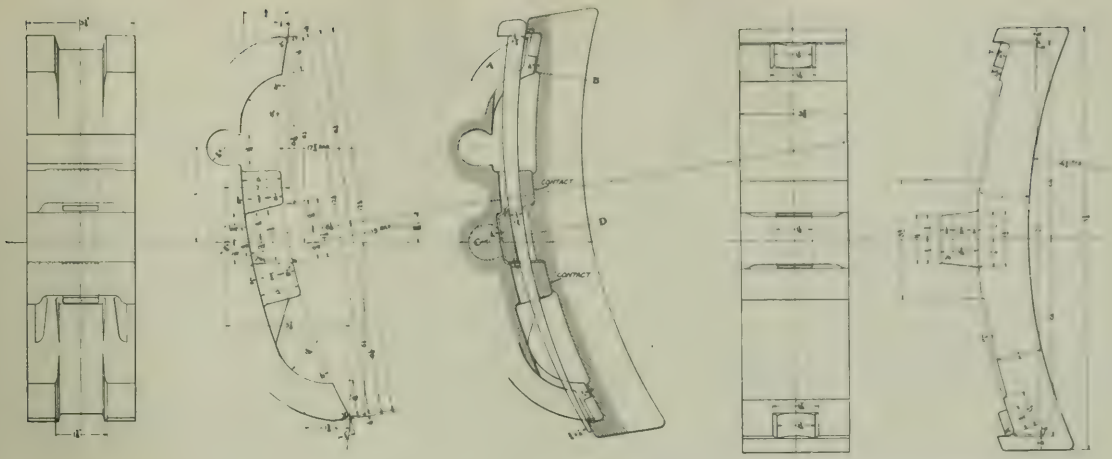


Fig. 5—Standard M. C. B. Contours of Brake Head, Shoe and Key and Their Relation to Each Other.

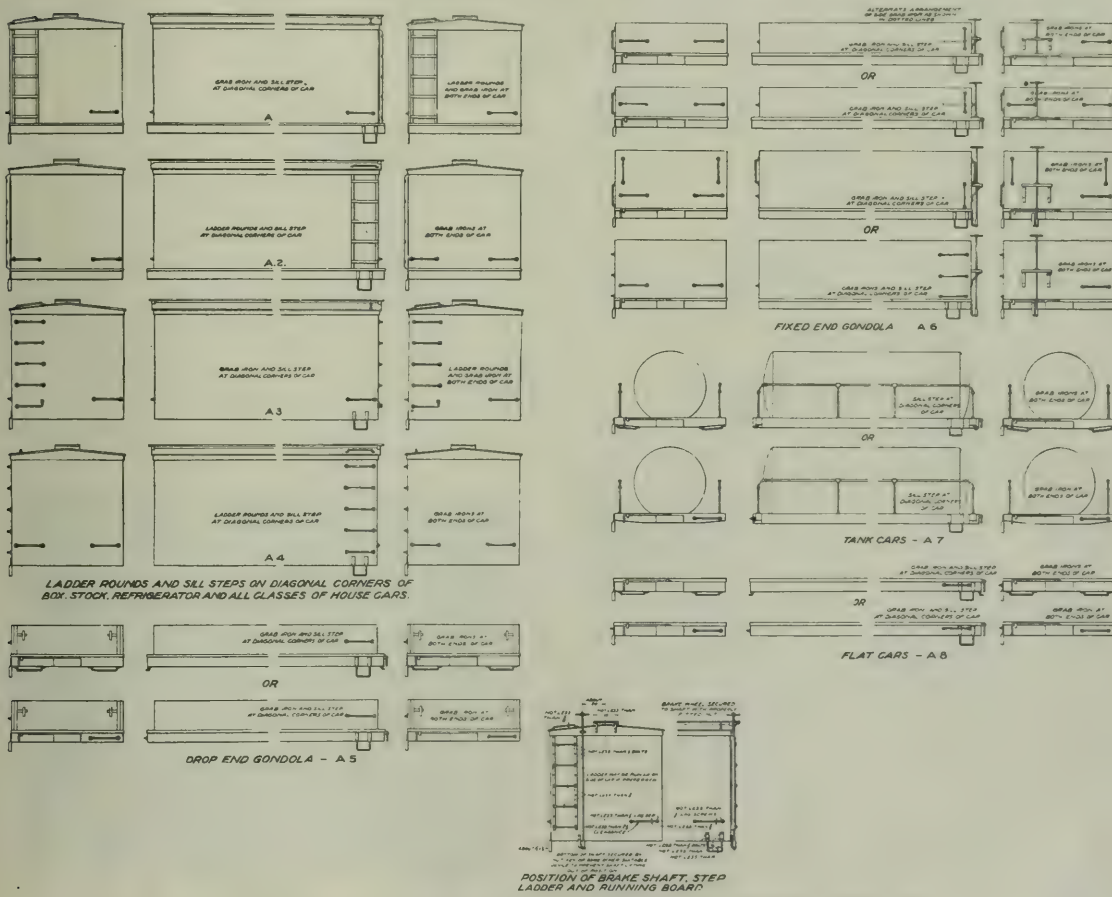


Fig. 6—M. C. B. Standards for Protection of Trainmen; Revised Drawing of Sheet 19.

proved. That the angle of brake-beam hangers with respect to a line drawn from the center of the brake-shoe to the center of the axle shall be as nearly as possible 90 deg. is approved. The use of third suspension hangers on all brake-beams is not believed to be necessary or advisable on freight equipment to secure a well-hung brake, *i.e.*, that approaches the wheel properly on application and then drops away from it freely on release with either a full or worn shoe. Probably third hangers are advisable with beams hung from the center and unbalanced by any other means. It is quite possible that the hanging can be so arranged as to sufficiently balance the beam and do away with the third hanger, which is not so frequently seen on freight equipment as to lead to the belief that it should be seriously entertained. The committee does not, therefore, approve this recommendation.

For safety hangers the recommendation that chains should be used is not approved. Two-link safety chains wear fast enough

without increasing the number of wearing points. The most successful safety device for brake-beams is a solid loop or stirrup passing around and under the beam attached to the bolster or truck side. Brake-beam safety chains are not mentioned in the present standards or recommended practice, and the committee doubts the wisdom of their introduction.

The recommendation that in order that these specifications may be generally observed, after September 1, 1910, all cars not equipped with brake-beams built in accordance with these specifications be subject to rejection in interchange on account of improper equipment, should be framed as a rule and proposed for adoption among the Rules of Interchange.

Air-Brakes, General Arrangement and Details.—The committee recommends that ⅜-in. straight link hand-brake chain be made a standard, and further recommends that the chain be attached to brake masts with a machine bolt instead of an eye bolt.

Siding, Flooring, Roofing and Lining.—Criticism has been made that the V in the section of siding does not show exactly central. It was the intention of the committee that proposed these sections in 1901 to have the V central and they will be so shown in the future.

Protection of Trainmen.—The text of the proposed changes is not reproduced here but Fig. 6 is a revised drawing of Sheet 19. —Editor.

Recommended Practice.

Safety Chains for Freight Cars.—The committee suggests that the buffer blocks shown on the drawing be eliminated, they being obsolete.

Box Car Side Door and End Door Fixtures.—This sheet should be referred to a special committee to cull out what is obsolete and to recommend modern and up-to-date door arrangements and fixtures. The present sheet is now 10 years old.

Pedestal and Journal Box for Passenger Cars for Journals 5 x 9 in.—This box and pedestal could be improved by being made 9 in. in width, and it should be referred to a special committee to make recommendations and propose designs.

The report is signed by T. S. Lloyd (Chairman), J. E. Buker and T. M. Ramsdell.

BRAKE-SHOE TESTS.

Last year attention was called to the fact that up to that time the committee on brake-shoes had been confined to a study of frictional qualities, and the importance of some work being undertaken which might lead to information concerning wearing qualities was urged. The practicability of such tests was shown, and a design for a proposed addition to the testing machine which would make them possible was presented as an appendix to the committee's report. As an initial step in the work for the year now ending it was determined that the work of the year should concern itself exclusively with a study of the wearing qualities of brake-shoes.

From a study of the problem the committee reached the conclusion that tests to determine the durability of the shoe might readily be made in the laboratory, provided some additional mechanism could be attached to the brake-shoe testing machine. The purpose of the proposed addition would be to permit the shoe to be brought in contact with the wheel of the testing machine for a predetermined interval, after which it would be automatically released, remaining in release position for another and a much longer interval, during which time both wheel and shoe would return to their normal temperature. It was believed that by such a cycle any shoe could be given a definite amount of exposure to wear, that a comparatively short interval during the application and a much longer one during the release would avoid all chances of excessive heating, and that by its automatic action the motion of the machine could continue hour after hour, with but little attention from the laboratory attendants. Accessory to the large machine there would of course be required a registering counter to show the number of applications, and a delicate balance for weighing the shoes before and after they are exposed to the action of the machine.

A mechanism which, when applied to the existing testing machine, would give the function above described, was designed by Prof. W. P. Turner, of Purdue University, employing compressed air for bringing about the required movements, the supply and discharge being governed by a light and comparatively inexpensive valve driven by gear connections with the testing-machine shaft. Under the control of the apparatus the brake-shoe testing machine may be run steadily at any given speed, the shoe being automatically applied and released. The apparatus was placed in service early in April and has since been employed in tests the results of which appear in another paragraph. Two sets of connecting gears are at present supplied. By the use of one, hereafter referred to as Gear A, the shoe is in contact with the wheel approximately one-tenth the total time and by use of the other, hereafter referred to as Gear B, one-quarter of the total time. The exact action is as follows:

Cycle Controlled by Gear A.

Revolutions during which shoe is in contact with wheel.... 160
Revolutions during which shoe is out of contact with wheel.1,440

Under the control of this gear 1,600 revolutions, or approximately the equivalent of 2.6 miles running, were required for each complete cycle. After some preliminary running it was decided that progress under this cycle was unnecessarily slow.

Cycle Controlled by Gear B.

Revolutions during which shoe is in contact with wheel.... 190
Revolutions during which shoe is out of contact with wheel. 610

Under the control of this gear 800 revolutions, or approximately the equivalent of 1.3 miles running, were required for each complete cycle. It was found that by employing a speed equivalent to 20 miles an hour and a brake-shoe pressure during application of 2,808 lbs., the machine could be kept in continuous motion under the cycle without undue heating either of the wheel or shoe. The severity of test conditions may be judged by the fact that the work done by the brake-shoe during each application is approximately the same as that which would be done by each of the eight shoes of a loaded 100,000-lb. capacity car in bringing the car to rest on a level track from a speed of 40 miles an hour. Shoes giving a high coefficient of friction, however, are under test conditions exposed to action which is somewhat more severe than that which would be required to stop the car. Under these conditions the wheel never became more than sensibly warm to the touch, and the shoe never excessively hot.

Shoes subjected to wearing test.—In selecting shoes for test, it

SPEED CONSTANT AT 20 MILES PER HOUR. PRESSURE OF SHOE ON WHEEL 2808 POUNDS REVOLUTIONS OF WHEEL DURING APPLICATION 190. EQUIVALENT DISTANCE RUN DURING APPLICATION 1641.5 FEET.

NUMBER OF SHOE.	RAILWAY CO SUBMITTING SHOE	MARKINGS ON SHOE	COEFFICIENT OF FRICTION	WEIGHT OF SHOE, POUNDS.	NUMBER OF APPLICATIONS	TOTAL LOSS OF WEIGHT POUNDS	LOSS OF WEIGHT PER APPLICATION POUNDS	1000,000 FOOT-POUNDS OF WORK ABSORBED PER APPLICATION	1000,000 FOOT-POUNDS OF WORK ABSORBED PER POUND OF MATERIAL LOST
1	2	3	4	5	6	7	8	9	10
158	HOCKING VALLEY RR	S IF STREETER	22.5	22.046	90	.229	.002544	1.036	407.2
161	"	◇	21.8	21.208	94	.644	.006850	1.004	146.6
163	AT & SF RR	BXU 36 PAT'D 1900	21.7	19.964	118	.337	.002856	1.000	350.1
172	AT & SF R.R.	G 79-B	22.8	17.180	90	.366	.004066	1.050	258.2
175	W & LE RR	NBC STD 33	30.3	11.202	40	.690	.017250	1.395	80.8
178	"	33 IN PAT. 1 5 04	20.0	18.662	90	.364	.004044	.921	227.7
179	"	PITTSBURG BR. SHOE CO	36.8	9.298	40	.593	.014825	1.695	114.3
183	O M & N RR		38.7	7.846	60	.615	.010250	1.782	173.8
186	"	C-23	24.1	13.778	90	.615	.006833	1.110	162.5
194	L S M S RR	LAPPIN	26.5	22.730	90	.198	.002200	1.220	554.6
200	"	STREETER	22.7	15.780	90	.243	.002700	1.045	387.0
203	"	STEEL BACK LSEMS CARS	23.5	17.610	90	1.058	.011755	1.082	92.0
209	"	STEEL BACK PULL CARS	24.7	16.818	90	.593	.006588	137	178.0
215	OSS & A RR		20.9	16.354	90	.320	.003555	.963	270.9
220	C & A RR	AM. CEF CO.	26.5	13.066	91	.220	.002417	1.220	504.7

Table 1—Wear of Brake Shoes on Cast Iron Wheels.

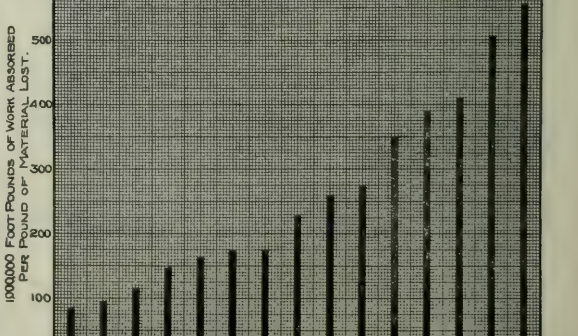


Diagram Showing Energy Absorbed per Unit of Weight of Material Lost in Brake Shoe Tests.

was thought proper to take those for which frictional results were reported last year. Fifteen such shoes were available. All had been submitted for test by railroad companies, and had been taken from service after having been about half worn. A description and photograph of each shoe, and a statement of their frictional qualities, constitute a part of the committee's report for 1906.

Tests to determine resistance to wear.—The cycle employed was that obtained by use of Gear B and the conditions were those mentioned in connection with a description of that cycle. Briefly stated they are as follows:

Diameter of test wheel	33 in.
Material of test wheel	Cast iron
Revolutions, per cycle	800
Revolutions during which shoe has contact with wheel	190
Revolutions during which shoe is out of contact with wheel	610
Brake-shoe pressure	2,808 lbs.
Revolutions per minute	204
Equivalent speed, per hour	20 miles
Approximate time interval during which shoe has contact with wheel	1 min.
Approximate time interval during which shoe is out of contact with wheel	3 min.

By the maintenance of these conditions it was found easily possible to secure from 80 to 100 applications in a single day's run.

Before a test, the shoe was carefully weighed on an accurate balance. It was then exposed to wear in accord with the program already set forth. A registering counter attached to the machine gave a record of the number of contacts. Weighings of the shoe made at intervals as the work proceeded, clearly showed that the loss of weight was always proportional to the number of stops. While the balance used in weighing the shoes was so delicate as to permit a determination of the loss for a single application, the values reported have in all cases been determined from a considerable number of applications for which the gross loss in weight was so great as to admit of no considerable error in determining its value. The results are given in Table I.

Basis for comparison.—It is apparent that no measurement of wear is complete which does not take into account the frictional qualities of the shoe; that a true measure must include both wearing and frictional qualities and this is best expressed in terms of energy absorbed per unit of weight of material lost. Assuming that the conditions affecting the exposure of the shoe to wear are equally fair to all shoes tested, comparisons upon this basis should constitute a satisfactory measure by which to determine the relative value of the different shoes as a means of stopping trains. Such a comparison is graphically shown by the accompanying diagram. A more detailed explanation of Table I is as follows:

Column 4 gives the coefficient of friction as reported to the convention of 1906. Column 5 is the weight of the shoe at the beginning of the wearing test. Column 6 shows the number of applications made. Column 7 gives the total loss of weight in pounds. Column 8 gives the loss of weight per application. This equals the total loss of weight divided by the number of applications. Column 9 shows the number of million foot-pounds absorbed per application. This is found by multiplying the pressure contact (2,808 lbs.) by the coefficient of friction (column 4), by the distance in feet passed over by the surface of the wheel during the application (1,640), and by dividing by one million. Column 10 shows the million foot-pounds of work which can be done by each shoe under conditions of test for each pound of material lost. It is obtained by dividing the values of column 9 by those of column 8. That the values in column 10 vary between wide limits is best shown by the diagram accompanying.

Significance of results.—In carrying out the tests all shoes were subjected to the same exposure to wear. Whether the relative results would be the same had the conditions of test involved lighter pressure or higher speeds than those which were actually employed, is a question which the committee has not yet had time to determine. It is not impossible that a shoe giving a relatively poor performance under the conditions of the test would show relatively better under some other conditions. If, for example, shoes are designed for specified service, it would perhaps be unfair to expect all to show at their best under a single condition of operation. The probability is, however, that a shoe which is good under one condition of running will not be bad under other conditions. But, as has been stated, these are questions which have not been studied, and the results as set forth in the accompanying diagram should be accepted, not as an absolute measure of the relative values of the shoes in question, but rather as an exhibit of facts obtained by a process which is clearly described and the significance of which each member will be able to judge for himself. They illustrate the sort of information which can be secured.

It is a matter of regret that no measure has yet been made which will disclose the wear of the wheel under the influence of the shoe. To secure such a measure, it will be necessary to have a balance of sufficient capacity to weigh the wheel and of such delicacy as to indicate differences in weight as small as one five-hundredth part of a pound. No such balance is now available at the laboratory. The possibility that some of those shoes which show high performance in the accompanying diagram may have been protected from wear at the expense of the wheel makes it highly desirable that precise information be had upon the print.

The preceding statements show the possibility of formulating a prescribed laboratory test covering the wearing qualities of shoes. Enough has been accomplished to reveal both the intricacies and the value of a much more elaborate study of the brake-shoe problem. It would seem that the time has come when mechanical tests could very profitably be supplemented by chemical analyses of the shoes tested, to the end that, step by step, the problem may be proven. Thus far the committee has not involved the Association in any considerable expense. It would be well if, in further expression of its interest, the Association could provide a fund sufficiently large to permit the committee to proceed actively for a considerable period along both mechanical and chemical lines.

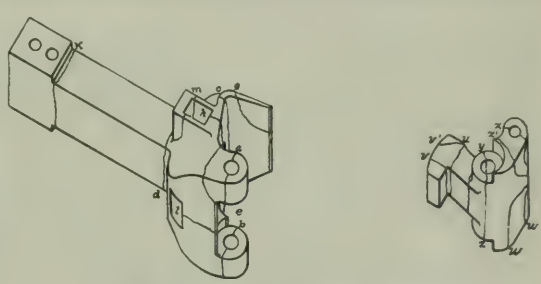
The report is signed by W. F. M. Goss, G. W. West, B. D. Lockwood.

TESTS OF M. C. B. COUPLERS.

During the past year the committee has made a thorough investigation of the breakages and failures of steel couplers with the view of obtaining some reliable data concerning the location and nature of such fractures, and to recommend such changes as will strengthen the couplers in the weakest parts, improve them, and to reduce the failures to a minimum.

An examination was made of approximately 5,000 broken steel couplers and 3,000 broken steel knuckles, together with the locks or their substitutes, of the more prominent types of couplers.

The locations of the breakages of the couplers and knuckles are shown in the accompanying diagram, and comprise the most common fractures found. For convenience, the detail breakages, which localize around a particular part of the coupler or knuckle, have been combined.



Location of Coupler and Knuckle Breakages.

The various breakages have been grouped as follows:

COUPLER.

(Combined breakages.)

"A"—Combined breakage of the lugs, comprising:
- "a"—Upper pivot pin lug.
- "b"—Lower pivot pin lug.
- "c"—Just back of upper lug.

"H"—Combined face breakage, comprising:
- "e"—Neck of the guard arm.
- "g"—Upper corner of guard arm.
- "h"—Through face into locking-pin hole.

"D"—Combined failure of the shank, comprising:
- "d"—Immediately behind horn.
- "k"—Immediately in front of butt.
- Bent shank.

(Singular breakages.)

- "l"—Side wall of head behind knuckle tail.
- "m"—Across horn through locking-pin hole.

KNUCKLE.

(Combined breakages.)

"U"—Combined breakage of knuckle-tail bearing, comprising:
- "u"—Knuckle tail immediately forward of lock bearing.
- "v"—Knuckle tail through lock bearing.

"X"—Combined breakage of coupling lugs, comprising:
- "w"—Lower lug through link-pin hole or corresponding position on solid knuckle.
- "w"—Neck of lower lug or corresponding position on solid knuckle.
- "x"—Upper lug through link pin hole or corresponding position on solid knuckle.
- "x"—Neck of upper lug or corresponding position on solid knuckle.

"Y"—Combined breakage at pivot pin hole, comprising:
- "y"—Directly through pivot pin hole.
- "z"—Immediately back of pivot pin hole shoulder.

(Singular breakages.)

- "v"—Knuckle tail behind lock bearing.

The couplers represented were not all M. C. B. standard, that is to say, only about six of the types shown on the diagrams had been tested under the M. C. B. specifications to a greater or less extent during the last two years. The latest type of couplers which have been on the market for a year or two are not shown, inasmuch as an insufficient number of these later designs were found broken to compare them with accuracy.

Breakage of 5 by 5-in. Shank Couplers.

Lug Breakage.—In the 5 by 5-in. shank couplers the lug breakages have decreased in the later type of couplers, which can be attributed to the strengthening of the lugs in design by the manu-

between 1905 and the increased amount of metal which was added when the contour lines were last changed. The upper lug breakage has been the most serious of the three breakages grouped under this head, which can be accounted for by the fact that most lug breakages are caused by broken knuckle pins, the lower half dropping out and the upper half remaining in the head. In three types of couplers, the breakage "e" just back of upper lug was greater than through the upper pivot pin lug, which can readily be overcome in the design.

Face Breakage.—The combined face breakage is generally on the increase and is by far the greatest point of failure in the coupler, and it is evident that the strength of the face has not kept pace with the increasing forces which affect it. This in part results from the greater amount of attention the lugs and the shank have received in the design, and is further accounted for by the lack of room to strengthen the section, which is limited to some extent by the space occupied by the locking mechanism, particularly with the bar type of locks. The breakage through face into locking-pin hole is by far the most prominent, which is to be expected, as this is the most limited section. The guard arm breakage has run very evenly except in isolated cases, the box and rib design showing no general difference in their failures. The fracture through the upper corner of the guard arm is negligible without exception.

Shank Failures.—The combined shank failures appear least on the early modern couplers, while on the later types they are on the increase. This increase is chiefly due to bent shanks, but the breakage back of the head has also shown an increase, while the breakage immediately in front of the butt is also in the ascendancy. In almost every case of couplers having bent shanks the bend is in the vertical direction. It is believed that the shank failures can be materially reduced by more attention given the individual design of coupler by the manufacturer.

Breakage of Side-wall and Across Horn.—Of the two odd breakages, the one through the wall behind the knuckle has been quite large in three types, but is on the decrease in the latest types of couplers. There should be no breakage at this point, as there should be little strain, and the design can be changed to provide for any strength necessary without affecting any other vital part of the coupler. The breakage at the horn has been low, with one exception. As an emergency stop the horn should be designed strong enough to withstand the shocks, but with the introduction of properly designed draft gears of sufficient capacity, the trouble from horn breakage should disappear.

Breakage of 5 by 7-in. Shank Couplers.

Lug Breakage.—On 5 by 7-in. shank couplers, which are all modern, lug breakages show an even greater decrease on the later types than on the 5 by 5-in. shank couplers, and with the three exceptions are below 10 per cent. of the total breakages. Most of these couplers are equipped with the knuckle tail hook to prevent the knuckle from pulling out when the pivot pin breaks, which assists in preventing the lugs from breaking.

Face Breakage.—The face breakages are by far the most prominent and on all the types are considerably above 50 per cent. of the total breakages. The breakage into face through the locking-pin hole and the breakage at the neck of the guard arm constitute the largest percentage of the failures, and these two breaks vary in the different types of coupler; in some makes the breakage through face into lock-pin hole is the most numerous, whereas, in the other types, the neck of the guard arm is broken more frequently. The failure of the upper corner of the guard arm has become negligible.

Shank Failures.—The shank failures in three instances are above 10 per cent. of the total failures, and this is mainly due to bent shanks. The breaks immediately behind the horn and directly in front of the butt are rather constant for the different types of couplers and about uniform in the two breaks, both of which are very low, only one case reaching 7 per cent. of the total failures.

Breakage of Side Wall and Across Horn.—The breakage through the side wall of head behind knuckle tail shows excessively high in two cases, one type showing 28 per cent. and the other type 21 per cent. of the total failures. The break across horn through locking-pin hole has almost disappeared, probably due to the more efficient draft gears applied with these couplers on the later cars, which prevent the horn from coming in contact with the end sill.

Comparison of the Breakages of the 5 by 5-in. and 5 by 7-in. Shank Couplers.

Shank Failures.—The percentages of the combined shank breakages of the 5 by 7-in. shank couplers average less than 3 per cent. lower than the shank failures of the 5 by 5-in. shank couplers. Bending has been the most serious failure of the shank in the late types, and as the shank generally bends vertically, we do not obtain the full benefit from the additional 2-in. width of shank, as the additional metal is not in the right direction to stop the vertical bending most effectively.

Face Breakages.—The percentages showing the combined breakages of the face are slightly lower for the 5 by 5-in. shank couplers, but the breakage through face into locking-pin hole is lower on the 5 by 7-in. shank couplers. This is accounted for by the increased width of shank backing up the guard arm, the benefit accruing directly to the section forward of the locking-pin hole, as the guard arm failures in the 5 by 7-in. shank couplers are very much higher than the 5 by 5-in. shank guard arm failures. The results show, without question, that the weakest point of the couplers is in the section of the face immediately forward of the locking-pin hole. The neck of the guard arms should also receive further consideration in the way of strengthening.

Breakage of Knuckles.

The breakage of the solid knuckle is not confined to any particular point, but may be said to vary with the construction of the knuckle, the main failures being combined breakage at pivot pin-hole, knuckle tail behind lock bearing, combined breakage of knuckle tail bearing and combined breakage of the coupling lug.

Breakage at Pivot Pin-Hole.—The combined breakage at pivot pin-hole is divided into the breakage through pivot pin-hole, and the breakage through the tail immediately behind pivot pin-hole shoulder. The breakage behind the shoulder is more serious in some knuckles than the actual breakage through the pivot pin-hole.

Knuckle Tail Behind Lock Bearing.—The breakage of the knuckle tail behind lock bearing, or in other words, of the hook which prevents knuckle from pulling out when pivot pin breaks, has been pronounced, all but two of the solid knuckles represented being equipped with this safety device. The breakages show the value of the knuckle tail hook as well as the weaknesses. It will be difficult to strengthen this hook in most knuckle-throwing couplers, but it should be done wherever possible.

Breakage of Coupler Lug.—Lug breakage has diminished from the most prominent failure in slotted knuckles to one of minor importance in the solid type. The fracture through end of coupling lug on the upper portion of the knuckle, and the break through neck of coupling lug on the upper portion of knuckle, are the most prominent. A number of these fractures were the direct result of improperly designed cores, and of cores slipping when casting knuckles which have lightening cores through lug.

Defective Metal, Poor Coring, Etc.

The percentage of each type of 5 by 5-in. and 5 by 7-in. shank couplers, also the solid and slotted knuckles of those examined, in which the fractures could be attributed to defective metal and poor coring, should be carefully weighed in drawing conclusions, as the number of couplers examined which were broken and the percentages of same showing defective metal may be a very small proportion of the total number of couplers or knuckles in service; whereas, on another type, this ratio may be much larger, and, therefore, no deductions can be made between the different types of couplers. For example: The total number of solid knuckles found broken in proportion to the number in service was very small, and not to be compared with the number of slotted knuckles broken to the number in service. If, however, the defective metal or improper coring would be eliminated, the relative failures in the same type of coupler or knuckle would probably be reduced by the percentages shown.

The percentage of defective castings among the 5 by 5-in. shank couplers has decreased with the development, and the types which have been tested most generally under the M. C. B. specification. This also holds true in the 5 by 7-in. shank couplers, where, with one exception, the tested couplers when broken have shown less defective metal than those not tested.

In examining the broken knuckles and defective locks, the committee has found that many knuckles and locks have been purchased for repairs which were manufactured by steel foundries other than the makers of the original couplers. A large proportion of such knuckles and locks have varied from the original design to such an extent that it directly affected the operation of the coupler, which not only results in troubles from parting, but also has a direct influence on the breakage of the coupler and knuckle parts. This is aside from the question of inferior metal used in such knuckles and the fact that they are not tested under M. C. B. specifications. Separate knuckles for repairs should be purchased according to M. C. B. specifications for economy, as well as in justice to the owners of the cars who have originally applied couplers in compliance with the Interchange Rules and Standards of the M. C. B. Association.

A large number of locks, knuckle throwers and other like parts were examined. The data obtained are of no particular value for comparison, but the examination emphasized a number of points to which the committee desires to call attention.

A great majority of the lock failures were due to the breakage of the lock chain attaching the lock block to the uncoupling lever chain, which is the weak point of a lock of this type. It is not within the province of the committee to make definite recommendations concerning the form of lock, as most of the coupler patents are based on this feature, but where the flexible link connection is

used from the lock block to the uncoupling lever chain it should be strengthened.

Conclusions.

This investigation has pointed out wherein the different types of couplers and knuckles are failing, and has satisfied the committee that a closer observance of the M. C. B. specifications in purchasing couplers and the insistence of the railroads to have the couplers tested in accordance with the requirements of the Association will overcome much of the trouble from breakage of couplers, knuckles and parts which is now being experienced. The use of the M. C. B. specifications is being extended, and in this connection attention should be called to rule No. 59 of the Interchange Code, which provides that: "When using materials for repairs to foreign cars for which the M. C. B. Association has adopted specifications as a standard, the materials must comply with the requirements of these specifications." Therefore, it is a violation of the Rules of Interchange for any railroad company to apply any coupler or knuckle to a foreign car in repairs, that is not in accordance with the specifications and which has not been tested.

Defective uncoupling arrangements are an increasing source of trouble on account of the bending of the uncoupling rods, breakage of uncoupling chains and loss of pins from the clevises. The breakage of these chains is very often due to the excessive slack in the draft rigging, and as the length of chain must necessarily be limited to obtain the proper amount of lift for the locking pin it cannot well be lengthened. With the knuckle-throwing couplers the amount of lift of the locking-pin is increased, which aggravates this trouble. Some better means should be provided for operating the locking device, but the committee is prevented from making any definite recommendations on account of patented devices. In order to provide for increased strength at this point, a recommendation is appended to make the diameter of the eyelet at the top of the locking device for uncoupling rigging $1^{1}/_{16}$ in.

The lock-set within the head of the coupler is now standard, so that there is no longer any necessity for the lip on the outside bracket, shown in Recommended Practice, Sheet "B." The uncoupling lever is frequently allowed to hang on the lip of this casting while coupling cars, and when this is done it results in damage to locking-pins and sometimes causes breakage of knuckles and couplers.

Under Recommended Practice for uncoupling arrangements, all the fifth paragraph should be omitted, except the first sentence reading as follows, "Diagram No. 3 shows the application to a car having projecting end sills," to comply with this recommendation.

In order to conform to the recommendation to make standard the location of the lock lift in the central longitudinal plane of the coupler, it is recommended that diagram No. 2 be omitted from Sheet M. C. B. "B," and under Recommended Practice for Uncoupling Arrangements, fourth paragraph beginning "Diagram No. 2 shows," be omitted, inasmuch as diagram No. 2 shows the lock located 3 in. from the vertical center line of the coupler. For a similar reason paragraph seven under Uncoupling Attachments beginning with "There are some designs of M. C. B. couplers, etc.," should also be omitted.

The location of the lock lift in the central longitudinal vertical plane of the coupler, located between the striking horn and the contour lines, and operate from the top by an upward movement, was adopted as Recommended Practice in 1905. It is recommended that this requirement be advanced to standard and included in the specifications, inasmuch as all the couplers made under M. C. B. Specifications conform to this recommendation, and the best working couplers are of this design, besides which, it forms a common basis for uncoupling arrangements which is of great advantage.

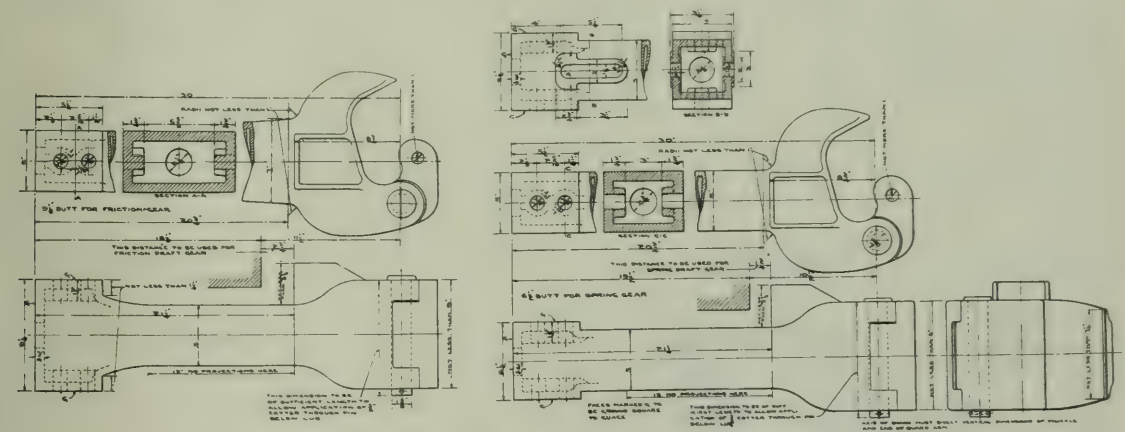
Since all couplers manufactured under M. C. B. specifications are provided with a knuckle designed not to pull out when the knuckle pin breaks, and the examination of breakages shows that this design has greatly prevented lug breakages when the knuckle-pin breaks, the committee recommends that this be advanced to standard and included in the specifications.

As the various knuckle-throwing devices employed in modern couplers have not had sufficient service to determine their working qualities or ultimate efficiency, your committee believes that this feature should remain as Recommended Practice for at least another year.

The specifications for separate knuckles while appearing under Standards, have never been adopted as such, but were made Recommended Practice in 1904. They have now been given sufficient trial and with the minor changes suggested in this report, the specifications for separate knuckles should be adopted as standard. The last paragraph appearing under this head and beginning, "Your committee has tested," should be omitted, as it is not a part of the specifications.

Attachment of Couplers to Cars.

The committee received a recommendation to increase the number of rivets in coupler butt from two to three. The proper function of the rivets should be to hold the yoke arms tight against the butt, so that the yoke gibs have a full bearing on the butt. With a three-rivet connection as an additional standard, there would be two non-interchangeable types in service, the individual maintenance of which would scarcely be justified by the increase in strength, and the need of which is doubtful. In a connection subject to lateral bending strains, such as that between the yoke and coupler, the vertical rivet method of fastening may not be the best, so until some better method can be devised, and its worth proven, it would seem advisable to maintain the parts interchangeable to facilitate repairs. In order to increase the bearing of the present yoke upon the butt, the committee recommends increasing the length of the gibs in front of the butt ½ in. on the 9½-in. butt couplers, which will necessitate decreasing the dimension of the opening between the gibs from 7¾ in. to 6¾ in., the remaining dimensions of the yoke to be the same as the present recommended practice.



Recommended Revised Drawing of Left-Hand Half of Sheet M. C. B. 11.

More care should be exercised by the manufacturers in casting and grinding the top, bottom and back face of the butt to insure their being square, which will increase the bearing surfaces for the yoke; also the bearing surfaces in front of butt for the gibs of the yoke. A dimension showing 1¾-in. depth of bearing, top and bottom, for rivets in the butt will also aid in this matter. The committee further recommends that the following Recommended Practices be advanced to Standards, in view of the great advantage to be thus attained in future repairs on the large number of steel cars now being constructed.

"That the spacing between steel center sills be 12⅞ in."

"That front and back stops with rivet holes $^{15}/_{16}$ in. in diameter be spaced as shown on sheet M. C. B. 'B,' drawings 'A' and 'B.'"

"That the spacing between coupler horn and buffer beam be 1¾ in. for all spring gear and 2¾ in. for all friction gear."

"That followers be made of wrought iron or open hearth steel 1⅝ in. thick for tandem spring gear, and 2¼ in. thick for twin spring and friction gear."

"That the total side clearance of the coupler be not less than

2½ in. The words 'not less than' have been added to this recommended practice in advancing it to a Standard, as the original intention was to specify the minimum clearance, and the committee is of the opinion that the increase of the clearance should not be limited at this time.

"That the butt 5 by 5½ by 9⅛ in. for use with friction draft gear be advanced to Standard."

Inasmuch as the original design of the shank has been changed in foundry practice to the square type, and since it is desirable to more definitely specify the construction of the butt and other details, the committee suggests that the left-hand of Sheet M. C. B. 11 be modified to conform to the drawing shown. This sheet shows many unimportant changes to conform to present standards, etc. The important changes other than those which have already been explained, are:

The back wall of butt changed to ¾-in. thick, inasmuch as the tail pin has fallen into disuse, and there is no need of having such a heavy block of metal on the end of the butt.

The width of the butt is changed from 4 in. to 5 in. on both sizes of shanks, as this dimension will provide for properly securing the yokes now represented in Recommended Practice, and modern couplers are being furnished with butts so constructed.

A dimension of not less than 1¼ in. is shown forward of the 9⅛-in. butt to provide for this ½-in. increased length of gib in the 9⅛-in. yokes.

A limiting dimension of not more than 1 in. is shown for the diameter of core hole in lug of knuckle to prevent a recurrence of the slotted knuckle weakness.

A note is added to the effect that there shall be no projections on the bottom of the shank from the line of the horn back for 12 in. in order that the working of the shank on the carrier iron shall not be interfered with.

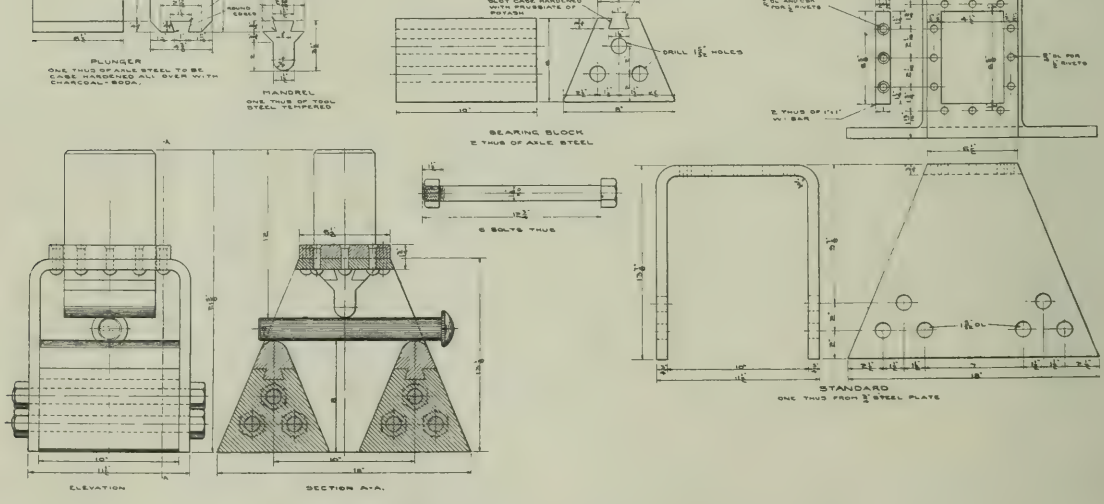
It has been suggested that the marking on couplers to indicate that they comply with the M. C. B. specifications, be stamped instead of cast, so that the letters "M. C. B." will be applied after the couplers have passed the test. This will prevent any couplers from receiving the marking "M. C. B." until they have complied with the specifications, and the committee recommends that paragraph 8 of "Specifications for M. C. B. Automatic Couplers" be changed so as to read: "8. Every coupler and knuckle made to comply with these specifications must have a slightly raised plate or flat surface cast upon the head in plain view where it will not be subject to wear. After a lot of complete couplers have successfully passed the inspection and tests prescribed below, the letters 'M. C. B.' must be legibly stamped upon the plate on each coupler and knuckle; this mark to be evidence that the complete coupler is an M. C. B. standard." This marking is as important for identification on the knuckle as on the coupler, therefore the knuckle has been included in the above. The committee also recommends that a paragraph be added to the "Specifications for Separate Knuckles" as follows: "7. Every knuckle made to comply with these specifications must have a slightly raised plate or flat surface cast upon the head in plain view where it will not be subject to wear. After a lot of knuckles have successfully passed the inspection and tests prescribed below, the letters 'M. C. B.' must be legibly stamped upon the plate on each knuckle; this mark to be evidence that the knuckle is an M. C. B. standard."

In the "Specifications for Knuckle Pivot Pins" given below, a limit gage is necessary to determine that the pins are of the proper diameter. Limit gages for round iron are prescribed under M. C. B. Recommended Practice, for sizes of round iron up to 1¼ in., and the committee suggests that the standing committee on supervision of standards and recommended practice add dimensions of such a gage for round iron of 1⅝ in. nominal diameter; the total variation allowed to be increased proportionally as compared with that of the smaller sizes. The use of this standard gage has been prescribed in the specifications.

Knuckle Pin Specifications.

Specifications for knuckle pins purchased for repairs are very necessary, and the specifications appended are recommended for adoption as Recommended Practice.

After experimenting with the various methods of testing under static loads, it was finally decided to abandon the static test and use the standard M. C. B. drop test machine as the most convenient, efficient and best method of testing. The only additional apparatus necessary consisted of two triangular shaped blocks topped by round bearing edges with a radius of ¾ in. and held by means of a suitably formed plate, 10 in. center to center, above the bearing edges. The plate was formed into a suitable shape for retaining a vertical plunger which was also provided with a round bearing edge of the same radius. It was designed to place the pin across the two lower supports and rest the upper plunger on it in the center; the whole device being placed on the anvil block of the drop testing machine. Construction of the apparatus is shown herewith.



Construction of Apparatus for Drop Test of Knuckle Pivot Pins.

Some 70 or 80 knuckle pins were secured and tested. The pins tested varied in size from 1⅜ in. to 1⅝ in. and the results obtained with each group were remarkably uniform. Each pin was subjected to a blow of the 1,640-lb. weight falling 3 ft., irrespective of the size of the pin tested. The amount of bending was measured by finding the angle included after the pin had been tested, and subtracting it from 180 deg. The amount of set was measured by noting the height of point on the vertical block before and after the test, the difference between the two dimensions showing the amount of set of the pin between supports, also including any indentation. In comparing the tensile strengths, elongations, chemical analyses, and the results of the drop test of the pins of the various groups, it was found that the method of manufacture affects the result of their test under the drop to a large extent; so that two pins of somewhat different analyses may show like results depending on their heat treatment and vice versa.

Comparing the data obtained from these tests with the results obtained from similar pins under actual service conditions, it seems advisable to specify a test which will insure obtaining a pin which is not too brittle, but on the other hand is stiff enough to stand up under service conditions. This test should require a pin to bend cold at least 15 deg., but not more than 35 deg., and not to show any fractures under a blow of 1,640 lbs. at 3 ft.

The object of using angles as limits instead of the amount of set in inches, is to eliminate the effect of the indentation by the supports and plunger. Suitable angular limit gages can be easily constructed and used for measuring the angle of deflection. These gages should be long enough to measure the angle at least 3 in. from the center of the bend on each side so as to eliminate the possibility of a false measurement of the angle.

The additional apparatus can be constructed at a small cost from the accompanying drawings and the pins can be tested at the rate of from 15 to 20 per hour, or testing three out of every 500, from 2,500 to 3,500 pins passed per hour, exclusive of the surface inspection.

Specifications for Knuckle Pivot Pins.

All knuckle pivot pins ordered under these specifications must be made from open-hearth steel properly forged and then annealed and must not be painted.

1. Knuckle pivot pins will be subject to the inspection and test of the above-named company as to their general condition and strength. The tests and inspection will be preferably made at the place of manufacture where assistance and labor necessary to make satisfactory and prompt inspection and shipment must be furnished free by the manufacturer. The testing machine, approved by the M. C. B. Association, must be used in the test of knuckle pivot pins.

2. Knuckle pivot pins will be ordered as far as practicable in lots of 500; for each lot ordered the manufacturer shall furnish three extra pins, and in the event of additional pins being required to carry out the prescribed tests, they shall be furnished free of cost by the manufacturer.

3. All pins must be of such size as will enter the plus end and will not enter the minus end of a limit gage for 1⅝-in. round iron as prescribed in M. C. B. Recommended Practices under "Limit Gages for Round Iron," and must not vary more than ⅛ in. above or below the proper length. The lower end of the pin must be cut off square and have at least ¼ in. bevel or chamfer. The cotter-pin hole to be properly drilled for ⅜-in. cotter. The head must be well formed, and pins which are not straight and true and those which have blisters or surface defects of any kind will be rejected.

Inspection.—Knuckle pivot pins, after having been thoroughly inspected by the manufacturer to see that they meet the requirements as to interchangeability, soundness, dimensions of parts, etc., herein specified, should be arranged in lots of 503. The inspector shall then inspect and gage each pin as to its compliance with drawing sizes and for surface defects.

After this inspection the inspector shall select three pins taken at random from each lot or lots, as provided for above, and subject them to the cross-bending drop test as hereafter specified. If one of the pins fails to stand the test as prescribed below, and the other two pass, three more pins shall be selected at random from the same lot from which the first pins were taken; if all three of these pins stand the prescribed test, that lot of pins shall be accepted, otherwise that lot of pins shall be rejected, and another lot substituted and tested in the same way. If two or more pins fail to stand the test, originally, the lot represented will be rejected without further consideration.

Physical Test.—The cross-bending test will be made in a standard M. C. B. drop-testing machine, the pins resting on rounded supports, held rigidly 10 in. center to center, to be subjected to a blow by the weight falling a height of 3 ft. The blow of the weight should be transmitted to the specimen by a block having a round lower edge resting on the specimen. The radius of all these round edges is to be ¾ in. All pins are to be tested cold and must not show any cracks or fractures. The bend must be directly under the nose of the plunger. Pins will be rejected if they break, or crack, or show a deflection less than 15 deg. or greater than 35 deg.

The report is signed by R. N. Durborow (Chairman), G. W. Wildin, F. W. Brazier, F. H. Stark.

RULES FOR LOADING LONG MATERIAL.

During the past year the committee has endeavored to ascertain what objections, if any, existed to the rules in their present shape. The consensus of opinion seemed to indicate that few, if any, alterations were necessary and but few changes were suggested. The general impression seemed to be that the rules should be allowed to remain in their present form.

The committee, however, has located several typographical errors, which have been corrected. For the purpose of making the rules clearer, without necessarily changing their substance, certain other suggested corrections which will involve transposing rules with their cuts, have been embodied, the idea being that by thus improving the grouping it will be easier for the inspector to locate the requirements covering certain conditions, etc.

The principal corrections and additions are as follows:

Rule 12.—Substitute "must" for "may" in middle of third line from bottom.

Rule 15-*D*.—Change the first sentence to read: "Short material may be carried on floor of gondola cars under loads carried on top of sides, but should be distributed so that the load carried over each truck as well as across floor of car is equally balanced."

Fig. 3.—Should be provided with note reading "Size of chain to conform to M. C. B. Recommended Practice" instead of the present note, "Chain to be made of not less than 1 in. iron."

Fig. 4.—Change size of cross boards to 1 by 5 instead of 1 by 6. Also make the note indicating the recommended size of stakes, and then insert note specifying, "For number and minimum sizes for stakes see sections of Rule 34."

Fig. 4-*A*.—The last line of note reading, "One-pile Rule 32—6 stakes not less than 3 by 4 on each side of cars," should be omitted.

Rule 33.—The question has been raised as to the necessity for applying binders for such shipments where loaded in gondola cars. To clear this point the second sentence should be made to read: "Strips should be located at intervals in height of not more than 30 in. from floor or top of sides of car and 6 ft. apart to act as binders."

Page 36.—Reference to Fig. 44 and clause following should be omitted. This was inserted by mistake.

Page 37.—Paragraph referring to Figs. 44 and 45, should read 45-A and 45-B.

Fig. 46.—Side strut should be 4 by 8 instead of 4 by 6, as it was in the 1905 Rules. It was changed by mistake. Also suggest a vertical post or filling piece 4 by 8 just inside of 1¼-in. rod, that is, between it and the lading, which can be shown in cut.

Rule 114.—The last sentence specifies that for "Pipe more than 18 ft. long there must be at least four pairs of stakes." This requirement would seem to be entirely proper, but where dunnage strips are used three stakes will be sufficient, and the last sentence of this rule should read as follows: "For pipe more than 18 ft. long there must be at least four pairs of stakes, but where dunnage strips are used between consecutive layers of pipe three pairs of stakes should be sufficient."

The report is signed by A. Kearney (Chairman), C. E. Fuller, A. Stewart, F. H. Clark, G. S. McKee, J. S. Lentz, W. F. Kiesel, L. H. Turner.

TRIPLE VALVE TESTS.

No new triple valves were presented to the committee for test since the 1906 meeting. The committee has been requested to test certain improvements on train brakes, but has decided that the testing of these devices did not come within its jurisdiction, and therefore declined to make the tests.

Referring to the revision of the code of triple valve tests, which was also turned over to the triple valve committee, the committee has decided that it will be impracticable to conduct a series of tests which will allow it to revise the present code until the opportunity of conducting tests on the new M. C. B. 100-car rack is available. The Westinghouse Air Brake Company has prepared the details for a 100-car testing rack with estimate of cost. This has been turned over to the Executive Committee of the Master Car Builders' Association.

The report is signed by A. J. Cota (Chairman), F. H. Scheffer, R. K. Reading, E. W. Pratt, Jas. Macbeth.

CAST-IRON WHEELS.

The recommendations of the committee covering the *increased thickness of flange and coning of the tread* having been adopted last year the committee has confined its work during the past year to the revision of the drawings and specifications, and the design of a complete set of gages of various descriptions required for cast-iron wheels, to replace those now shown in the standards and recommended practice of the Association, to suit the requirements of the new flange and tread adopted in 1906, as well as the standard flange and tread adopted by the Association and in general use prior to that date.

The committee presents the *revised drawings and revised portions of specifications*, and at the conclusion of the report calls attention to *certain rules and paragraphs in the Rules of Interchange that need revision* to make them conform to the requirements of the new standards. It recommends that the latter be referred to the committee having these rules in charge for the necessary corrections.

The recommended standard drawings of wheel tread and flanges and measurements for loose wheels or out of gage wheels are shown herewith in Figs. 1 and 2.

Specifications for 33-in. cast-iron wheels, as revised in 1904, and now appearing as Recommended Practice, have been further revised as follows:

Title of specification has been changed to read, "*For 33-in. cast-*

iron wheels, having a minimum weight of 600, 650 *and* 700 *lbs. for cars of* 60,000, 80,000 *and* 100,000 *lbs. capacity.*

The words in italics represent additions.

Paragraph 1. Chills must have the inside profile as shown on M. C. B. drawings of wheel tread *adopted in* 1906.

Paragraph 3. The wheels must show clean gray iron in the plates, except at chaplets, where mottling to not more than ½ in. from same will be permitted. The depth of pure white iron must not exceed 1 in., nor be less than ½ in. in the middle of the tread, *and shall not exceed 1 in. in the middle of the tread* or be less than

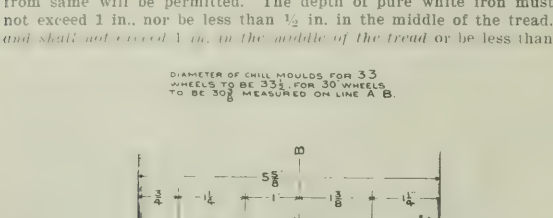


Fig. 1—Recommended M. C. B. Standard Wheel Tread and Flange.

⅜ in. in the throat for wheels *having a minimum* weight of 600 lbs. It shall not exceed 1 in. in the middle of the tread, or be less than 7/16 in. in the throat for wheels *having a minimum* weight of 650 lbs. It shall not exceed 1 in. in the middle of the tread, or be less than ½ in. in the throat for wheels *having a minimum* weight of 700 lbs. The depth of white iron shall not vary more than ¼ in. around the tread of the rail line in the same wheel.

Paragraph 4. *When ready for inspection, the wheels must be arranged in groups, all wheels of the same date being grouped together,* and for each 100 wheels which pass inspection and are ready for shipment, two representative wheels of *normal diameter,* shall be taken at random, one of which shall be subjected to the following test:

The wheel shall be placed flange downward on an anvil block, weighing not less than 1,700 lbs., set on rubble masonry at least

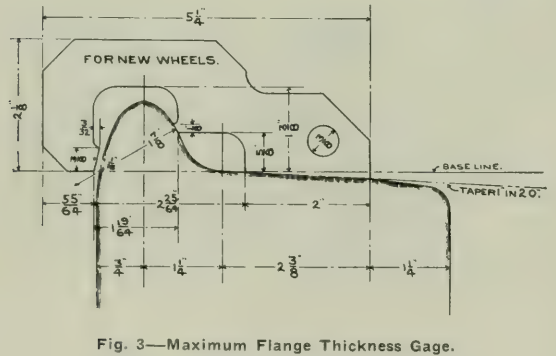


Fig. 3—Maximum Flange Thickness Gage.

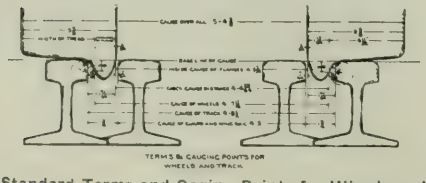


Fig. 6—Standard Terms and Gaging Points for Wheels and Track.

2 ft. deep, and having three supports not more than 5 in. wide to rest upon. It shall be struck centrally on the hub by a weight of 200 lbs.

For wheels *having a minimum* weight of 600 lbs., 10 blows falling from a height of 9 ft.

For wheels *having a minimum* weight of 650 lbs., 12 blows falling from a height of 10 ft.

For wheels *having a minimum* weight of 700 lbs., 12 blows falling from a height of 12 ft.

Paragraph 7. To be eliminated entirely and all following paragraphs to have their numbers changed accordingly.

Paragraph 8. Provided the maximum and minimum flange thickness gages as recommended by this committee are adopted at this convention, the following, "in 1907," should be added after the word Association, at the end of this paragraph.

Paragraph 9, Section 2. The words "or over" to be eliminated, making the section read, "are under weight."

The committee presents the following recommendations for approval and acceptance by the Association:

(1) The drawings of the wheel as a whole.

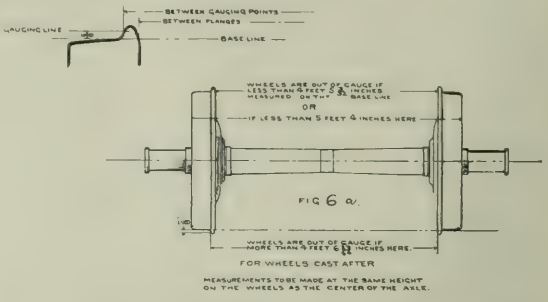


Fig. 2—Measurements for Mounted Wheels Loose or Out of Gage.

(2) The form of wheel tread and flange.

(3) The maximum flange thickness, and minimum flange thickness gages, as presented. (Figs. 3 and 4.)

(4) The wheel defect and worn coupler limit gage, as presented (Fig. 5), in which one additional slot for gaging worn flanges on wheels under cars of 100,000 lbs. capacity and over has been added.

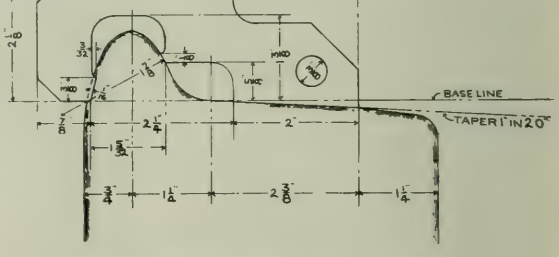


Fig. 4—Minimum Flange Thickness Gage.

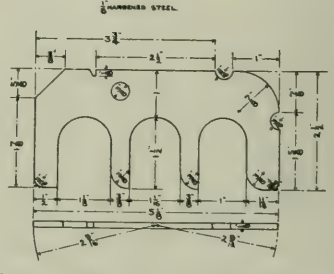


Fig. 5—Wheel Defect and Worn Coupler Limit Gage.



Fig. 7—Guard Rail and Frog Wing Gage.

(5) The drawings showing "Standard Terms and Gaging Points for Wheels and Track," as presented (Fig. 6), and on which the "Guard Rail and Frog Wing Gage" (Fig. 7) has been revised to correspond with the standards adopted by the Engineers of Maintenance of Way and approved by the American Railway Association,

and from which the gaging point ⅝ in. below the top of the rail has been fixed for all gages appearing on the drawing.

(6) The discontinuance of and removal from the standards of the Association of "Gage for Locating Wheels Equidistant from Center of Axle," now shown on M. C. B. Sheet 22, as same is not in current use and is not essential.

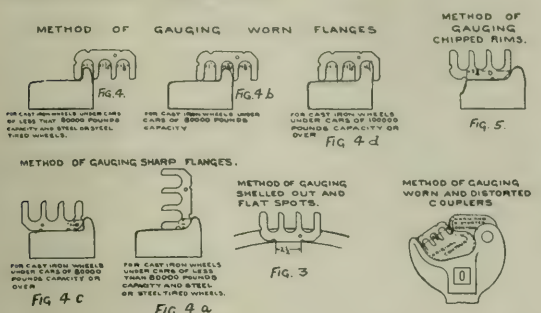


Fig. 8—Methods of Using Wheel Defect and Worn Coupler Limit Gage.

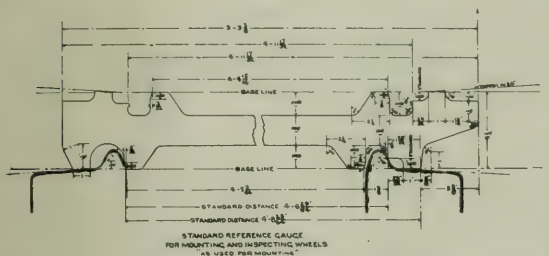


Fig. 10—Use of Standard Reference Gage for Mounting Wheels.

(7) The changes in the specification as presented.

(8) The drawing showing the method of using the wheel defect and worn coupler limit gage. (Fig. 8.)

The wheel check gage and the standard reference gages for mounting and inspecting wheels are shown herewith. (Figs. 9, 10 and 11.)

Attention is called to the following quotation, taken from the minutes of the Wheel Makers' Committee, namely: "What the Wheel Makers ask to have done is that the Wheel Committee of the M. C. B. Association make good, strong recommendations in their report to the officials of the leading railroads, that the new standard be accepted."

The committee endorses and advocates such action, since the Wheel Makers are emphatic in stating that, notwithstanding the new standards' acceptance by the M. C. B. Association, it does not mean that the various railroads will use them, and what the wheel makers want is to have the new standards put into practice so that they can afford to make the necessary manufacturing equipment and be prepared to deliver wheels promptly.

The wheel makers desire, on account of increased wheel loads and mileage, that an equitable guarantee for 600, 650 and 700 lbs. wheels be adopted by this Association. The committee does not feel qualified to frame such a guarantee on account of insufficient data concerning the performance the new wheels are going to give in actual service, and until this Association has secured such data no guarantee can be framed that will be equitable to both the railroad companies and the wheel manufacturers. The committee recommends that a service record of the performance of the new wheels be maintained by the members of the Association for a sufficient

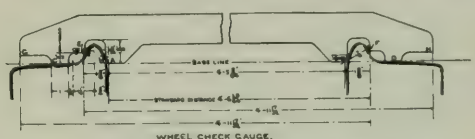


Fig. 9—Standard Wheel Check Gage.

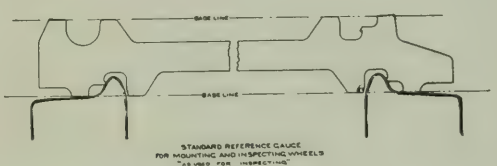


Fig. 11—Use of Standard Reference Gage for Inspecting Wheels.

period of time to determine what the wheels are going to do under the increased wheel loads and mileage, so that if it is desired by the Association to adopt a guarantee at some future time, the actual performance of these wheels can be used in determining what the guarantee should be.

The report is signed by Wm. Garstang (Chairman), A. S. Vogt, H. J. Small, W. E. Fowler, R. L. Ettinger, R. F. McKenna, J. E. Muhlfeld.

Supplementary Report of Committee on Cast-Iron Wheels.

The committee has devoted considerable time to the design of limit gages for use at shops when inspecting second-hand wheels for remounting. The gages shown herewith (Figs. 12 and 13) are designed on lines determined in actual practice by one of the leading railroads of this country, and the angle of gaging face having a taper 2¼ in. in 12 in. is the result of several years' experience,

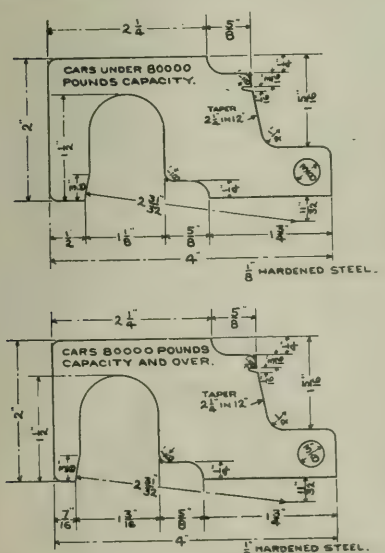


Fig. 12—Recommended Design of Limit Gage for Inspecting Second-Hand Wheels for Remounting.

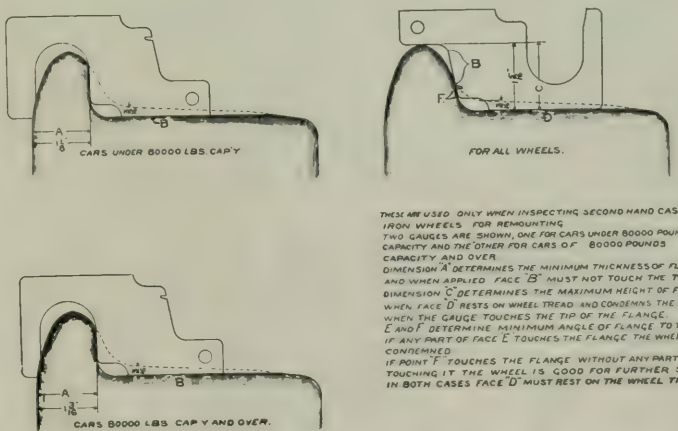


Fig. 13—Method of Using Limit Gage for Inspecting Second-Hand Wheels.

and has been found to meet requirements in a satisfactory manner. The committee recommends the adoption of these gages as recommended practice.

ARCH BARS.

The committee was instructed to consider what changes in the dimensions and shapes of the standard arch bars would be necessitated if the truck wheel base should be changed from the present standard of 5 ft. 2 in. to 5 ft. 6 in., in order to better accommodate inside hung brakes, the matter of the angularity of the brake hanger also to be considered. The committee is of the opinion that the sizes of sections used on the present standard arch bars, namely, 1½ by 4½ top, 1⅜ by 4½ bottom, and ⅝ by 4½ tie bars may be safely used in trucks for 80,000 lbs. capacity cars having 5 ft. 6 in. wheel base; the increase of the stress due to the greater span not being sufficient to warrant an increase in the sections. It therefore suggests that the drawing of standard arch bars as shown on Plate M. C. B. 19 of the 1906 Proceedings be revised, showing the same sections, and (a) that the journal bearing centers be spaced to 5 ft. 6 in., the additional 4 in. to be added to the total length, but that the following revisions be also included.

The bends next to the columns are too closely spaced, as, with the present arrangement, there is but $^{13}/_{32}$ in. between the edge of the holes and the beginning of the bend. The spacing of the bends should be increased from 18½ to 20-in. centers, and the horizontal distance between bends be increased from 16¼ in. to 17½ in. The turned-up lip on the ends of tie bars are unnecessary, and the committee recommends that they be eliminated, the total length of the tie bar to be the same as the arch bars, or 74 in. over all.

Regarding the double nuts shown on column bolts, the committee suggests the addition of a note to the drawing, reading as follows: "A single nut with a nut-lock or a cotter may be used instead of double nuts." The utility of the column bolt washer has been questioned and the committee suggests that the washer or its equivalent is desirable in order to provide suitable clearance for a fillet under the column bolt head. A note should be added to the drawing, reading as follows: "Column bolt washers may be omitted if bolt holes in top arch bars are countersunk."

As regards the matter of angularity of the brake hangers, the committee approves the suggestion of the committee on brake-beams in 1906, which reads as follows: "That brake hangers should have an angle as nearly as possible to 90 deg. from a line drawn from the center of the brake-shoe to the center of the axle, when the shoes are half worn."

The report is signed by C. A. Seley (Chairman), S. N. Dow, J. J. Ewing.

HEIGHT OF BRAKE STAFF.

The American Railway Association committee on standard dimensions of box cars requested the Master Car Builders' Association to consider the height and location of brake staff of standard box cars and adopt, if practicable, a standard height and location. The following is recommended: That the standard maximum height from rail to top of brake staff be 14 ft. and the standard distance from center of car to center of brake staff be from 18 in. to 20 in.

The report is signed by E. A. Miller (Chairman), J. E. Keegan, F. T. Hyndman.

TANK CARS.

At the 1906 convention the rules proposed by the committee were adopted with an additional provision for the stenciling by railroads of acceptable cars. This feature has not yet been put into general effect. Confusion exists at interchange points in regard to the phase of the specifications which covers construction "as strong as"; and it has developed that the same car might be accepted by inspectors on one part of a system and held up by inspectors on the same system at another point. This has entailed much delay and a considerable amount of correspondence. In consequence, a meeting was held of representatives of a number of railroads handling a large number of tank cars, and the points causing confusion were discussed and amendments suggested in the wording of the requirements.

While the severity of the service to which all classes of equipment is subjected has undoubtedly changed for the worse, and while the committee is not yet prepared to withdraw the earlier minimum requirements for tank-car construction, it feels very strongly that it is to the interest, not only of the transportation companies but, also, of the car owners as well, to very materially exceed the requirements for strength.

The committee proposes the following changes in the specifications:

Damage by Fire.—The word "cars" has been omitted from this paragraph, so as to specify that the *tanks* must be withdrawn from transportation service, which was the original intention.

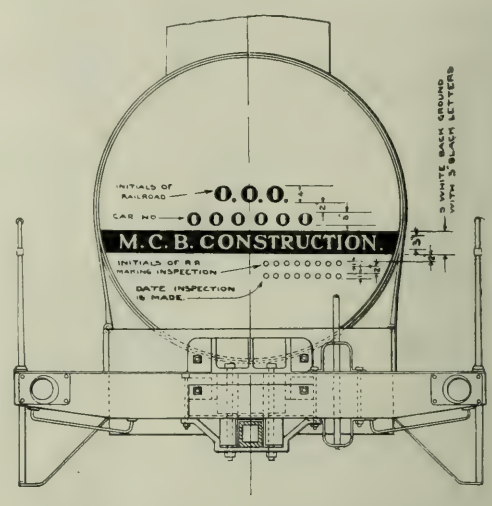
Trucks, Sizes of Axles.—This paragraph has been changed to conform to the requirements of the Rules of Interchange.

Axles.—Tank cars have been placed upon the same basis as other M. C. B. cars, giving them the advantage of the larger axle when the owners equip the cars with same.

Safety Appliances.—A change in this paragraph was made in order to bring out the necessity for securely fastening the side handrailing.

Push-pole Pockets—The modification of this paragraph was necessary in order to overcome the interference of the push-pole with the hanging step when the push-pole pockets were applied to the trucks placed above the end journal boxes.

Dome Yokes, Tank Straps, Etc.—Under this heading, the size of the tank bands and dome yokes have been further specified and reference made to the size of round and bar iron. A large number of existing cars are fitted with 1-in. rods for tank bands which are not upset for the threaded portion to 1⅛ in., and if the tank conforms to the requirements in all other details it is thought inadvisable to reject the car for this minor detail but permit it to run



Revised Marking of Inspected Tank Cars.

until such time as the car goes to the shop for repairs, when such rods must be upset to 1⅛ in. to provide for the proper strength specified.

Test.—The committee suggests changing the periodical time requirement for inspection and test of tanks with cold water pressure from five to ten years, for the reason that experience does not show such deterioration as to make the five-year period necessary. To compel tank car owners to go through this process more often than safety demands, imposes a hardship for the reason that the testing generally starts slight leaks involving the lifting of the tank from the underframe in order to perform the necessary caulking.

Inspection.—A change under this heading is made, as shown in the drawing published herewith. This is with the view of insuring that tank cars which have been inspected and stenciled by a railroad company are accepted in interchange, in so far as construction is concerned, but provides against tank cars being wrongly stenciled if they do not conform to the M. C. B. construction; in such cases, the matter should be taken up with the road stenciling the car and have the detail corrected.

The note has been changed from "Meets Requirements" to "M. C. B. Construction," which is the more suitable legend and expression of fact. The date of inspection has also been added to the cut so that any future requirements may be added as necessity may demand.

Vent Hole or Small Valve.—The paragraph relating to coal tar has been rewritten in order to more clearly set forth the requirement.

Tank Cars Having Wooden Underframes.

Center Sills.—This paragraph has been modified to include center sills of different section but equivalent in strength to the center sills specified.

Center Sill Filling Timbers.—The following sentence has been added to this paragraph: "On cars where the draft arrangement is between center sills, the filler timber must be extended to the cross-tie timber when the cars go to shops for repairs to center sills," this to provide for the proper strength at body bolster.

End Sills.—This paragraph has been modified so as to cover end sills which are reinforced by buffer blocks, specifying the minimum requirements for such end sills and buffer blocks.

Draft Timbers.—Specification in regard to seven ⅞-in. draft

bolts in each draft timber has been modified to more clearly set forth the requirements in connection with existing constructions.

Draft Gear.—A paragraph has been added to this specification, more clearly setting forth the draft stop and draft attachment requirements.

Head Blocks.—The alternate fastenings of head blocks have been more definitely specified so as to clearly set forth the fastenings which are acceptable under this requirement.

Dome Heads and Covers.—This paragraph has been changed so as to permit the use of cast-steel dome heads and covers.

New Tank Cars.

Bolsters; Draft Gear.—Reference to the friction draft gear has been omitted, it being considered unnecessary to specify any particular type of draft gear.

Cars Without Underframes.—This paragraph has been rewritten so as to more clearly set forth the original intention in regard to the riveting of the circumferential seams, which should have specified that on cars without underframes the circumferential seams in bottom sheet only, except head seams, must be double riveted.

While the committee is not ready to make any definite recommendation in regard to the modification in the present method of taking care of longitudinal anchorage, experience shows the necessity for some improved method of preventing end movements of tanks. The hitherto accepted plan of placing the tank between head blocks, more or less securely fastened to framing, may well be improved upon. Tanks are frequently steamed, resulting in material endwise expansion. With tightly fitted head blocks this may result in forcing down the ends of the car. If slackness is allowed for steaming, the tank is allowed to move endwise when cold, and inspection shows that this takes place and with serious consequences. The committee believes that the best construction should not demand the tank to fit both head blocks at the same time, but that the tank should be anchored to frame either at the center or at one end, so as to allow full freedom for expansion.

Attention has been called to the fact that on certain tank cars no facilities have been provided for jacking. On all new tank cars built, hereafter, this feature should be taken care of, but the committee is not ready to make any definite recommendation.

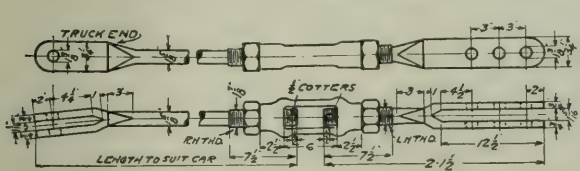
The committee recommends that the revised specifications be submitted to letter ballot for adoption as Recommended Practice.

The report is signed by A. W. Gibbs (Chairman), C. M. Bloxham and Robert Gunn.

HIGH-SPEED BRAKES.

The committee was continued from last year to report on recommended practice for high-speed foundation brake gear for passenger cars. It recommends to provide for taking up slack on six-wheel trucks, which accumulates from brake shoe wear, by substituting the adjustable connection shown; substituting this connection for the one described on M. C. B. Sheet J as B-C7-A. The proposed connection has been tried in service and found satisfactory.

To give more prominence to the maximum theoretical load which may come on beams of the various schedules the committee



Adjustable Connection for Taking up Slack on 6-Wheel Trucks; To Be Used with High Speed Brakes.

recommends that the following notes be carried under the respective schedules. On Sheet J under Table 1, "Brake-beams used with schedule A-1 should be suitable for maximum load at middle of beam of 22,000 lbs." On Sheet J under Table 2, "Brake-beams used with schedule A should be suitable for maximum load at middle of beam of 28,000 lbs." On Sheet K under Table 1, "Brake-beams used with schedule B-1 should be suitable for maximum load at middle of beam of 22,000 lbs." On Sheet K under Table 2, "Brake-beams used with schedule B should be suitable for maximum load at middle of beam of 22,000 lbs." On Sheet L under table, "Brake-beams used with schedule C should be suitable for maximum load at middle of beam of 15,200 lbs."

The report is signed by F. M. Gilbert (Chairman), S. G. Thomson, C. B. Young.

STRESSES TO WHICH WHEELS FOR 100,000-LB. CAPACITY CARS ARE SUBJECTED.

The committee is of the opinion that this subject could best be investigated at such a plant as that at Purdue University or of the Pennsylvania Railroad at Altoona where proper facilities could be had to carry out an extended study. Such an investigation should cover: First, stresses due to vertical loads imposed; second, stresses in the flange due to side pressure on curves; third, effects of brake-shoe applications and form of brake-shoe.

The report is signed by J. F. Walsh (Chairman), E. D. Nelson, O. C. Cromwell, G. E. Carson, W. J. Buchanan.

SUBJECTS.

The committee on subjects suggests the following:

For the Noon-Hour Topical Discussion.

What can the Master Car Builders do to secure the more rapid movement of freight cars and prevent delays under repairs and inspection? To be opened by J. E. Muhlfeld.

What are the advantages or disadvantages of a freight-car pool? To be opened by R. P. C. Sanderson.

The effect of hump yards on the damage to freight cars and their contents. To be opened by Le Grand Parish.

The collar wear of large axles. Should this collar have a larger fillet? To be opened by W. H. Lewis.

The damage to rails by flat spots on wheels. Should not the practice of wheel grinding be extended? To be opened by D. F. Crawford.

Subjects for Committee Investigation During the Year 1907-1908.

The lateral bracing of steel freight cars; also the proper design for the superstructure of steel box cars. The majority of wooden cars have no diagonal bracing in the underframing, depending on bolted joints and connections to keep the bodies square. In the case of a severe shock a wooden car will spring and give, but return to its former lines, while cars of steel or composite construction, on account of inability to spring after a severe shock, will remain sprung and bent out of line. The same committee to investigate the design of the upper framing of box cars. C. A. Seley, W. F. Kiesel, Jr., W. J. McKeen, Jr., Committee.

Side bearings and center plates for freight cars and locomotive tenders. Committee to recommend a standard spread, height and clearance for side bearings, review and give synopsis of reports on side bearings and center plates made to the Association in the past, since and including 1900; to present plans for the most improved anti-friction side bearings and center plates and recommend the proper proportions for ball and roller bearings. The investigation and report to embrace the relations which center plates and side bearings may bear to derailments. Alfred Lovell, H. J. Small, O. M. Stimson, C. A. Schroyer, A. W. Gibbs, Committee.

Friction Draft Gears: To recommend a standard maximum capacity. The most desirable resistance during each ⅛-in. compression. A standard maximum weight for the friction draft gear proper. The proper design for the attachment of friction draft gear. The value of friction draft gear in reducing damage to cars and their contents. J. E. Muhlfeld, F. M. Whyte, W. H. V. Rosing, R. D. Smith, Committee.

Steel Passenger Cars. To recommend a standard sectional area for the center sills and cover plates, the relative merits of steel passenger cars with an upper deck and those with a semi-elliptical section without upper deck; the best construction for flooring and relative merits of various materials for inside finish for fireproof construction. W. A. Nettleton, E. A. Benson, Representative American Car & Foundry Company, T. Rumney, R. L. Ettinger, Committee.

The ventilation and heating of coaches and sleeping cars. To investigate methods for the regulation of the temperature and the supply of fresh air to passenger cars with special attention to comfort in sleeping cars; to recommend plans which provide for the regulation of heat and air supply by the occupant of each berth. R. P. C. Sanderson, Joseph A. Buker, William O'Herin, W. E. Fowler, F. H. Clark, Committee.

Protective coatings for steel cars; the method of application and results of experiments made therefor. C. A. Fuller, T. H. Russam, F. H. Clark, S. T. Parks, Committee.

The report is signed by W. E. Symons, William Forsyth, H. LaRue.

Additional Exhibits at the Atlantic City Conventions.

The following list of exhibits at Atlantic City completes the partial list printed on pages 858 to 860 in our issue of last week:

Acme Supply Co., Chicago.—"Acme" vestibule rollers, vestibule curtains, vestibule curtain shields, car shade rollers, vestibule diaphragms and metallic weather strips.

American Brake Co., Pittsburg, Pa.—See Westinghouse Companies. RAILROAD GAZETTE, June 14, p. 860.

American Car & Foundry Co., St. Louis, Mo.—New York Central suburban passenger coach.

American La France Fire Engine Co., Elmira, N. Y.—"One Man" chemical engine; hose reel; Babcock, "Salvage," "20th Century," and "Patrol" fire extinguishers; hose nozzles.

American Locomotive Co., New York.—Reception booth with catalogues.

American Palace Car Co., New York.—Track exhibit of combination parlor, sleeping and dining car "Beaulah," built by the St. Louis Car Co.

American Track Barrow Co., Lowell, Mass.—Models of track barrows and timber trucks.

American Ventilator Co., New York.—Track exhibit of automatic injector and ejector ventilators, applied to New York Central steel suburban car.

Bemis Mfg. Co., Pittsburg, Pa.—The Miller quick acting monkey wrench.

Baldwin Locomotive Works, Philadelphia, Pa.—Reception booth.

Baldwin Steel Co., New York.—Hudson high speed steel and a full line of high speed steels; also crucible tool steel.

Boker, Herman, & Co., New York.—"Novo" patent section tool steel and cutters; also "Intra Steel," a new semi-high speed steel to be used as substitute for carbon steel.

Boyd, Jas., & Bro., Philadelphia, Pa.—Boyd-Champion chemical fire engine; "Keystone" fire extinguishers.

Cambria Steel Co., Johnstown, Pa.—Track exhibit of two steel hopper cars and one low side steel gondola, all of 100,000 lbs. capacity and equipped with Coffin toughened axles.

Carborundum Co., The, Niagara Falls, N. Y.—Samples of "Carborundum," the abrasive material.

Celfor Tool Co., Buchanan, Mich.—High speed and twist drills in operation.

Chase, L. C., & Co., Boston, Mass.—"Goat Brand" mohair car seat plushes in various styles and colors.

Cleveland Car Specialty Co., Cleveland, Ohio.—Pressed steel carlines.

Coale Muffled Safety Valve Co., Baltimore, Md.—See Nathan Mfg. Co., RAILROAD GAZETTE, June 14, p. 860.

Crocker-Wheeler Co., Ampere, N. J.—Photographs showing application of motor drive to machine tools; also form I-F field-weakening motor.

Crucible Steel Co. of America, Pittsburg, Pa.—Tool steel forgings; twist drills made of "Rex A" high speed steel; flat and round bars of "Rex A" and tempering steel.

Dahlstrom Metallic Door Co., New York and Jamestown, N. Y.—The Dahlstrom all-steel hollow-construction door and cold-rolled steel car trimmings; views of standard Long Island R. R. passenger coach and track exhibit of New York Central coach built by the St. Louis Car Co. trimmed with the above.

Damascus Brake Beam Co., Cleveland, Ohio.—"Damascus" and "Waycott" brake beams.

Davis, John, Co., Chicago, Ill.—Back pressure and reducing valves; pump and air regulators; armored hose.

Davis Expansion Boring Tool Co., St. Louis, Mo.—Davis expansion boring tools.

Ehret Magnesia Manufacturing Co., Philadelphia, Pa.—Reception booth.

Fibrous Paint Co., Philadelphia, Pa.—"Fibrous" paint under demonstration to show its adhesive, flexible, water- and acid-proof qualities.

Forsyth Bros. Co., Chicago.—Chaffee drawbar centering device; Stucki radial drawbar centering device; Forsyth buffing mechanism; metallic sash; draft rigging and drawbar controlling devices.

France Packing Co., Philadelphia, Pa.—France metallic packing; fibrous "Steam Stopper" packing; rubber sheet packing; France grease cups.

General Electric Co., Schenectady, N. Y.—Photographs of electrical apparatus and installations.

Gisholt Machine Co., Madison, Wis.—Photographs showing Gisholt lathes, vertical boring mills and universal tool grinders.

Gould Coupler Co., New York.—Gould Z-beam steel platform with friction buffer and friction draft-gear for passenger cars; Gould steel freight couplers; Gould malleable iron journal boxes; "Crown" steel body and truck bolsters; Gould wing body bolster; malleable iron draft arms; Gould friction draft gear for freight and locomotive service; Gould tandem draft gear for wood and steel sills; spring buffers; tender couplers; Gould improved vestibule; "Crown" truck bolster for 30-ton cars, showing casting unfractured after bending test of 250,000 lbs.; steel castings; Gould steel freight coupler with side unlocking device.

Grip Nut Co., Chicago.—Square and hexagon grip nuts in all sizes.

Hess-Bright Mfg. Co., Philadelphia, Pa.—A standard set of Prussian State Railroads axle and wheels equipped with Hess ball bearing journals that have had 65,000 miles of service.

High Duty Saw & Tool Co., Eddystone, Pa.—A 52-in. diameter standard Tindel inserted tooth saw; a 36-in. diameter structural saw.

Home Rubber Co., Trenton, N. J.—"M. B. O." brand air pump and sheet packings and steam hose.

Kansas City Railway Foundry Co., Kansas City, Mo.—Rogers journal box, waste box and engine journal cellars; also Fisher grain door.

Keystone Nut Lock Mfg. Co., Pittsburg, Pa.—The Smith nut lock as applied to arch bars, trucks and draft rigging.

Koppel, Arthur, Co., Pittsburg, Pa.—Industrial railway materials.

Landis Machine Co., Waynesboro, Pa.—Two-inch double head bolt cutter with full equipment for threading and nut tapping; also samples of work.

Latrobe Steel and Coupler Co., Philadelphia, Pa.—Latrobe, Chicago and Melrose freight couplers; Latrobe Lewis-Seley engine coupler; Goodman cast-steel drawbar yoke and wrecking hook.

Lawrenceville Bronze Co., Pittsburg, Pa.—"Corinthian" bronze driving-box brasses and rod brasses; "O.K." quick union; "K. & S." malleable bronze.

Love Brake Shoe Co., Chicago.—Armbrust car and locomotive brake shoes and brake heads.

Lucas, John, & Co., Philadelphia, Pa.—Lucas coach and car colors; stains; fillers; varnishes, and the "Mirac" varnish and paint remover.

McIlvain, J. Gibson, & Co., Philadelphia, Pa.—Samples of domestic and foreign hardwood lumber.

McGuire Cummings Mfg. Co., Chicago, Ill.—McGuire car door brackets.

Massachusetts Mohair Plush Co., Boston, Mass.—Plush covered car seats and samples of car plushes.

Metal Plated Car & Lumber Co., New York.—Full size section of N. Y. N. H. & H. coach, equipped with the Brown metallic window strip; section of metal plated car.

Modoc Soap Co., Philadelphia, Pa.—Demonstration of "Perfectol" car cleaner on P. R. R. passenger coaches on exhibit tracks; reception booth in ball room.

Moran Flexible Steam Joint Co., Louisville, Ky.—Moran flexible joints for steam, air, liquid, and gas; also trolley controller.

Morgan & Wright, Detroit Rubber Works, Detroit, Mich.—Morganite throttle stem packing; piston rod-packing; steel sheet packing, and engine and tender hose.

National Roofing Co., The, Tonawanda, N. Y.—"Security," "National," "Crystalite" and "Royal" brands of ready roofing.

National Tube Co., Pittsburg, Pa.—Track exhibit of steel gondola car loaded with pipe and equipped with tubular telescopic steel stakes and wire cross ties.

Oil Well Supply Co., Pittsburg, Pa.—Railroad special globe valves.

Ostermann Mfg. Co., Chicago.—Ostermann grain door.

Otis, Spencer, Co., Chicago.—Hutchins car roofs; Solid Steel Tool Co.'s forgings and Tyler Tube & Pipe Co.'s tubes.

Pennsylvania Railroad.—Track exhibit of a 60-ft. all-steel postal car built at Altoona from the company's designs.

Phillips-Laffitte Co., Philadelphia, Pa.—Laffitte welding plates.

Pyle-National Electric Headlight Co., Chicago.—Rest room and booth.

Riverside Metal Co., Riverside, N. J.—Phosphor bronze; German silver and white metal ingots; also castings, sheets, rods and phosphor bronze wire ropes.

Roadhouse Steam Coupler Co., Detroit, Mich.—Steam hose coupler.

Rostand Mfg. Co., The, Milford, Conn.—The McCarthy baggage rack for passenger cars. Collection of old style racks showing the evolution of the baggage rack; full size section of a standard N. Y., N. H. & H. coach, showing application; photographs.

Rubberset Brush Co., Newark, N. J.—"Rubberset" paint brushes for railroad use.

Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.—Steel nuts and bolts for locomotive and car work.

St. Louis Car Co., St. Louis, Mo.—Track exhibit of combination parlor, smoking and dining car "Beaudah" built for the American Palace Car Co.; also steel trailer car for suburban service built for the New York Central & Hudson River and fitted with injector and ejector ventilators made by the Automatic Ventilator Co., New York.

Scullin-Gallagher Iron & Steel Co., St. Louis, Mo.—Booth and rest room.

Sectional Grain Door Co., Indianapolis, Ind.—Sectional grain door.

Societe Generale des Freins Lipkowski, Paris, France.—Chapsal-Saillot long freight train brake.

Standard Coupler Co., New York.—Sessions-Standard friction draft gear. Reception booth.

Taylor, Jas. L., Mfg. Co., Bloomfield, N. J.—Screw clamps of various sizes and designs.

Summers, H. J., Chicago.—Automatic releasing vestibule curtain hook.

Timms, Jas. & J. O., Columbus, Ohio.—The "Excel" automatic car coupler.

Toomey, John A., Chicago.—Folding car stake for flat cars.

Universal Railway Equipment Co., Jackson, Mich.—Sample of "Easy Lift" grain door.

Washburn Steel Castings & Coupler Co., Minneapolis, Minn.—Washburn car and locomotive replacers; cast-steel bolsters; buffer beams; friction draft rigging; car and locomotive couplers, etc.

Wendell & MacDuffie, New York.—Gutellus asbestos ventilating smokejack; "Century" asbestos shingles and building lumber.

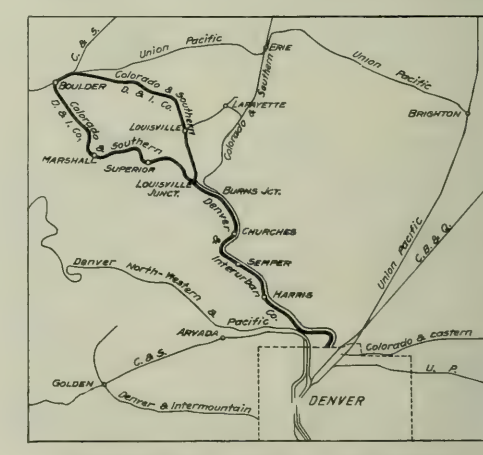
Western Railway Equipment Co., St. Louis, Mo.—Linstrom siphon pipes; car doors; Western truck end castings; Economy slack adjusters; Western bell ringers; door fastenings; Acme slack adjusters; Western sill pockets and carlines; Western brake-jaws; Hoerr tandem draft gear and Linstrom eccentrics.

Wood, G. S., Chicago.—Air brake hose protectors and mechanical rubber goods. The Harlin coupler.

The Denver & Interurban's Electrification Plans.

The organization by officers of the Colorado & Southern of the Denver & Interurban Company and an outline of its plan for building electric railroads and electrifying certain lines of the Colorado & Southern were given in these columns about the time of the company's incorporation (Oct. 14, 1904, p. 121, General News Section). Nothing was done toward carrying these plans into effect until recently. The company now has under way a line from Denver to Boulder, 44 miles, as shown on the accompanying map. From Denver to Louisville Junction, 16 miles, is to be on private but independent right-of-way, parallel to the Colorado & Southern. From Louisville Junction to Boulder the electric line will use the Colorado & Southern tracks to Boulder, and from Boulder, by the loop shown, back to Louisville Junction.

The company will buy power from the plant of the Northern



Colorado & Southern Electric Line to Boulder.

Colorado Power Company at Louisville. The line will be overhead construction, poles on one side, with brackets and suspended catenary construction. The trolley line will carry alternating current at 11,000 volts. At the Denver city limits the new line connects with the tracks of the Denver Tramway Company, which uses overhead construction and direct current. These will be used to the heart of the city. Transfers will be issued to all lines of the Tramway company.

It is expected to begin service about December 1. The initial equipment will be 10 motor cars and six trailers, the cars to run in multiple. Plans for these cars are not yet fully decided on, but they will be 56 ft. long and 9 ft. wide, and have a seating capacity of 60, except the combination cars, which will have baggage compartments. The motor cars will be equipped with four 125-h.p. a.c. motors with Baldwin trucks.

Besides this line, this company also is building a street car line in the town of Fort Collins, 74 miles north of Denver on the Colorado & Southern. Seven miles of line will be built this year. The power for this will also be furnished by the Northern Colorado Power Company and will be delivered to the street car barn in Fort Collins at 60,000 volts and there stepped down and converted into direct current. Four motor cars have been ordered in Denver, and two motor cars and four trailers are to be ordered in the East.

The Master Mechanics' Convention.

The fortieth annual convention of the American Railway Master Mechanics' Association was held on the Steel Pier, Atlantic City, N. J., June 12, 13 and 14. President J. F. Deems (New York Central Lines) called the meeting to order at 9.45 a.m. The address of welcome of Mayor Stoy, of Atlantic City, was responded to by A. M. Waitt, following which President Deems delivered his address, which was in part as follows:

PRESIDENT'S ADDRESS.

* * * Did you ever stop to think that Omaha, or even Denver, is to-day, thanks to our railroad service, nearer to New York City than Philadelphia was in 1764, when Benjamin Franklin amused himself for three and a half days knitting stockings in a stage coach while going from the Quaker City to New York to sail away to the other side in connection with some diplomatic service at the Court of St. James? History makes no record of a development that is in any way a parallel to that which has taken place in connection with the railroads on this continent, and I dare assert here this morning that no organization, that no association as such, has done so much in this grand achievement as the one represented here to-day. The history of this association of earnest men is written in the progress of the nation, which of all nations the world is proud to call great. Throughout all time all great works have been effected by earnest men—few or many—brought together by a common object or a common impulse, whether conquest, colonization, political achievement, struggle for independence, or the defense of that which men hold most dear—this country, although young, bears upon its breast many medals and memorials to those who have devoted their lives to leadership in sanguinary strife. Monuments to military achievement are most common in the Old World. Every land across the sea is dotted with those memorials which in their mute eloquence bear testimony to the fact that the world loves, honors and reveres those who have given their best for her glory, even though many of the causes for which they contended were never important, and have long since been forgotten. Where man has died for man is sacred ground, and while to those heroes we humbly pay the homage of our tears, let us hope that the day of the military hero is passed, passed never to return, and that in his place is one who leads on and ever on in that greater development which stands for that future which means sublimer peace, a larger hope, greater happiness and a better humanity.

No war-bronzed veterans ever had deeper inspiration or greater cause for self-forgetful devotion than had the pioneers who bore the brunt of the early days of the development which this association has so splendidly advanced. All the honors accorded to military achievement in the past but illy compare with those which the future will gladly erect to the memory of the men who have given us that grander, that more useful development, transportation, without which to-day the world would be largely a waste. Our predecessors met in a small way and singly the problems which we and those who follow us must meet collectively and in a larger sense, and to solve which it will be necessary to form great combinations that must be harmonious, cohesive and permanent. It is no slight task to conceive and build a structure that will provide for the interchange of people, the mutation of ideas and the physical distribution of that which enters into man's every need. We are fortunate in that our fathers built so well; let us hope that those who follow can truly say the same of us. Let us devote ourselves seriously to the problems of to-day, chief among which is to try to do as well the things that come to our hand as our predecessors did with the smaller things that came to their hands.

A legacy has been bequeathed us, a legacy for which all preparation has been made, a legacy of opportunity which looms large in the future and awaits with rich reward the man who is prepared. We have received; what shall we give? We have inherited; what shall we bequeath? What shall we leave to aid in solving the problems of the future, many of which may be much more perplexing than those we are called upon to solve to-day? We may work in brass and steel and leave the most perfect mechanism; we may develop and improve and solve methods and practices until nothing more can be desired; we may reach perfection in all these in mechanism, structure and method and yet our bequest be a failure and itself a burden unless we provide that which is paramount, which is over and above the sum total of all of this, and for which even to-day events throughout the world are crying aloud—the man. A man prepared, experienced, earnest, hopeful and happy, consecrated to his work and ready to the hand of the future.

This, my friends, as I see it, constitutes our greatest opportunity, our most imperative, our most sacred duty. If the man is provided, the machine will cease to be a burden and methods will come forth as the buds at the kiss of spring. Our own future, and the hope of that larger future which lies beyond, depends on our efforts and our success in providing those who are to help us to-day, and upon whom at no distant day must fall our duties, our opportunities, our honors and our failures. Have we any greater, grander, more sublime obligation than this? Can we justify a pride in our life-work if we fail in this? If I can but bring to you this single message, if I can inspire you with this one thought, I am content.

The Secretary's report showed two members transferred to the honorary roll, 10 deaths, 12 resignations and six dropped during the year. There were 66 new members added and two reinstatements, making a total membership of 876, divided as follows: 819 active, 17 associate and 40 honorary. The balance in the treasury was $2,739.

The Secretary reported that there would be a vacancy for four scholarships at Stevens Institute of Technology, beginning with the next college year; also that the Ryerson & Sons' scholarship at Purdue University, the present holder of which graduates this year, would be continued for another four years.

W. C. Ennis, Henry Elliott and G. S. Allen were transferred to honorary membership, and J. Snowden Bell and Lawford H. Fry were elected to associate membership.

Before proceeding to the regular business on the programme President Deems spoke of the excellence of the exhibits made by the Supplymen's Association, and advised the members to devote a certain period each day to looking them over, as it would be to the material benefit of all members.

DISCUSSION OF REPORTS.

Mechanical Stokers.—The committee submitted only a brief progress report, and there was little discussion of this subject. Mr. Walsh (C. & O.) mentioned an interesting point in declaring that with the substitution of wide firebox engines for those having long, narrow fireboxes the necessity for mechanical stokers had practically disappeared.

Shrinkage Allowance for Tires.—F. J. Cole, chairman of the committee, presented the report. Mr. Waitt spoke of the prevailing practice in Europe to use driving-wheel centers cast solid and of the contrary custom in America. Professor Hibbard (Cornell University) asked why in the shrinkage recommendations there was an allowance of one-eightieth of a foot for 66 in. in diameter and under, and then a sudden jump to one-sixtieth of a foot for diameters in excess of this. David Brown (D., L. & W.) thought that the rims of the wheels are being made too narrow; that by the time the necessary coring is done and the tire fitted on, the available surface for the shrunken tire to exert its pressure on is too much reduced. Answering Mr. Waitt, Mr. Cole said that there were at least three or four foundries in this country that will make the solid rim centers, which, of course, are preferable where shrinkage strains are properly cared for. Regarding greater width of rim, he said the committee recommended this, and there would be no objection to making them solid except on small locomotives with very heavy rods and pins.

On motion, the committee was instructed to prepare its recommendations in the form of a letter ballot for submission to the association, these recommendations to include one concerning retaining rings as against shoulders either on the tire or center.

Locomotive Lubrication.—Much of the time given to this report was taken up by different members citing incidents within their knowledge of unusual performances with a given quantity of oil, and occasionally no oil at all, the point in most cases being to show that it depended almost entirely on the engineman as to the mileage got from a given quantity of oil. It appeared that if enginemen cared to devote the time and attention to the matter they could make excellent oil records, but most of them thought the saving did not repay the amount of trouble and constant care necessary.

The superior results in lubrication of automobiles, as compared with locomotives, were referred to and the suggestion made that if with the latter similar methods could be employed it might give equally good results. In answer, however, attention was directed to the difference in operating conditions of the two machines, the shutting off and drifting with locomotives causing particularly adverse conditions as regards cylinder and valve lubrication, which, of course, is not present in automobiles.

There was also testimony regarding the importance of properly locating the steam chest plugs, and from some members concerning good results obtained from grease.

Apprentice System on New York Central.—This was intended originally for a topical discussion, but the description prepared by Messrs. Cross and Russell (N. Y. C.) had been printed and distributed as a report. Its presentation aroused so much interest that the entire time of the first day's noon-hour discussion period was devoted to it, and it was continued to the following day. A. M. Waitt said: "At the present time there is no more serious problem confronting the railroads, and especially the mechanical department of railroads, than the future relationship between the employees in the mechanical department and the companies. We find that probably as much of the time of motive power officers is taken up in considering the difficulties of the labor problem as is devoted to strictly technical subjects of the department. The growing tendency to specialization seems to have led to a lack of general all-around mechanics in the shops. It has been noticed in probably every shop in the country that there is a great

dearth of suitable men when a good man is desired for a foreman and the man in charge of the shops, or of the department looks about to find a man of the right caliber and a man who has enough of general information on his department work to be put in charge of men. That problem has got to be faced, and it seems to me that this step that has been taken by the New York Central Lines, on a comprehensive and broad scale, is one of the most important steps that has been taken by railroads in this country for a long time. I think there is nothing more important for the future good of railroads, in the mechanical department, for raising the standard of mechanics in the shops than the establishment of a thoroughly comprehensive and wisely carried out system for educating apprentices, so that we can have all-round mechanics and men who will not simply know one little specialty and take no interest outside of that. There has been a tendency lately, in connection with various organizations to lower, seemingly, the standard of efficiency of the men. I believe that a system, such as has been outlined by Mr. Cross, is one of the steps to offset that tendency and to raise permanently for the future the standard, as it should be raised, so that instead of going through our shops and comparing the present class of men with those of 15 or 20 years ago, and commenting as we do now that they are not up to the old standard, that we may in five or ten years from now look through the shops and find the standard constantly improving, and so that others may look to the railroads as an example of the best methods of raising the caliber and the general standard of the mechanics. There is a common tendency in shops for general foremen to feel that they must, in taking young fellows into the shop and training them eventually to become mechanics, to get all that they can out of them, to get all the value possible at first from their services, forgetting that one of the desirable features in training apprentices is to make them first-class workmen. The value cannot come in the first years of their apprenticeship, but just as surely as they are properly trained the value will come to the company and to the community at large from their services after they have been properly trained. I think we should not forget to make the proper training of the young men the first consideration and the getting of the value of their services in the first years of their apprenticeship secondary, and surely the best results will come in the end by carrying out that principle."

H. Emerson (Coun. Engr.): It may be of interest to give a statement of what apprentices were doing under the old system, which I hope will soon become obsolete, and perhaps some time in the future it may be possible to find out what they are doing under these new systems that I hope to see spread. In the boiler shop (on the Santa Fe) we had 23 apprentices whose average efficiency was 87 per cent. in the work that they did. The efficiency of the whole shop, including the apprentices, was 94 per cent., so that the apprentices, as a rule, were below the efficiency of the men. On the list I find one apprentice with an efficiency of 136 per cent. and another with an efficiency of only 43 per cent. In the machine shop there are 56 apprentices with an average efficiency of only 69 per cent. The first man on the list has an efficiency of 136.8 per cent., the next man an efficiency of only 33 per cent., showing the tremendous variation in individuals. The first man is four times as good as the second man, and my impression is that throughout life he will steadily gain, as time goes on, and he will not be only four times as good, but ultimately 10 or 20 or 100 times as good. One of the features that perhaps is necessary is to check up the apprentices throughout their course of service with reference to their efficiency so as to encourage those who show a high degree of efficiency, and if possible divert those that show no ability whatever into other walks of life. During the time of apprenticeship, more than at any other period of life, it seems to be necessary to impress upon the apprentice the question of his own efficiency, that what he is learning is not simply to absorb a certain amount of knowledge, but to carry it into actual work, so that he himself becomes efficient.

D. R. MacBain (Mich. Cent.): We found when we were trying to carry out our old system of apprenticeship work, when we undertook to have the apprentices attend a course of instruction for an hour or an hour and a half after the work of the day, we got little results out of that practice; the boys did not put the enthusiasm into the work which they are doing now. Also since the inauguration of the new system, and particularly within the last five or six months, since the thing has become advertised, we are getting applications from a much better class of young men than before. They have learned that our apprenticeship system is very much like a fairly good technical education when the young man starts in. For that reason the applications are very numerous and are many more than we can take care of.

G. M. Basford (Am. Loc. Co.): Nearly all railroads and industrial establishments have preached apprenticeship and nearly all have made serious efforts to practice it. In spite of this, it would probably require from 40 to 70 years for most of these establishments to recruit their service of skilled labor through apprenticeship if they relied upon present methods for the purpose. We need definite systematic apprenticeship, adapted to present conditions. Even if we had plenty of apprentice material shop people are too busy to teach boys, and if the boys are put into the shop organization to learn trades under prevailing conditions they will quickly absorb much that is harmful and more slowly learn some of the things we wish them to know. For 60 years the British navy has profited by a plan somewhat similar to the one described.

Professor Hibbard (Cornell Univ.): The trade schools of Germany have taken a position in educational matters in Germany that is practically unknown in the United States. I hope that the influence of this paper and the influence of the New York Central Lines in the progress that they are making, and will make in this regard, will stir up our public school educators, so that something will be done to put us on a par with Germany's manual training and manufacturing education.

W. McIntosh (C. R. R. of N. J.): In former methods of apprentice instruction the effort has always been made to give the boys instruction outside of the regular working hours, expecting them to go back to the works after the regular hours of the day and to give considerable time at night to instruction. It is not surprising that that did not prove successful. The plan to give instruction during regular working hours is one of the important features of the system, and one that is absolutely necessary to meet with success. In 1905 we established a school in connection with our road very much on the lines here described. We have 60 students under instruction at the present time, and some of them are advancing very rapidly.

Le Grand Parish (L. S. & M. S.): This method of instructing apprentices is a good, sound business proposition—no charity in it. We have found that by thus instructing the boys we get a much greater output from them. We are not losing anything in the matter of dollars and cents—from the financial point of view we are gaining.

W. B. Russell (N. Y. C.), one of the authors of the paper, gave a long description of certain of the features of the work, the methods, etc., in the course of which he said: "The two features of the work are the drawing courses, and what we call the problem courses, which will mean a good deal in the long run. The drawing courses for apprentices are nothing new, but this method of teaching drawing is different from anything I know of in this country. The geometrical work which ordinarily takes a year or two in most evening schools is omitted entirely. The boy starts immediately on practical work, being called upon to deal with actual conditions. The geometrical knowledge may be necessary, but that is introduced as it is wanted. We do not teach him the principle and then let him apply it, but teach the application and the principle at the same time, the idea being to keep the object in view all the time to accomplish something definite, and not the idea of the theory of training. * * * The problem work is unique in this respect, that we have nothing to fall back upon. We found it impossible to use text-books. There is nothing in the country at the present time to fit the needs of an apprentice in the machine shop, and it has been necessary to start from the beginning. * * *

"We are endeavoring as rapidly as possible to bring in experimental work, not the kind the colleges have, because we are not trying to prove the laws of nature, but the kind that will show the reason for things. We have introduced at most points a small engine, because we have found many apprentices did not know what a valve was, nor understand the definition of lapping and leading in the class room, but they can see these things on the actual locomotive. I think every machinist in our class will be able to set valves before he graduates.

"It was stated this plan would not work where piece-work was inaugurated. It will work equally well with either piece-work or day-work. We have it on both plans. Specializing and not piecework is to blame for the present condition of lack of apprentices. This plan will also work in a small shop, and we expect to put it in shops where there are only five apprentices. It may be that the shop instructor and the educational instructor will be one and the same man in that case, but he will be able to give lots of his time to this work. Provision is made for the college man. We have no objection to the college man's taking our regular apprenticeship course. Many instructors in the college are taking that view of the matter. Provision is made in the apprenticeship regulations for allowance to be made for previous experience, and that covers the college man."

F. P. Roesch (Southern): There has been inaugurated in the Spencer shops of the Southern during the past few months a system practically on the same lines as laid down by Mr. Cross. With some of the boys it is necessary to commence at the beginning, to teach them the A B C's. From that on they are taught drawing, arithmetic, some of the elements of geometry, although not in a regular way; they are taught the strength of materials, and what is the minimum cutting speed of the different steel and tools. The maximum cutting speeds we allow them to determine for themselves, and we find they are doing pretty well at that.

Mr. Waitt: In view of the evident interest taken in this subject and the importance that seems to be given to it, I move that it be placed in the hands of a competent committee to consider the developments and advancements in the apprenticeship system of education during the coming year and to report upon that, and also

to consider the advisability of continuing or substituting something more up to date for our present recommended practice that is printed from year to year in our reports.

Motion carried.

Spacing of Flues in High-Pressure Boilers.—Following the presentation of this report John Tonge (M. & St. L.), one of the committee, presented some supplemental information regarding the flue spacing and arrangement on his road with the savings in costs of material and labor effected thereby.

F. F. Gaines (C. of Ga.): At a previous meeting of the association attention was called to increasing the bridge spacing by using a much decreased end on a standard flue to accomplish practically the same object of the greater spacing of the flues—that is, to get a larger area around the flue at the bridge sheet. It seems to me this is the principal thing to be gained in the larger spacing of the flues, to get more room at the bridge.

G. W. West (N. Y., O. & W.): We have been following that practice for a number of years, putting 1¾-in. safe-ends on 2-in. flues and 2-in. safe-ends on 2¼-in. flues, and we have materially reduced our flue troubles and get better steaming engines, and our flue-sheets are almost doubling the extent of their lives.

Mention was made of the fact that the alleged advantages of wider spacing of flues had been known for several years, yet the practice in that regard has not changed materially.

F. H. Clark (C., B. & Q.): This question of flue spacing has to be considered in connection with several other matters—the water, the steaming qualities of the boiler and circulation generally. A number of years ago we changed an engine which previously had ⅝-in. bridges, and we increased the bridges. I do not know whether we did it by putting in a new flue-sheet and a number of smaller tubes, or used the same size tubes and a lesser number. At any rate, the result was to make a very poor steaming engine; the engine was not a good steamer in the first place. By increasing the spacing of the flues we had got below the necessary heating surface for that particular engine. Since that time we have increased the width of our bridges somewhat, though not much, probably 1/16-in., and we find that to be pretty satisfactory for almost any size of boiler, provided we have a good circulation outside of the flues and plenty of room between the flues and the shell. It does not seem to matter much what the spacing is so long as you get good circulation.

H. H. Vaughan (C. P.): There is no doubt that a bridge of 13/16 or ⅞-in., or even larger, has proved advantageous in bad-water districts. Sometimes we make a mistake in bad-water districts by heavy prossering after increasing our bridge. That will certainly allow the scale to accumulate around the bead formed on the inside of the bridge that almost neutralizes the effect of the larger bridges. We have obtained good results in bad-water districts by doing away with the prossering altogether, so as to leave as clear a chance as possible for the water to circulate and to prevent stale water from accumulating as much as possible.

Mr. Tonge's argument seems to be based very largely on the saving in the cost of renewing flues. I do not agree that it would be a good thing to have a smaller number of flues because it costs less to safe-end them. It is fairly safe to assume that the larger the number of flues you can get into a boiler without affecting the circulation and without getting them placed so close to the flanges that we have no room there for flexibility, the better. The general principle in designing an engine is to take a certain weight and try to get in as much heating surface as possible, and I believe that is the right principle. If we are going to reduce our heating surface 5 to 10 per cent., we may not by any test be able to distinguish any difference in the economy of the engine, but I feel that the decreased economy is there. You cannot cut down the heating surface 10 per cent. on an engine and expect to evaporate as much water right along as you would do with a larger amount of heating surface, and the loss in evaporation will certainly more than counterbalance the cost of replacing flues. In other words, I believe that until we get so many flues that we are getting more than the boiler can take care of comfortably, it is a good thing to have them. I would not cut out flues to save the cost of safe-ending them.

A motion was made by W. Forsyth to appoint a committee to ascertain in the most economical spacing of tubes in locomotive boilers and the relative value of the heating surface of tubes of different lengths; that the committee arrange to have experiments made at Purdue University, and that a fund be provided for the expense of a special experimental boiler for the purpose, the action being subject to the approval of the executive committee. After considerable discussion the motion was lost, the majority of the members seeming to think that if any tests were to be made they should be service tests. On final motion the report was received and the committee continued for another year.

Shop Cost Systems and the Effect of Shop Schedules upon Output and Cost of Locomotive Repairs.—This individual paper by A. Lovell, of the Santa Fe, was presented by Harrington Emerson in the author's absence.

H. H. Vaughan (C. P.): It appears to me that Mr. Lovell has described a system of shop costs that is one of the neatest and most complete arrangements that has ever been brought out in the direction of keeping track of men's efficiency. He has supplied the key to make operation-cost systems practical and useful by taking the standard time or cost on each job and compiling the figures for each man each month and then for all the men each month, and thus giving a system which probably is equal to any piece-work system we could devise. In a good many of our smaller shops piece-work systems are difficult. The work comes along in such a way that it does not allow of piece-work systems being satisfactorily introduced, and those shops are being judged very largely on their output of general repairs, or output of intermediate repairs, and we have no way of judging of them. When I was on the Lake Shore we were asked, as a committee of the New York Central Lines, to get up some system of comparing the output of different shops. We were immediately struck with the difficulty that always has been experienced in that connection, that a man could always get increased output by neglecting his repairs. A man can do repairs much cheaper than the other fellow if he does not do them as well. Mr. Lovell's system compares these things, unit by unit, and groups them together to form a completed engine, so that if one man does an engine for 110 per cent. and another for 90 per cent., you have a direct measure of the efficiency of those two jobs, based really on what would be equivalent to piece-work prices for each little job done. We have never before had a system brought before this association that would enable you to do a thing of that sort. We have never had a system for keeping track of each man's efficiency, or each gang's efficiency, in the way that this system does. I think this is one of the most remarkable papers that we have ever had, in that sense.

Results of Use of Different Valve Gears.—Discussion of this report consisted of testimony from different members concerning the satisfactory results given by the Walschaert valve gear with both slide and piston valves and its advantages over the Stephenson gear. No one seemed to have any complaints to register, either from the operating or maintenance standpoints.

Blanks for Reporting Work on Engines Undergoing Repairs.—The report was presented by E. W. Pratt, of the committee.

F. F. Gaines (C. of Ga.): There is one thing the report does not fully cover. It is very important at times to be able to give your operating officials a statement of how many engines you have available for service and how many engines you have in the shop daily. That could be handled in two ways: Where the conditions permit you can have the report made out and forward it to the train service department every evening, and the information contained in the report can be tabulated at headquarters every morning. In other cases it may be necessary to have a telegraphic report to cover this point, and, generally speaking, it will be found that it is very desirable to find what engines have been shopped daily, those turned out and those put into the shop, for light repairs, and also a statement of those engines which are undergoing heavy repairs, so that the operating department can get some sort of concise statement showing just where it stands each day. Of course, this information will be equally of value to the shop department.

H. Emerson: The paper outlines admirable records of what is going on in the shop, but it does not seem to me to be worth anything at all in determining the policy of what is impending with reference to railroad affairs. In looking over the repairs of a large railroad company we found that certain divisions would suddenly go all to pieces; they would apparently be in first-class condition, and inside of 30 days there was no motive power available, all the engines virtually being in the shop. A method was therefore devised that took the matter very largely out of the hands of the operating officials, as far as information was concerned. Every single engine was put on an efficiency basis, in the same way that the men were put on an efficiency basis. The average of all the engines in the division had to average 100. If they did not average 100, it was evident that the engines were dropping backward, and we would find ourselves in a hole. If, on the other hand, the engines averaged more than 100 on the monthly record, we knew the conditions as to that division were satisfactory. In connection with that the tonnage by months for a series of years was plotted in connection with each division, so that it was possible to say, without asking anybody whatever, in a general way exactly the period of the year when all the engines on any particular division would be required for very heavy service, and also the particular time of the year when it would be convenient to shop more engines from a particular division than at some other period.

Working along these lines it has been possible to plot the efficiency of the engines at any moment whatever, the efficiency of all the engines on the division, and plan months ahead as to just exactly how many engines should go into the shop and to tell the master mechanic three or four months ahead: "You must put so many engines into the shop next August, because if you do not put them in in August you will be in trouble in September or October," and that has introduced an entirely different method from the one with which I was formerly acquainted, for shopping and looking after engines.

On motion the committee was continued for another year and

asked to investigate what is being done along the lines touched upon by Mr. Emerson.

Development of Motor Cars for Light Passenger Service.—In presenting the report, H. F. Ball, chairman of the committee, said that since its preparation information had been received about the Kobusch-Wagenhals design of steam car, which he briefly gave. The first of these cars to be built was described in the *Railroad Gazette* of October 5, 1906.

William Forsyth mentioned a paper presented at the recent meeting of the American Society of Mechanical Engineers which illustrated quite a number of the foreign boilers for such cars.

There was no discussion of the committee report.

Causes of Leaks in Locomotive Boiler Tubes.—This individual paper was presented by its author, M. E. Wells (W. & L. E.), who discussed it quite at length. Among other things he said: One of the things in this paper that I want to bring out is the fact that the deterioration of the bottom tubes and the sides of the firebox is not caused by the fact that the sheet becomes hotter there than in any other place in the boiler, but on account of varying conditions in the water space, because the evaporation around the firebox is much higher than at the front end the demand for water at the firebox is much stronger and the circulation is toward the firebox when the boiler is in operation. The feed-water, therefore, goes to the bottom and back. I had an idea for a while that the cold water should settle uniformly throughout the whole length of the boiler, but it occurred to me that the mere fact of the deepening of the water-leg had a tendency to draw the water backward, whether the boiler was in operation or not. This colder water, causing the contraction of the tube in the space directly on the inside of the sheet, I feel, has quite an action to upset and make smaller the portion of the tube set in the tube plate, which has a tendency to be kept at a higher temperature on account of the fire. You may say that the reason I was led to take this view of the effects of the water is because we do not have the trouble in the top. You say there is more incrustation in the bottom; that when the engine comes out, for the first two or three months the leak is at the bottom the same as it is for the last six or eight months, but there is no excessive accumulation to cause what you might call overheating. The first leakage after an engine is out of the shop with new tubes is in the bottom, just the same as it always has and always will be, apparently. That is why I say that you cannot attribute this to the formation of scale. I am willing to admit after the boiler becomes old there is a formation of scale which helps possibly to make the trouble worse.

Cold air is a cause which has always been talked about more than any one cause, but I cannot see where there can be very much expected from cold air. I sent out to the larger railroads a list of questions in order to get some information bearing on this subject. One of the questions I asked was: Can cold air entering the firebox cool the tubes and plates below the temperature of the water on the other side? The majority of the men answering that question said no. There seems to be no other answer. You know that the influence of water on the inside of a boiler will keep the sheet that is adjacent to it up to within a degree or two of the temperature of that water, in spite of any ordinary air condition. It is an easy matter with the injector to cool the temperature of the boiler 100 deg., and cold air could not possibly cool it 5 deg. below the water temperature on the other side, but when you cool the water side, then you are doing some cooling that gets right to the point. It is the internal conditions in the boiler which cause the trouble. The best way to rectify that is with your crew; they can do a great deal. It is naturally a little trouble sometimes to fix your injectors conveniently and do away with the screw throttles and give your men lever throttles wherever you can; but the most important line to work along is to devise something to do that automatically. The London & South Western Railway, of England, sent me a most encouraging report along that line, and I believe their system was developed entirely independently of anything that was being done in the United States. On the London & South Western, where an engine comes in that needs injectors removed, they are taken off and they put on little duplex pumps located at the head of the firebox under the bell of the boiler. Mr. Drummond, of the London & South Western, says: "We start the pumps when we start the engine, and we shut off the pumps when we shut off the engine, and we maintain a uniform boiler feed. Our allowable variation in the water glass is ½ in." It seems almost impossible to think you could get your engineers to do that. Just get them to do that well with your injectors and much of the difficulty will be removed. There is quite an erroneous idea as regards the temperature of sheets and fireboxes. The temperature of the fire in the firebox ranges not far from 2,000 to 2,400 deg. The Pennsylvania tests at St. Louis gave 2,300 to 2,400 deg. The temperature of the water, with 200 lbs. of steam, is 388 deg. The sheet ordinarily is seldom higher than 75 deg. above that. The difference on the two sides of the sheet, according to some tests referred to in the paper, is not very great; the transmission of heat through a ⅜-in. sheet is so rapid that the difference in temperature between the two sides of the sheet is not very great, and there can be very little trouble from this heat, because the sheet in a firebox that evaporates the most water and gives you the most steam gives you the least trouble—the crown-sheet. If a boiler sheet does reach the point of burning, either from scale or from other cause, you know about it.

In answering the set of questions I sent out, Mr. Lewis, of the Norfolk & Western, says that 30 or 40 per cent., nearly half of their leaking engines, come in dry and leak over the clinker pit, largely on account of filling them up to save the boiler-washer's job. In answer to the question, "Have you made any changes in the introduction of feed-water into the boilers on this account," he said: "The effect of feed-water entering the boiler and starting the flues to leaking is more noticeable when the water is injected into the side of the boiler. To overcome this feature we have on several of our boilers constructed an auxiliary dome, which is located between the front of the boiler and the sand dome. This dome is filled with short sections of tubes, and the water is injected into it and among these tubes, so that by the time it has reached the bottom it is so nearly the temperature of the surrounding water that the difference in temperature is not so great as to cause such evil effects as where the water is injected low on the side of the boiler. The most important change in this connection was the application of a reinforced flue sheet, which consists of an auxiliary sheet placed 8 in. ahead of the back flue-sheet. This sheet is secured at regular intervals to the back flue-sheet by means of a series of stay-bolts. The auxiliary sheet has no other connection with the boiler, thus allowing it perfect freedom of adjustment in connection with the expansion and contraction of the flues and flue-sheet. The water has free access to this place on both sides. We believe with this auxiliary sheet a greater circulation of water at the flue-sheet proper is obtained, thereby keeping the flue-sheet at a more uniform temperature and also carrying away such sediment as is likely to adhere to the flue-sheet and result in scale."

F. P. Roesch (Southern): I cannot agree with Mr. Wells on the temperature of the water in the boiler being the cause of flue trouble. I draw my conclusions as much from practical experience as from practical tests. I have been located in countries with good water and bad water. I remember one particular instance in a bad-water country of a helper engine on a hill. The engine never entered the terminal to be washed out, or to have the fire cleaned, or anything like that; in fact, the fire was in the engine continually for months. Strange to say, while the particular water that this engine took was the worst water on the road, and while other engines passing through took the same water, and leaked, this engine did not. When business picked up, more engines were placed at this particular point, and they did not leak.

The question of flue leakage is exactly in ratio to the number of times the fire is knocked and the boiler is washed out. In a district I know of where the engine is washed every round trip, and consequently the fire is knocked, the life of flues is about three months. And in another district where the engine was washed every week and the fire was knocked only once a week, the same flues last six months longer. In a third district, where the engine is run for 15 or 30 days without a washing, and during that time the fire was not knocked except, possibly, to repair grates or something like that, the same flues last another nine months longer. On another road, up in the mountains, the fires are never knocked and flues last so long that we lose all record of them—20 years—never wash the boilers, never bother with them.

A year ago I had occasion to make a test to see if cold air did actually have any effect on flues. We took an ordinary wide firebox locomotive with 385 flues and put her over the cinder pit and knocked the fire. Preliminary to this test we opened up the front end and cleaned off one certain flue, perfectly clean and smooth. We made a long arm of wood with a micrometer attachment on the rear end of it. After the fire was knocked the engine still had 135 lbs. pressure, or 385 deg. of heat, and the length of that one particular flue was taken right in the center of the box, and at the same time the corresponding length was inscribed on the side of the boiler. After the engine stood quiet for 3 hours and 50 minutes without any water being injected into the boiler at all the pressure was dropped down to 56 lbs., or 305 deg. The boiler had contracted just an even $^{1}/_{16}$-in. in the length corresponding to the length of the flue, and this particular flue we took the length off had contracted $^{3}/_{32}$-in., showing that the flue through the action of the air through it had contracted more than the boiler itself. After the engine stood 2 hours and 30 minutes longer the pressure was down to 6 lbs., or 233 deg. of temperature. The boiler had contracted $^{14}/_{64}$-in., while the flue had contracted but $^{9}/_{64}$-in., showing that owing to the difference in the amount of metal in the boiler and flues, the final contraction of the boiler was greater than that of the flues, and produced a pushing and pulling action. Several other engines were tried with like results.

W. E. Symons: It is customary on some foreign and a few American roads, when an engine arrives at a terminal, to place a cap or lid over the smokestack. On many English roads there is a plate affixed to the stack on a hinge that is laid over the top of the smokestack to prevent air currents through the firebox and flues

in order to avoid the very difficulties that have been pointed out to us as coming from a change in temperature from feed-water. Therefore, it is very plain that the air temperature is very injurious and responsible for a great many of our boiler troubles.

A motion was adopted that further discussion be in written form and be forwarded to the secretary for incorporation into the Proceedings, subject to answer by the author of the paper before printing.

Superheating.—The report was presented by H. H. Vaughan, chairman of the committee, who said: Since writing the report I have come to the conclusion, from some facts we have learned about overheating of return bends, that the neglect of dampers has a good deal to do with the stopping up on the pipes. I do not believe the cinders will attach themselves to a cool return bend, and they do attach themselves very readily to a very hot one. * * There is a drop of pressure of from 5 to 7 lbs. under ordinary working conditions in the steam passing through the superheater. That makes the sight-feed lubricator a better lubricator on a superheater than it is on a saturated steam engine. As a matter of fact, on account of our always having 7 lbs. or more difference between the boiler and steam chest in the superheater than in the ordinary simple engine, the sight-feed lubricator worked just that much better instead of worse, and there is less trouble with it than there is on the ordinary engine. * * * Superheating came to this country with no experience except the European practice, and what does for European practice will not always do for us. That may be illustrated by a thing we have had driven on to us, and that is, that whatever superheater you use you have to use one that can be fixed up in an hour or two and the engine put back into business. * * * Several roads in the United States have tried a superheater that has given trouble, and they have said, to a certain extent, that the superheater would not do, that it gave too much trouble. Now, if the superheater can be properly handled it will not give too much trouble. I believe inside of another year's experience we can say definitely and reliably that you can equip your engines with superheaters, and if you will give them attention—not expense but attention—you can run without any more trouble than you have with the ordinary simple engine. I would like to emphasize the difference between attention and expense. If we are going to give up a device that will save from 10 to 20 per cent. on coal just because we cannot get roundhouse machinists and foremen to pay attention to things, we are going on the wrong track. It is a question of attention with your superheaters, and not of expense. We have the records from passenger service of the number of failures, and of these failures a large number came from the use of bronze nuts. There are only three failures that are serious in 198,000 miles. That shows definitely that you do not have enough engine failures with superheaters to condemn them. Our repair costs show that we do not have enough additional cost of repairs to condemn them. The road records show that they do make a satisfactory saving in coal. Therefore, I think this superheating is a thing that is worthy of careful attention and should be taken up properly.

We frequently hear it stated that coal costs only $1.50 or so, and it is hardly worth while to superheat, almost always forgetting that coal costs $1.50 originally may not cost that where it is burned. It costs money to haul coal to the place where it is burned. There are many roads showing coal at $1.50 on the performance sheets that are hauling it three and four hundred miles before it is used. You cannot haul it much under one-half a cent per ton mile, and that runs up fast, and there are few roads that cannot afford to spend $800 or $1,000 on a new engine to save that.

A. W. Gibbs (P. R. R.): Do the German recommendations for the sizes of piston valves hold out in our practice? One German engineer mentioned exceedingly small piston valves of special construction to prevent warping. Will they hold out, or do we have to use valves as large as with saturated steam, and do we have to use forced lubrication?

Mr. Vaughan: We have been using superheated steam in an ordinary engine of the regular design, but we have used rather smaller piston valves than most people. We use a 11-in. piston valve for a 21-in. cylinder, and we have since enlarged that cylinder to 22½ in. and still use the 11-in. valve, with results entirely satisfactory. I feel, though, that we have gone about as far as is necessary in putting an 11-in. valve on a 22½-in. cylinder. Of course, that is a considerably smaller valve than you would use in general practice with saturated steam. Forced lubrication I do not believe to be necessary at all. I think the sight-feed lubricator, as I said, works better on a superheated engine than on a saturated engine.

Blank Form to Give the History of Locomotive Movements at Terminals.—The report was presented, and the use of the blanks explained, by G. M. Basford, chairman of the committee.

P. H. Peck (C. & W. I.): This system may be all right where one road only has a terminal. I have the engines of five roads at our terminal and we are handling about 100 engines a day. We report the engines to the roads when they are ready for use. Sometimes they want more engines than we have at the terminal, and we have to call for a relay of engines to be delivered from outside the terminal. If we undertook to follow out the blank as presented by the committee, it would entail upon us an endless amount of work. In our case we merely report the movement of engines which we have ready for service.

F. H. Clark (C. B. & Q.): We use a similar report, and have had it in service for a couple of years. We have found it very serviceable at times in locating delays to power. You might probably get into a position where quick turning was necessary, and in a case of that sort I think this blank has a great many advantages.

G. M. Basford: The blank is not intended or recommended by the committee for continuous use. It is intended for use at times when power is very greatly needed, and when its use will save time.

L. G. Parish (L. S. & M. S.): We have a blank for similar use and it has given good results. We feel from our experience that it would pay us to continue its use throughout the year.

H. H. Vaughan (C. P.): I ask whether "mechanical delay" means the time the engine is received on the ashpit until it is ready, including all the time the engine is at the roundhouse?

Mr. Basford: The committee had not that idea in mind. The time the locomotive is in a terminal may be divided into two parts: necessary time and unnecessary time. The committee expected this column to include explanations or excuses, or whatever may be necessary under the circumstances to cover the differences between the time promised and the time ready, to indicate unexpected delays, or any delays that should not have occurred. It is not the intention of the committee to suggest this "mechanical delay" as covering all the time at the terminal by any means; a certain time is necessary, but only that time or delay which is created by mismanagement or accident.

Mr. Vaughan: I do not agree with the committee. These blanks would be used as telegraph blanks are used—only at busy times. Our regular blank is handled all the time, because we are getting our accounting department, which makes up the mileage statement by divisions from the superintendent's reports, to try to give us figures showing the time each engine was in the house and the average miles per hour which the engine makes between the time it leaves the house and the time it comes back to it. Some of the miles per hour do not amount to much and can be improved. If you can get a figure-level throughout the year and showing the miles per hour you work through-freight engines, you will find some great differences between different divisions. We, like a lot of other roads, always had reports from the mechanical department showing whether an engine was delayed on account of the mechanical department or on account of the traffic department. We used to get reports showing that eight or nine engines were ready and were not called for, and then, of course, we would write to the superintendent and tell him that he was not handling the trains right, that there were so many engines ready which were not being used, and that the roundhouse was ahead of him. As a matter of fact, in busy times the yardmaster can go in and give the roundhouse a bunch of orders which will keep it going for a week, and there is no defense possible on the part of the roundhouse. The only way to do is to take the total time at the terminal, and charge it up to the mechanical department, not worry as to who is responsible for it, simply saying we are losing five or six hours, say, as an average, at a terminal, and if we get up to an average of eight hours, we had better look into it. I think the mechanical delay should be computed from the time the engine is received at the yard until it is ready for the train, because when there is a transportation delay, at that time you do not need the power. When you do need the power, there are no transportation delays unless it is due to the roundhouse foreman's way of figuring with the yard. It is all mechanical. They will take the locomotives generally as fast as you can give them. If we should use this blank, I would like to make the mechanical delay to represent the time during which the engine is at the roundhouse until it is ready at the terminal and base the number of hours on the average of that.

Other members spoke of blanks of similar character to the one proposed by the committee which were in use on their roads with advantageous results, some using them continuously, and others when conditions required. No action on the report was taken by the convention.

Locomotive Failures, Records and Results of Keeping Them.—This paper was prepared by W. E. Dunham (C. & N. W.).

T. E. Adams (St. L. S. W.): During the discussion on apprentices, the question was asked, "What is to be done with our firemen?" I include in that our engineers, master mechanics, superintendents of motive power, general superintendents and general managers, on the question of coaling. There is not in Germany, France or the United States, at Purdue University or Cornell University, any course of instruction designed to impart knowledge as to the intelligent use of fuel. The railroads of the country have been trying for the past ten years to instruct their firemen in the intelligent use of fuel. A technical student could be educated thoroughly on the use of fuel, and if knowledge in that branch of engineering was imparted to him he would be a credit to himself and the company by which he is employed. On a large railroad failures of engines are one of the greatest drawbacks in the practical

operation of the road. For a number of years I was locomotive engineer, and I always felt if I had a good fireman I was a good engineer, and that if I had a poor fireman I was a poor engineer. It did not make any difference what the quality of the fuel was, the success of the engine steaming depended entirely on the fireman. A good engineer certainly ought to know how to instruct his fireman in the use of fuel when he does not know how to use it properly. The fuel question is one of the most important things for a motive power officer to understand in the conduct of his business. What is there to learn? First, that when slack coal is put on a tender, it is not necessarily an inferior quality of coal. Second, that the fireman must be taught to fire that kind of coal to avoid fires clinkering, flues honeycombing and netting in front-ends stopping up. It is possible to teach engineers how to avoid any kind of coal clinkering. There is not a shovel of coal used in the United States to-day as a fuel coal that will clinker if it is properly used. I believe that the education of enginemen and all concerned in the use of fuel would bring about results of the greatest value in the practical operation of the railroads of this country. One of the greatest difficulties encountered in any effort to extend knowledge regarding the subject of fuel consumption is in the fact that it is difficult in the case of the old engineers and firemen, who have been on an engine for years, to get them to understand that there is anything you can teach them. Naturally, they believe that their experience has fitted them to judge of the conditions of fuel economies from a practical standpoint. The greatest hope that we have of making satisfactory progress in the direction of securing a proper handling of fuel, and thereby bringing about fuel economies, is in teaching the young firemen and engineers.

A. E. Manchester (C., M. & St. P.): Referring to the first blank presented, I do not think it provides quick enough action. I like a form of blank which reads: "An engine failure from any cause must be reported to the train despatcher by the engineer at the first point where the train makes a stop." This report must then be transmitted to the roundhouse foreman, and if it be an engine delay or failure, state that in this way: "No. — Due to arrive at ——. Had an engine failure due to ——." This puts the roundhouse foreman in touch in advance with what he may expect to have to meet when that engine arrives. After the engine arrives and the proper inspection has been made to determine what is the cause of the failure, and what action will have to be taken to remedy it, it then devolves upon the roundhouse foreman to advise the train despatcher that engine No. — will be repaired and ready for service at such a time.

The second blank I do not like because it is too slow of action. I like a blank in which the train despatcher, or the superintendent, or the master mechanic, or the master car builder of the district, reports at the end of each 24 hours, showing that there have been certain engine failures, from such a cause, or car failures from such a cause occurring on the division during the last 24 hours. That is the method we pursue. Once each week the master mechanic or the master car builder makes a resume of all the delays that have occurred in his district, and furnishes them to the general master mechanic or the superintendent of motive power, somewhat on the lines as laid down on the blank, as shown.

E. A. Miller (N. Y., C. & St. L.): About two years ago we adopted a blank by which the engineer reports directly to the superintendent of motive power at the end of his trip on a special blank any failures he may have had, and the cause of that failure. From those blanks we make up a statement monthly giving the 87 items of failure, and miscellaneous conditions claimed to cover others. By this method we have reduced our engine failures more than 50 per cent. in about six months. Also, on account of engines running first in and first out, we make a record of the failure of each man. We do not publish that, although we did for a considerable time publish it, and it was wonderful what a change it made in regard to engine failures. The men did not have a failure if they could help it. However, in deference to the request of the engineers, we discontinued publishing the list of the engineers who had failures during the month, but kept this list carefully compiled for our own satisfaction. We found that in many cases we were able to take up with the master mechanics quickly the subject of certain failures, and were able to remedy the evils that were likely to become epidemic; that is, we kept our hand directly on the engine conditions of the road. We recently made 13,578 miles between engine failures on an average of about 75 locomotives that were in service on our eastern division.

Subjects: The Secretary presented the report of the committee on subjects. The suggestions were referred to the executive committee to consider for next year.

The officers elected for the coming year were: President, William McIntosh (C. R. R. of N. J.); 1st Vice-President, H. H. Vaughan (Canadian Pacific); 2d Vice-President, George W. Wildin (Lehigh Valley); 3d Vice-President, F. H. Clark (C., B. & Q). Members of the Executive Committee, C. A. Seley (C., R. I. & P.); F. M. Whyte (New York Central Lines); John Howard (New York Central), to serve two years, and A. E. Mitchell (N. Y., N. H. & H.), to serve one year.

Topical Discussions.

IS IT DESIRABLE TO ELIMINATE WATER-GAGE GLASSES ON LOCOMOTIVES TO ENFORCE THE USE OF GAGE-COCKS?

F. F. Gaines (C. of Ga.): The wording of this subject is such as to presuppose the superiority of the water glass over the gage-cock, and from a personal standpoint I entirely agree with that supposition. We have, however, to consider the effect of eliminating the water glass from two standpoints. I might say the first will be decided from what might be termed a legal standpoint, and the second by the effect on operating. Suppose an accident due to low water occurs on some railroad on which the water glass has been removed. What effect is it going to have on a jury to remove an admitted safety appliance? The road I am now connected with I found equipped both with gage-cocks and water glasses. Recently one of our engineers lost an eye through the breaking of a water glass at a terminal while waiting to go out on a train. I looked into the whole matter of the desirability of doing away entirely with the water glasses. I found that probably about 50 per cent. of our engineers depended either entirely on the gage-cocks or were sufficiently familiar with their use to handle their engine, and that of the other 50 per cent., some of them knew a little about using gage-cocks, but the majority of them depended entirely on the water glass. Under that condition of affairs I decided at the time to let the matter stand and not make any change. I think, however, there is a desirability of doing away with this, but that we ought to have something back of it to justify us in doing it. My idea is that the matter should be very fully discussed and later put to a vote of the association as a recommended practice.

A. W. Gibbs (P. R. R.): I think with Mr. Gaines that the water-glass is unsatisfactory because of the liability to breaks, but I am not yet ready to take it off. Most men are not skilled enough to see whether the thing is moving, so that the indication of a full glass is an indication of a full boiler, which in many cases is not the fact. In New York State I believe there has recently been a law passed enforcing the use of the water glass. My observation of boilers has been that the gage-cock alone, where you are obliged to use it because you have nothing else, is the more reliable appliance.

E. A. Miller (N. Y. C. & St. L.): Some months ago we developed an epidemic of broken pistons, caused, as we believed, by men working water through their cylinders, or rather, carrying their water too high in the boilers on the class of heavy compound engines that we had, and which all of our men, especially the younger men, were not familiar with handling. We got out of that trouble by changing the shield that covers the gage glass; that is, taking the space from the center of the lowest to the center of the highest gage-cock as 5 in., we found that the water glasses were 8 in., and that the variation of three additional inches in the space that the water could be carried in the boiler just made the water level in the boiler high enough to give us the trouble. We changed our shields to 5 in., so that 5 in. of the water glass would show instead of 8 in., and immediately our trouble with broken pistons ceased.

D. Brown (D., L. & W.): If you put the glass frame upside down from what it is at the present time, that is, instead of blowing the water out and having the steam follow down through, let the water go up, it will never go out of the glass. There will be water all the time. You can clean the glass better, scour it, and it is in better condition to observe the water. Furthermore, the temperature, in my judgment, is kept better in that way by the hot water being in it the whole time. You have not got to change from steam to water. Besides, any scale that would lodge on the glass otherwise is not allowed to do so. It passes off in solution, whereas with the steam passing down through it it dries and a certain portion adheres to the glass. I recently saw a glass that was taken from an engine scaled on the inside so that you couldn't see the water, and to all appearances it looked as if he had been painted with aluminum.

RELATIVE MERITS OF OUTSIDE AND INSIDE DELIVERY PIPES FOR LOCOMOTIVE INJECTORS.

Strickland L. Kneass: The main check has been applied to the back head of English and continental engines for many years, and this may be regarded as the standard location in the British Isles. The construction of the English locomotive boiler and cab yields readily to this arrangement, but there are other reasons. The chief objection against projecting side checks is that of danger to passengers, as serious accidents have occurred from the shearing of the boiler check by the overturning of the locomotive or the derailment of a passing train. The matter of safety has been partially met by an internal side check, but it is doubtful if this form is entirely satisfactory, as it is difficult to keep steam-tight, and impossible to examine or regrind without relieving the boiler pressure. The extreme length of the branch pipe on large locomotives is also a disadvantage on account of the cost of bending, the present high price of copper, and because of the weakening of the section at the bends. It is difficult to bend pipe and maintain a circular section. The cross section is almost always elliptical or the mate-

rial strained. The result is creeping of the pipe and occasional bursting when subject to excessive back pressure. I have taken indicator diagrams of the pressure in the branch pipe while starting and stopping an injector, rotating the drum by the stroke of the starting lever. An analysis of the diagram is of interest. With careful handling, the pressure rises gradually from zero to boiler pressure; quick, careless starting of the feed causes an overpressure double that carried on the boiler, which may weaken or burst the branch pipe. Creeping due to flattened bends causes undue strain on the boiler check and the pipe joints; the writer has noticed one instance where a main check was unscrewed one-eighth turn by the warping of the branch pipe; in this case the difficulty was corrected by using a check with a side instead of a bottom inlet.

The location of the boiler check on the back head, with internal feed pipe delivery at the forward end, gives short direct and protected valves and pipe connections. It usually offers a convenient location for the two injectors, placing the operating levers directly beside the engineer and fireman, and out of the way of the reverse lever and throttle. The engineer then has his air-brake and feed valves close beside him; this enables him to feed the boiler to the best advantage with the least possible trouble to himself. If an engineer has to rise from his seat and reach a considerable height to apply or adjust his injector the feed will be intermittent, without the careful adjustment required for continuous feed or to maintain a constant water level. If the sprinkler valve is connected to the feed on the left-hand backhead injector, both can be operated by the fireman while on the deck of the cab.

The outlet of the back head check should enter the boiler below the low water level. The delivery pipe, connecting the back head valve with the front end of the boiler, should be not more than 2 in. above the crownsheet, so that steam may not enter through opened joints. This recommendation is made, as excessive pressure has been noted in three instances in the back head valves, due to water hammer. This phenomenon, due to faulty connections, results from the fact that if the rear end of the delivering tube has an open joint within the steam space, steam is drawn in by the feed water flowing downward toward the immersed end of the delivering pipe when the injector is shut off. The steam is instantly condensed, forming a partial vacuum, which causes a backward rush of water up into the delivering pipe against the back head check. This causes a powerful water hammer. The remedy is simple. The delivering pipe should be immersed as recommended above, the conduit may be made in the shape of a trough, or the joints kept tight. When correctly attached, no water hammer has been noticed. As joints are liable to work loose it is safer to use one of the first two methods given.

The back head feed system is preferable, as it gives an opportunity for even distribution of the feed water over a larger tube area, instead of coming in direct contact with the nearest tubes and side sheets only. When the feed enters the side of the boiler, its greater density causes it to flow downward along the side sheet to the bottom of the boiler and the waterleg, where it lies dead owing to sluggish circulation. This is aggravated by intermittent feeding, as frequent changes of temperature cause an expansion and contraction of the sheets and tubes which loosen the joints and produce leaks, increasing the cost of the flue mileage. On some railroads there is applied to the shank of the side check an upward nozzle of reduced area, which forces the water above the tubes and into the steam space. This opening, however, is liable to be closed by incrustation when the water contains lime bearing salts, and adds to the back pressure against which the injector must operate, reducing the life of the tubes.

CORRUGATED TUBES FOR LOCOMOTIVE SERVICE.

G. W. West (N. Y., O. & W.): It had always seemed strange to me that locomotive tubes, no matter how well they were set in the firebox or how poorly set in the smokebox, would invariably leak at the firebox end, and when it was not considered bad practice to remove part of the set of tubes we often found two or three rows at the extreme sides and top would outlast two sets of tubes near the center. I concluded that there was a reason for this other than the excuse often given, that of expansion and contraction. The tubesheet in the firebox did not get the protection that the smokebox sheet did, and smokebox end of all tubes and the extreme top and side rows in the firebox end did not leak owing to their having sufficient amount of water to fully protect them at all times. By welding 1¾ in. safe ends 6 in. or 8 in. long on 2 in. tubes and 2 in. safe ends on 2¼ in. tubes, we increased the bridges ¼ in., thus strengthening the tubesheet, increasing the volume of water around the tubesheet where it was needed, and improving the circulation. This practice we have kept up and our engines steam better, tubes leak less and little trouble is experienced from clogging with cinders.

In 1897 the corrugated tube was first called to my attention. It was the same size throughout but I ordered a set with plain ends with one end reduced in size to fit a fluesheet we were then putting in a passenger engine. We looked for trouble with clogging but never had it. We were using at that time a very poor grade of bituminous coal and kept a gang of men at each terminal boring out tubes. This engine was run a long time before a flue auger or any other device was used to clean the flues. The corrugated tubes made double the mileage of any plain tube we had ever before used in this particular engine or any of its class. Since the tubes have been made in this country we have applied them to all classes of engines, with wide and narrow firebox, burning both bituminous and anthracite coal, often a mixture of both. The extra first cost is soon met by increased mileage and saving of labor.

Another important advantage is the elimination of hot sparks thrown from the stack. We have a passenger locomotive fitted with these tubes that is pulling eight cars up a continuous grade of 21 miles, 80 ft. to the mile, and on the darkest night, or through tunnels, you can hardly see a red-hot spark thrown from the stack. The effect of this is shown in the temperature of smokebox front. The paint on the front end of engines equipped with these tubes will outlast three paintings on engines equipped with the plain tubes.

F. P. Roesch (Southern): We have one experimental set of spiral corrugated tubes in use on the Southern which were put in last December. Up to this time we had had no trouble from flue leakage on account of the short length of time. We have had no difficulty with the tubes clogging up although we use a very fine grade of coal and have more or less trouble with it. These tubes will eliminate sparks that might otherwise escape, and might enable us to do away with a number of devices in the front end used for the prevention of sparks, thereby obtaining a better exhaust. From what we have seen so far there is something in their favor as regards flue leakage. Another locomotive of the same type which received plain tubes at the same time is now beginning to show signs of flue leakage, and it is only a question of a short time when the flues will have to be renewed. Both locomotives were in the same condition, and in the same class of service and operating under the same conditions.

WHAT IS THE BEST METAL FOR HUB LINERS FOR DRIVING AND ENGINE TRUCK WHEELS, THE BEST METHOD OF APPLYING AND THE LIMITING LATERAL HUB PLAY FOR SUCH WHEELS BEFORE REPAIRS ARE REQUIRED?

J. F. Dunn (Oregon Short Line) by letter: Our experience has been that babbitt metal is the best material to take up hub wear. We apply it to the face of the boxes by recessing the boxes, dovetailing the outer edges of the recess and drilling a few ⅞ in. holes into the face of the box. This is to dowell the babbitt and prevent it sliding or turning. We also tin the face of the boxes, heating them sufficiently to melt the tinning while pouring the babbitt. While the babbitt is not quite as durable as brass or bronze liners on the hubs of wheels, it is more economical and serves the same purpose. It also prevents any cutting or undue wearing on either the hubs of the wheels or the face of the boxes. We do not allow more than ⅝ in. lateral wear in driving boxes or ¾ in. in engine truck boxes.

E. W. Pratt (C. & N.-W.): The metal used for hub liners, to give the best satisfaction, will be somewhat dependent on lubrication, and inasmuch as a number of railroads are using grease for driving box cellars I would like to ask if any of them have demonstrated the best lubrication for the hub. We have had trouble with friction on the hub in using grease.

J. F. Walsh (C. & O.): On account of the low temperature at which babbitt melts we abandoned it some years ago and used bronze entirely for hub liners. It is practically impossible to use babbitt metal successfully with grease lubrication.

F. P. Roesch (Southern): We use grease and bronze or brass liners, pouring the metal directly on the wheel centers.

P. H. Minshull (N. Y., O. & W.): We use steel driving boxes and steel hub plates and part the boxes with babbitt. We get good results, using grease, and have no trouble with hot boxes.

Thomas Roope (C., B. & Q.): Babbitt is much the preferable metal in a sandy country. Brass is more expensive and it wears more rapidly. Babbitt should be in every case sweated on the box.

J. J. Thomas (A. C. L.): We formerly used brass liners on the hub, and they wore fairly well, but about two years ago I tried putting babbitt on the boxes instead of on the hub. In several instances where these liners were attached to the wheel hub and had worn out, we drilled the face of the box, cleaned the face and lined it with babbitt. This has given good results.

D. J. Reading (P. & L. E.): Where a babbitt hub liner is used on the side of the driving box, you do not get the same amount of wear all over the hub. The babbitt does not wear away at the same time that the end of the crown brass wears. I have seen hubs of wheels badly scored on that account. The end of the crown brass will wear a recess while the babbitt has not worn away so rapidly. While the babbitt has been satisfactory for freight engines, we found on high-speed engines, our road having many curves, that we got the best results by using a plain hub on the wheel, cast-steel or iron, and then putting a brass hub on the face of the box. I have seen good results by using a brass face on the box, recessing the wheel box and putting in a cast-iron liner.

M. D. Fraley (L. S. & M. S.): The method in use on the Lake Erie & Western consists of pouring the driving box shell in the driving box proper. The shell is poured into the box and held in place by dovetails going through the upper portion of the driving box. These projections on the box, or recesses in the box, are slotted so as to form a dovetail. The interior of the box is then heated in the crown so that the lower portion, or free portion, expands about ⅜ in. A cast-iron former is used for the circular portion of the brass and the brass is buried between the box and the former. We adopted this practice on the Lake Shore, and it is our experience in pouring the brass that if the brass cools in the box it has a tendency to draw the box together on the lower portion. Where we pressed the brass into the box it would expand the box about ⅛ in. or more. Pouring the brass of the shell into the box has the opposite effect. When the brass and box cool the free end is drawn together about $^1/_{16}$ in. It has a double advantage. With this method it is possible to pour the brass at a lower temperature than when it was poured in the sand holes, and there is not the same tendency to segregate. It holds up better and gives a better fracture and better bearing metal. In pressing the brass out it requires from 80 to 100 tons to press one of these shells out of the driving box. It is claimed that this method does not give an equal bearing surface between the brass of the shell and the box. It is our experience that it does give that bearing surface. We pour the hub liner on the box at the same time we pour the shell, making the shell and the hub liner continuous. Where we use a steel box we pour the sideliners over the shoes and wedges. We also pour liners in our eccentric straps in the same way. It gives a much better bearing than the same metal and same mixture poured in a sand mould.

Wm. McIntosh (C. of N. J.): We recess the hubs of the boxes, fit them and face them with a good quality of babbitt. We are using that facing for our fast passenger engines round curves and over hills. We use grease for lubricating in some cases, and oil in others, and we apply it in the ordinary manner. We pack our boxes about the same as usual, using Galena oil.

F. F. Gaines (Cent. of Ga.): If you pour babbitt and peen it with the ball of a hammer, going over the whole surface thoroughly from one end to the other, it will wear longer and give less trouble from getting loose. It makes it denser and adds materially to the life of the babbitt.

G. W. Wildin (Lehigh Valley): On the Erie we abandoned brass hub liners and substituted cast-iron with soft metal facing on the box. We did not depend on the grease for the lubricating between the hub and box, and used oil in all cases. On the Lehigh Valley the practice is to use brass hub liners against steel boxes, but more trouble develops. Part of that may be due to the crooked road.

Prosecution of Anthracite Coal Carriers.

In the United States Circuit Court at Philadelphia, June 12, the long-expected suit of the government against the anthracite coal carrying railroads, charging illegal monopoly, was filed. The list of defendants includes all of the roads in the anthracite field except the Pennsylvania and the New York, Ontario & Western. The petition recites that these defendants control 78 per cent. of the tonnage and 90 per cent. of the coal deposits, and that they produce 75 per cent. of the annual supply; that independent operators, although owning only 5 per cent. of the coal deposits, produce 20 per cent. of the annual supply, which would be sold in competition with the products of the monopolized mines were it not for the restraints imposed by the big companies. The complaint further specifies:

(a) That the defendant railroads agreed among themselves upon a uniform contract to be entered into by them or their coal companies with the independent operators along their respective lines under which the railroads would be able to control the sale of the independent output, and that by virtue of their control of all the means of transportation from the anthracite mines to tidewater save the lines of the Pennsylvania and the New York, Ontario and Western, the defendant railroads were able to force and practically did force the independent operators along their lines into making these contracts.

(b) That the Erie Railroad has exchanged shares of its own capital stock for a majority of the shares of the New York, Susquehanna & Western, a competing line, thereby uniting under a common source of control the two competing railroad companies and their subsidiary coal companies.

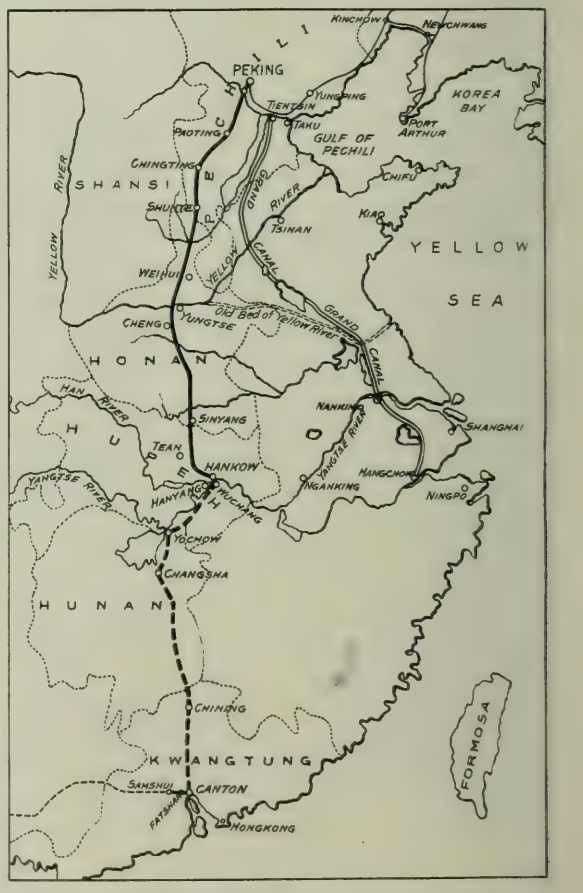
(c) That the Reading Company, which already held all the shares of the Philadelphia and Reading, has exchanged its own shares and bonds for a majority of the shares of the Central of New Jersey, a competing line, thereby uniting under a common source of control the two competing railroads, and their subsidiary coal companies, which together transport about 35 per cent. of the annual anthracite tonnage and control about 60 per cent. of the anthracite deposits.

(d) That twice in recent years the defendants have defeated the construction of projected independent railroads from the mines to tidewater, which would not only have introduced competition into the transportation of anthracite coal, but would have permitted the output of the independent operators to be sold in the markets in competition with that of the defendants.

The petition prays generally that the defendants be enjoined from further carrying out their combination, and that the above described contracts be cancelled; that the mergers between the Erie and the New York, Susquehanna and Western and their coal Companies, and between the Philadelphia and Reading and the Central of New Jersey, and their coal companies be dissolved.

The Great Interior Trunk Line of China.

"One of the first steps toward the realization of our new national ideas would be the construction, under Chinese auspices, of a great trunk line to traverse the central and most fertile provinces of China, from Peking to Canton." These are the words of the Chinese minister at Washington, and they represent one of the most definite ambitions of the awakened China. Peking, the capital of the Chinese empire, is about 100 miles inland from the gulf of Pechili, with which it is connected by railroad. Canton, the principal city of south China, is a port on the southern coast of the



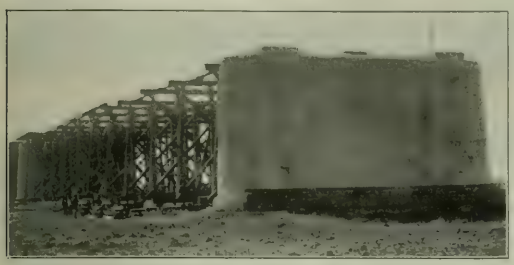
The Peking-Hankow and Canton-Hankow Railroads.

empire. It is important to China to have these two great cities connected by a railroad, not only in order to develop the populous provinces lying between them, but also for military and political purposes. China territorially is not unlike the United States except that she has no western seacoast. The natural plan of railroad development would be by east and west lines inland from the seaports such as were first built in this country. In China, however, many of the most important ports are under the control of foreign nations, who also command the sea. The Chinese fear to open up the empire to foreign attack by building east and west lines. The advantage of the north and south line from Peking to Canton is that it will make it possible to concentrate military forces

in case of need, a thing impossible without it, for military transport would not be safe by sea and the distances are too great for land marching over poor roads.

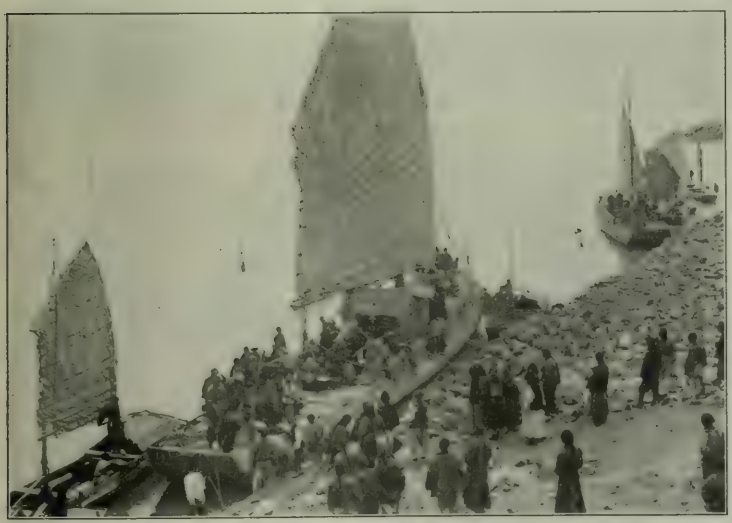
The route of this proposed interior trunk line is shown on the accompanying map. It is already in operation from Peking south to Hankow, 753 miles. From Hankow to Canton is nearly as much further. The completed section of the road was built by a Franco-Belgian syndicate under Jean Jadot, a Belgian engineer, as Chief Engineer, and was officially opened on November 12, 1905.

Since that time there has been every reason for building the remainder of the line south to Canton. The original concession for this section of the line was granted to an American citizen and by



Typical Masonry Bridge Pier.

him turned over to an American syndicate, headed by the late Senator Brice. A preliminary survey for the line was made by William Barclay Parsons in 1898 and 1899. Subsequently the American-China Development Company was organized and took over the concession. The Boxer troubles in 1900 and following events delayed the construction. After these matters had been all adjusted the company built the Samshui branch from Canton westerly through the manufacturing city of Fatshan to Samshui, 30 miles. The traffic immediately developed on this line was very large, chiefly in passengers. Most of the trains are hauled by Manhattan Elevated locomotives, which are heavy enough for the short-train, broken-service traffic. Photographs of trains on this branch were published in the *Railroad Gazette* of October 12, 1906, and January 25, 1907. The



Landing Construction Material for Peking-Hankow Railroad.

American-China Development Company also graded 12 miles of roadbed on the main line northerly from Canton to Kotung, laying track for about six miles, delivering the rails, bridge work and some of the equipment on the ground for the whole. At the close of the work P. H. Ashmead, who is now in charge at New York of the railroad work which J. G. White & Company are doing in the Philippines, was Chief Engineer.

At this point the Chinese Government intervened, stating that it was its policy not to grant any more concessions to foreign companies, but to acquire the existing concessions so far as possible, and that it therefore desired to purchase from the company all its property and rights. A loan having been made by the viceroy of one of the provinces through the Hong Kong-Shanghai Bank, the necessary funds were obtained to buy from the American company all its rights, at a price satisfactory to both the company and the Chinese Government. This was done in the autumn of 1905.

Since that time many complications appear to have arisen. The territory through which the road is to run is under the government of two viceroys, one at Canton, the other at Wuchang, on the southern side of the Yangtse river opposite Hankow. Each viceroy promptly took possession of that part of the property in his own territory. The bulk of the work which had been done was on the southern end of the line, which fell to the Canton viceroy. The viceroy of Wuchang, however, secured control of the property at the head office of the company at Shanghai. In the same way the different provinces through which the road was to run decided on different methods for building the road. In Canton (Kwangtung province) the merchant class decided to build the road themselves; in Hunan the gentry and officials agreed to co-operate with the merchants; in Hupeh the railroad was to be built by the government officials exclusively. In these last two provinces no work whatever has been done, but the people are not ignorant of the fact that they are to have a railroad, for they have to pay higher taxes in order to repay the loan made to buy the road from the American company. Thus nothing was accomplished on the northern or Hankow end of the Canton-Hankow line.

On the Canton or southern end matters have progressed further. Subscriptions were asked for building the road and shares issued in $5 denominations for $1 each. These were heavily subscribed for. Dissensions immediately began as to who should have control of the money. The viceroy appointed one set of directors; the merchants another. The viceroy thereupon arrested the directors appointed by the merchants, and was upheld in his action by the central authorities at Peking. After this trouble had blown over, it was discovered that there were no Chinese engineers competent to build the road. It was natural to turn to the Belgian engineers who had built the northern section of the trunk line, but the governor of Hongkong, a British city, intimated that it would be more graceful on China's part to appoint British engineers. At this deadlock the viceroy's appointee as President of the company resigned, accompanying his resignation with a statement that the Chinese engineers who were in charge of the work were absolutely incapable and urging that English, American or Japanese engineers be secured. The only result accomplished was the completion of the line from Canton to Kotung, 12 miles, already more than half finished by the American company. This was the progress of the enterprise up to about September, 1906.

The situation since that time is summed up by the Hongkong correspondent of the *North China Daily News*. According to him the present situation is characteristically Chinese and could hardly have been created in any other nation. It is confusion worse confounded. For a foreigner, lacking the Chinese mind, it is almost impossible to apprehend clearly what is the trouble. The general situation, however, appears to be somewhat as follows: Two Chinese gentlemen of Hongkong, large shareholders in the railroad company, who had in their possession large sums of money which had been subscribed toward building the road, refused to hand over the money at the central office at Canton when called on to do so on the ground that there should first be a public audit of the money already received. Probably in consequence of the implications involved in this demand the viceroy was removed and a new viceroy appointed, who ordered that an audit be made. So far as has been announced no crookedness was discovered, but a full disclosure of the findings has never been made public. The two Hongkong gentlemen then applied to have their names reinstated as shareholders of the company. Following this there was a general meeting of shareholders at Canton which seems to have put in the shade any stirring shareholders' meeting of which the Occident has record. A certain man openly charged the Canton officials of the road with wholesale bribery of the provincial officials, naming specifically the viceroy, the provincial treasurer and the provincial judge as bribe takers. The proceedings at this meeting were supposed to have been kept secret, but modern journalistic methods having apparently found a foothold in China, a report of the meeting was published in one of the Chinese daily papers. The ink was hardly dry before the accused officials had arrested the editor, and discovered from him the author of the original accusations, who was at once thrown into prison. There he was at last accounts, the officials, according to report, being consumed by a white hot rage,



One of the Long Steel Bridges; Peking-Hankow Railroad.



Coolies at Work in a Deep Cut; Peking-Hankow Railroad.



Partially Completed Embankment and Stone Arch Culvert.



Steel Bridge Over the Hwangho or Yellow River; Peking-Hankow Railroad.



Sin-Yang Station; Peking-Hankow Railroad.



South Portal of Tunnel Just South of Yellow River Bridge.

and demanding that he shall remain in custody until he can produce the very man who actually saw the bribes paid over. Besides all this, the seventy-two Hongs, which represent the shareholders, and the directors of the road have repudiated the meeting as unauthorized and at the same time are doing all in their power to prevent the reinstallation of the gentlemen of Hongkong whose original protest started all the trouble. Meanwhile the ex-viceroy, who was put out of office on account of the implications of dishonesty, has sent a telegram from Shanghai advising patience and deprecating anything like summary or unpremeditated action.

It is probable that the preliminaries of construction of the Peking-Hankow section of the through line were equally complicated, for the project was definitely outlined in 1889. In that year arrangements for building the line were entrusted to two viceroys, one of whom was Li Hung Chang, then viceroy of the province of Pechili. This is the northern province through which the road runs, the southern provinces being in order to the south Honan and Hupeh. These three provinces are among the most populous in China.

Years passed but the project made no progress. China was anxious to build the road entirely with her own resources, but the attempt to raise the funds in China was at last given up about the end of 1896, and the two viceroys who were promoting the road received authority to grant the concession to a company of the "most favored nation." They communicated first with the United States but were unable to arrange satisfactory terms. They then turned to Belgium, "a very wealthy, small country whose power is negligible" as they said in their report of December, 1897. About this time the French minister at Peking, reminding the Chinese government of an article of the Franco-Chinese treaty of 1885, which stipulated that "in the construction of railroads China will use all her influence to attract French industry," brought pressure to bear to give French capital a share in the project. On June 26, 1898, in spite of opposition from Great Britain, a revised concession was granted to a Franco-Belgian syndicate for construction of the road. This contract was more favorable than those previously granted to foreigners for building railroads in China. The earlier roads had been built at the risk of the concessionaries without any guarantee from the Chinese government. The Franco-Belgian syndicate, on the other hand, obtained not only the support of the Chinese Imperial Railway Administration, but the official assistance of the authorities at Peking, who issued a state loan of $22,500,000, guaranteed by the Chinese government and payable in 1929, in aid of the road. The syndicate had only to negotiate these bonds to secure funds. In March, 1899, this loan was issued simultaneously in Brussels and Paris and was immediately many times oversubscribed.

The first surveys and drawings for the line had already been made by the southern viceroy while the negotiations were going on. The road for a short distance from Hankow, its southern terminus, follows up the Yangtse river, and then traverses a broad plain. A little less than 100 miles north it zigzags between steep hills with picturesque scenery. Beyond this in another plain it crosses two smaller levels and then reaches the Yellow river (Hwangho), which it crosses on a bridge about 9,875 feet., or nearly two miles, long. The entrance to this bridge from the south is through a tunnel under a hill on whose summit a temple is erected consecrated to the divinity of the river. This temple and the southern entrance to the tunnel are shown in one of the accompanying photographs. All bridges, of which there are about 100 besides the Yellow river bridge, from 650 ft. to 2,200 ft. long, are steel with concrete approaches. One of the steel bridges on masonry piers, as well as a view of one of the piers and the method of construction, is shown in the photographs. There are only two tunnels, both short, on the whole line.

The construction of the road was begun at both ends at the end of 1898 and the beginning of 1899. In 1899 quays and work shops were built and rolling stock and construction materials received. The northern section of the road had been extended 114 miles south of Peking when it was interrupted in May, 1900, by the Boxer revolt. Most of the finished road was destroyed, many of the employees killed and the final completion of the road set back at least a year. Early in 1901 order was restored through the military occupation of Peking by the Powers and work resumed. There was no further interruption and the northern section of the road was steadily, although slowly, pushed to completion. A little more than half of the road was built from the north. The two working parties met a little south of the Yellow river.

On the southern end of the road 56 miles of line was built in 1900, the year of the Boxer trouble. In 1901 great damage was done to the embankments at Hankow by the flooding of the Yangtse river. As this is a usual summer happening, the slope of the embankment of the road on the river side was protected with stone, a work which was finished at the beginning of 1902. At Hankow a quay 15,748 ft. (about three miles) long, which can be used by deep draft vessels, was built along the river. The maintenance of this quay is costly as the current continually gnaws at it and undermines the foundations. Before the end of 1901, notwithstanding the inundations, the road was opened 96 miles north from Hankow. At first a weekly service in each direction was begun but after the beginning of 1902 there were three trains a week in each direction. Heavy cutting was necessary over the watershed between the Yangtse river and the Yellow river. In 1902 daily train service was begun between Hankow and Sin Yang, 136 miles north. This station is shown in one of the photographs. On January 1, 1904, the road was opened for 195 miles north of Hankow. At this point the road runs into a hilly country with the steepest grades on the whole line. At the beginning of December, 1904, rails were laid from Hankow to the Yellow river, 312 miles.

The steel bridge across the Yellow river, as already mentioned, is nearly two miles long. It is 20½ ft. above high water level. A general view is shown in the photograph. The bridge rests on screw pile piers. The piles were screwed down into the bed of the river by hand-capstans manned by coolies. To each pile was clamped a large grooved pulley around which was wound a wire hawser. One end was led to one of the capstans and then the coolies heaved away and the work of screwing began. The rotary motion with the corkscrew point at the bottom of the pile forced the pile down in the mud till the pulley was level with the platform on which the workmen were standing. When the pulley reached this platform, another section of pile was bolted on, the pulley raised to the upper flanges, and the screwing resumed. When the piles had been screwed to a sufficient depth, say 40 to 50 ft., the water was pumped out from the inside and the pile filled with concrete. Wooden piles were then driven in a triangle around the up-stream side of the piers with the points to the current, as a protection. Huge beds of tree branches, lashed together with wire, were then sunk around the steel piers, and on these beds many hundred tons of rock were thrown. This was to give more solidity to the river bed where the piers were driven. The river bed is one great quicksand and during the construction of the bridge many piles and platforms supporting machinery were sucked under. Stone breakwaters have been built along the banks of the river to prevent the undermining of the bridge foundations and each end of the bridge is protected with stone-faced dykes. Half of this bridge was built in France, the other half in Belgium, the work being distributed among the principal builders of the two countries.

The roadbed is well built and ballasted; the track, standard gage. Most of the material for the roadbed, as well as the rolling stock, was imported from Belgium and France. As there is little timber in China, even the ties were imported, 130,000 coming from France, 50,000 from the Baltic countries, a few from Oregon and the rest from Japan. The steel works of Hanyang, near Hankow, supplied about 175,000 tons of rails, which were tested by the same tests as those used by the Belgium government railroads. Seventy-five pound rails are used. At the close of 1905 there were in service 101 locomotives, 145 passenger cars (first, second and third class), and 2,200 freight cars of from 15 to 40 tons capacity. The passenger fares are about 9, 6 and 3 cents per kilometer for the respective classes. The syndicate which built the road has formed a mining company under the name of "Mines du Luhan," which holds the concession for development of several coal fields that will supply the road with excellent fuel. Sixty miles of short branches to coal mines have already been built. The railroad was built by the Societe d'Etude de Chemins de Fer en Chine. A supplementary issue of $2,500,000 bonds, under the same conditions as the original loan, was made in 1905 to meet the final expenses of construction and the purchase of rolling stock.

For the accompanying photographs we are indebted to the *Far Eastern Review* to which and to *Le Mouvement Geographique*, among other sources, we owe information in regard to the road.

Missouri Rate Laws.

The State Circuit Court at Kansas City, Mo., has issued orders to 18 principal railroads of that state requiring them to obey the 2-cent passenger-rate law and the maximum freight-rate law which went into effect June 13, but in the United States District Court the railroads are suing for an injunction to prevent officers of the state from enforcing these laws. Judge McPherson, in the United States District Court, will probably take up next week the question of conflicting jurisdiction. After his preliminary decision the railroads and the state agreed to a statement of facts as follows:

That the railroads' application for a temporary injunction as to the maximum freight laws of 1907 is sustained, and until further order of court herein the state officials are enjoined from attempting to recover any penalty or seeking to enforce that law.

As to the two-cent rate act, the order heretofore entered by the court enjoining the railroads from obeying that law shall remain in effect until June 19 next at 6 a. m., at which time the rates fixed by said act shall be put and kept in force for three months, without prejudice to the rights of either party, for the purpose of ascertaining more definitely the extent that experience will show that the rates under said act reduce or increase earnings of complainant.

GENERAL NEWS SECTION

NOTES.

The Delaware & Hudson has advanced the pay of conductors, baggagemen and trainmen 10 per cent.

The Interstate Commerce Commission has sent to the railroads of the country a circular asking what commissions are paid for the sale of tickets.

The bill before the legislature of Wisconsin to reduce all passenger fares in that state to 2 cents a mile has been killed. The Senate rejected it by a vote of 41 to 6.

The bureau of railroad statistics of the Canadian Government has decided to adopt whatever changes the Interstate Commerce Commission shall make in the classification of operating expenses in the annual reports of railroads.

The General Electric Co. has applied to the Interstate Commerce Commission for an order requiring the railroads to make it an allowance for switching and other terminal expenses at its plant in Schenectady, N. Y. The company has extensive yards and switching service of its own.

At New York City, June 18, the Central Vermont Railroad was indicted for the illegal payment of rebates of 1 cent per 100 lbs. on coffee shipped in 1904 from New York to Detroit. The consignee was the Woolston Spice Co., and the agent of the consignee in New York was Lowell M. Palmer.

The state railroad commissioners of Kansas, who were empowered by the last legislature to make a valuation of the railroads of the state, have decided to postpone the work until the Interstate Commerce Commission published the results of its studies in connection with this subject.

The Long Island Railroad on Decoration Day, May 30, carried 128,652 passengers, an increase of 28 per cent. over the number carried on May 30 last year. Throughout the year the average daily passenger traffic on this road amounts to about 60,000, being about 40,000 in winter and 80,000 in summer.

The Interstate Commerce Commission has issued a circular again reminding the railroads that applications for permission to change rates in less than 30 days must be more rigidly restricted. Notice is also given that tariffs and other documents arriving at Washington with insufficient postage will not be accepted.

The Pullman Company has sent to the Interstate Commerce Commission its reply in the complaint of George S. Loftus, of St. Paul, alleging excessive rates, and denies the jurisdiction of the commission. This means, apparently, that the company intends to contest the validity of the law which declares sleeping car companies common carriers.

The railroads of Texas have for sale a large quantity of cotton, said to be about 100,000 bales, most of which, by reason of the loss of tags or mistakes in loading, went astray at various times during the past season and was settled for by the railroads, claims for loss having been presented by the consignees. It is said that in consequence of the rise in price the railroads will make 3 or 4 cents a pound profit on this cotton.

The Governor of Illinois has signed a bill legalizing the consolidation in 1882 of the Chicago & Western Indiana Belt and the South Chicago & Western Indiana. This action was necessary because of an error made in the original consolidation. At that time, the Chicago & Western Indiana Belt was to be merged with the South Chicago & Western Indiana and the resultant company consolidated with the Chicago & Western Indiana Railroad, but instead all three companies were merged at once.

The United States Circuit Court at Baltimore, Md., on the application of the Pitcairn Coal Co., has issued a mandamus requiring the Baltimore & Ohio to include shippers' cars in its basis of computation for ascertaining the number of cars to which each mine is entitled for loading coal. The application for a mandamus included several other points, but on all except this one the application was denied. The complaint was that when the supply of cars was short the road favored the Consolidated Coal Co. and the Fairmount Coal Co. These companies had 5,500 cars of their own, but the railroad company allowed them as full a percentage of railroad companies' cars as if they had had none. On this feature of the case the action of the court favored the complainants.

It is announced in Chicago that the three principal lines between that city and Cincinnati will, on July 1, reduce the through fare to $6, which is about 2 cents a mile. This action is based, it is said, not on the new laws passed by Illinois, Indiana and Ohio, which do not apply to interstate rates, but on the action of the new line, the Chicago, Cincinnati & Louisville, which proposes to charge only $5. It is said that some interstate rates in the states named are to be reduced, within a month or two, to the basis of 2 cents a mile, but no particulars are given. In Illinois the 2-cent law goes into effect July 1. In Iowa it goes into effect July 14. It is expected that the railroads will contest the laws in both of these states. In Minnesota the reduced rates went into effect May 1 and in Nebraska March 7. Efforts are being made in both of these states to secure injunctions against the enforcement of the laws.

Adams Express Company "Melon."

Holders of the $12,000,000 capital stock of the Adams Express Co. are to get a 200 per cent. dividend in the form of $24,000,000 collateral trust 4 per cent. distribution bonds of 1947, which will be given to stockholders of record on June 27 at the rate of $200 bonds for each share of stock held.

New North German Lloyder.

The North German Lloyd Steamship Company announces that it is building a new vessel, second only in size to the Mauretania and Lusitania, of the Cunard Line, and of the moderate speed type, with which the Hamburg-American and White Star lines have been very successful. This ship, named the George Washington, will be of 27,000 gross tons, 720 ft. long, 78 ft. wide, 54 ft. deep, 33 ft. draft and 18 knot speed.

The Tramp Nuisance.

With few exceptions the local authorities do not assist the railroads in checking the tramp nuisance. In not a few cases actual encouragement is given to those who prey on railroad property. In cases where tramps have broken into cars and were caught in the act of stealing the local authorities have declined to take action. They declare that it is not their business to prosecute suits for the railroads. The remedy must begin with co operation between the railroads and the authorities of every community through which it passes. There should be as prompt prosecution of an offender against a railroad as of one against an individual. There should be no more suspended sentences on account of leaving town. There should be confinement at hard labor for a fixed period for every tramp. It is now the almost universal custom for the officers before whom the vagrants are brought in petty cases to order them to leave town within 24 hours.—*J. J. Hill, Great Northern Ry.*

Many communities have solved the tramp problem by imposing a long term of hard work upon wanderers, but nobody has paid much attention to the woes the "hoboes" have brought upon railroad officials. The largest roads in the country show that the vigilance of villagers has only aggravated the problem. The majority of villages prefer to save money and trouble by running tramps out of town. If the states would relieve the villages of the cost of prosecuting and maintaining vagrants rigorous treatment of the latter would result, and the swarms of petty marauders would be greatly reduced. But even state control will not solve the problem until farmers' wives will listen to reason and withhold mince pie. * * * Good nature and timidity can thwart the wisest lawmakers. —*New York Tribune.*

New Buildings at Rensselaer Polytechnic Institute.

On commencement day of the Rensselaer Polytechnic Institute on June 12 the new main building, Carnegie Hall, the gift of Andrew Carnegie, and the Dr. William Weighton Walker chemical laboratory, the gift of graduates and friends of the institute, were dedicated. President Palmer C. Ricketts announced that through the gift of $1,000,000 from Mrs. Russell Sage two new courses in engineering will immediately be established; one leading to the degree of mechanical, the other to the degree of electrical engineer. Of the gift, $700,000 is to be invested and the income used for maintenance. The following committee of graduates, which is significant of the success of Rensselaer graduates, has been named to formally send thanks to Mrs. Sage: Theodore N. Ely, Chief of Motive Power of the Pennsylvania Railroad; William B. Ridgely, Comptroller of the Currency; Edward C. Carter, Chief Engineer of the Chicago North-Western; William H. Courtenay, Chief Engineer of the Louisville & Nashville; Harry H. Rousseau, Rear-Admiral United States Navy and member of the Panama Canal Commission; William P. Mason, Professor of Chemistry of the Rensselaer Polytechnic Institute; Washington A. Roebling, Vice-President John A. Roebling

Company, Trenton, N. J.; David Reeves, President Phoenix Iron Company of Philadelphia; Isaac W. Frank, President United Engineering & Foundry Company, Pittsburg, Pa.; Nelson P. Lewis, Chief Engineer Board of Estimate and Apportionment, New York City; O. F. Nichols, Chief Engineer Department of Bridges, New York City; Arthur B. de Saulles, Superintendent of the Bethlehem works of the New Jersey Zinc Company; Frank G. Smith, Brigadier-General, U. S. A., retired, Secretary of the Chicamauga and Chattanooga National Park; T. Guilford Smith, Regent of the New York State University; I. M. de Varona, Chief Engineer Department of Water Supply of New York; William H. Burr, Professor of Civil Engineering of Columbia University; J. Van W. Reynders, General Manager Pennsylvania Steel Company, Steelton, Pa.; A. L. A. Himmelwright, General Manager Roebling Construction Company, New York, and George S. Groesbeck, President Springfield Construction Company, Springfield, Mass.

New York 16-Hour Law.

Governor Hughes, of New York, has signed the bill of Senator Page amending the penal code to make it a misdemeanor for a railroad to permit any employee engaged in or connected with the movement of any train to remain on duty more than 16 consecutive hours, or to require or permit any such employee who has been on duty 16 consecutive hours to go on duty without having had at least 10 hours off duty; or to require or permit any such employee who has been on duty 16 hours in the aggregate in any 24-hour period to continue on duty, or go on duty, without having had at least 8 hours off duty within the 24-hour period, except when by casualty occurring after such employee has started on his trip, or by unknown casualty occurring before he started on his trip, and except when by accident or unexpected delay of train scheduled to make connection with the train on which such employee is serving, he is prevented from reaching his terminal.

Honorary Degree for J. M. Graham.

The honorary degree of Doctor of Engineering has been conferred by the Kentucky State College on J. M. Graham, Fourth Vice-President of the Erie, who is a graduate of the college.

Passenger Results Under Two-Cent Law in Ohio.

The following is a quotation from the annual report just issued by the Pittsburg, Youngstown & Ashtabula for the year ended December 31, 1906:

> The number of passengers carried increased 92,232, or 15 per cent., with an increased passenger mileage of 1,423,852 miles, or 13 per cent., and an increase in passenger train-mileage of 18 per cent. There was a decrease in the earnings per passenger per mile of 0.11 cent, due to the enforced reduction in the passenger rate caused by the recent legislation in the state of Ohio, providing for a maximum rate of 2 cents a mile, which went into effect in March, 1906; and this decrease in earnings, taken in conjunction with an increase in the cost per passenger per mile of 0.26 cent, increased the loss per per passenger per mile from 0.58 cent to 0.95 cent, or 64 per cent. This result, which was not unexpected by your officers, goes to show conclusively that the increase in the number of passengers carried does not compensate for the large reduction in the rate.

Enterprise Transportation Company.

This company, known as the New Line, has attained its second anniversary, and has issued a circular relative to its competition with the New Haven interests on Long Island Sound. The company now operates two services, one from New York to Providence and one from New York to Fall River, and has a fleet of five steamers.

INTERSTATE COMMERCE COMMISSION RULINGS.

In an opinion by Commissioner Clark on the case of Barden & Swarthout vs. Lehigh Valley the Commission gave its first opinion under the amendment giving power to require connections to private sidings. Complainants petitioned for a connection to a proposed industrial siding in Geneva, N. Y. A verbal understanding was had between complainants and the carrier in 1904 for the construction of the siding. Complainants refused to agree that coal business should never be carried on in connection with the siding, and the carrier refused to make the connection. Complainants brought suit in court, proper service was not had, and case was abandoned. After the act to regulate commerce was amended, complaint was filed with the Commission. The Commission does not recognize the right of a carrier to dictate as to the business which will be conducted at a siding which is connected with its lines, excepting so far as may be reasonable with regard to dangerous commodities. Complainants must, however, make written application upon the carrier in order for the Commission to have jurisdiction, and such written application must be made subsequent to the date upon which the amendment to the law became effective. No such application has been made and the case is therefore dismissed because of lack of jurisdiction.

The Commission announces the dismissal for want of prosecution of the complaint of the Producers' Pipe Line Company vs. St. Louis, Iron Mountain & Southern et al. The Commission holds that in formal proceedings before it, complaints must be prosecuted with reasonable diligence when a case has been formally assigned for hearing on a certain day, the parties must appear and present evidence, or, in advance of the date set, request postponement on stated grounds, showing good and sufficient cause for delay. The case in question was twice assigned for hearing at Kansas City, but on each occasion the complainant failed to appear.

The Commission after much reflection has taken up the question of the law relating to posting of tariffs. The impracticability of posting at every station or office all of a carrier's tariffs, and the difficulties which would be met with in an effort so to do, are recognized and appreciated, and the propriety of some modification of the requirements of the law is conceded. Such modification, however, must not be so radical or sweeping as to amount to nullification, and it is practically impossible to deal efficiently with the question by a general order. The Commission has therefore decided to try the plan outlined below, depending upon the honor and good faith of each official to resolve doubts in favor of the spirit of the law. If the plan fails to prove satisfactory in any instance because of failure to so deal with it, the only alternative will be literal compliance with the terms of the act.

Ordered, that the principal traffic official * * * shall, on or before August 1, 1907, file with the Commission a request for modification accompanied by (1) a list of the points (stations) on its lines at which the volume of traffic and number of shippers are sufficiently large to reasonably call for full compliance with the terms of the act, and (2) a list of points (stations), not included in list (1), at which agents are regularly on duty and at which tariffs containing rates applicable to or from those points should be posted, and also by statement of the special reasons upon which such request is based.

The intention is to require that at points at which all tariffs are not posted a complete file of that carrier's tariffs shall be kept in charge and custody of the agent, and that notices shall be posted in two conspicuous and public places in every station, warehouse or office at such point that (*a*) "The rate schedules of this company which contain rates applying to or from this station are here posted. Additional schedules are on file with the agent, and can be inspected on request"; or (*b*) "The rate schedules of this company are on file with the agent, and can be inspected upon request."

The Commission will reserve the right to cancel at any time any order that may be issued hereunder to any carrier, and also the right to at any time require any carrier to add the names of any of its stations to any list named in such order.

The Commission decides that "posting," as here used, does not necessarily mean attaching to the wall. The law requires that schedules shall be posted in such form that they shall be accessible to the public and can be conveniently inspected. Placing them in a case or cupboard which is accessible to the public would be compliance with this requirement. The term "station" used in this connection to indicate point on carrier's lines will be understood and held to include all of that carrier's stations, warehouses or offices which are located at that station—that is, in that city or town.

A tariff circular was promulgated June 17, containing a revision of previous circulars and setting forth in consolidated and simplified form all the live matter shown in previous tariff circulars. Many changes have been made in the rules covering the construction and filing of tariffs. The new rules permit carriers to authorize fast freight line agents to act for them in the publication and filing of tariffs. Tariffs covering rates to and from points on new lines shall bear notice that they apply to new stations to and from which no rates have theretofore applied.

Carriers may lawfully make special rates for the movement of federal troops when such movement is under orders and at the expense of the United States government, and rates so made need not be posted or filed. This applies to similar transportation for the naval and marine services. No traffic or transportation can be the subject of special agreement between carrier and shipper, and the provision contained in classifications to the effect that high explosives will be taken only by special agreement is held to be wrong. The classification should state that such traffic is subject to regulations and rates in tariffs, and tariffs must provide the regulations applicable to the traffic.

Shipments which are refused by consignees may be reconsigned under application of the through rate from point of origin to final destination, either with or without the exaction of the reconsignment charge, and it is not deemed improper that articles damaged in transit be returned free or at reduced rates if tariffs contain rules so providing. Instructions of shippers as to intermediate rout

ing cannot be disregarded by carriers, unless the initial carrier reserves the right to dictate intermediate routing, and carriers will be held responsible for the routing shown in bills of lading. Overcharges on account of misrouting by a carrier may be adjusted as to shipments moving after March 18, 1907, the authority therefor being limited strictly to cases in which rates are covered in tariffs effective at the time the shipment moved and lawfully applicable thereto.

The Commission will give no consideration to tariffs which are not received at its office in time to give the statutory notice. Literal compliance with the law in that respect will be exacted.

MANUFACTURING AND BUSINESS.

The American Car & Foundry Company, New York, is planning to build a steel car plant at Gary, Ind., on land adjoining that of the United States Steel Corporation.

The Minnesota Steel Co. has been incorporated in Minnesota with $10,000,000 capital. It is said that the new company will operate the United States Steel Corporation's plant at Duluth.

A semi-annual dividend of 2½ per cent. on the common stock of the Standard Coupler Company has been declared, payable June 29. The last semi-annual dividend on this stock was 2 per cent.

Iron and Steel.

The Grand Trunk Pacific is reported to be in the market for 71,000 tons of rails.

The Pittsburg Railway & Light Company has ordered 3,800 tons of rails; the Lexington & Interurban, 1,600 tons; a Cleveland line, 500 tons, and additional miscellaneous orders from electric lines aggregate 1,500 tons.

The Chicago, Milwaukee & St. Paul has given an order to the American Bridge Company for 575 tons of steel for bridges, making the aggregate quantity ordered recently by this company 5,000 tons. The Louisville & Nashville has ordered from the Louisville Bridge Company 100 tons, and the Hocking Valley 725 tons from the Mount Vernon Bridge Company.

The Central of Georgia has ordered 10,000 tons of rails from the Pennsylvania Steel Company; the Cincinnati, Hamilton & Dayton 4,000 tons from the Carnegie Steel Company, and the Grand Trunk 30,000 tons from the Lackawanna Steel Company. An order for 14,000 tons has been given to the United States Steel Products Export Company for export to Peru.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Iron and Steel Institute.

The autumn meeting of this institute is to be held in Vienna Austria, September 23-25, 1907. The reception committee has arranged a number of excursions. The papers to be read and discussed will be announced later. Visitors to this meeting may secure reduced rates from London via Switzerland on application to G. K. Turnham, at the Tourists' Agency of the Great Northern Railway, 2 Charing Cross, London, S. W.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Arkansas Western.—E. P. Hall has been appointed Assistant Auditor, with office at Kansas City, Mo., succeeding W. V. Bolman.

Baltimore & Ohio.—Hugh L. Bond, Jr., Second Vice-President and General Attorney, has been elected Second Vice-President and General Counsel. John G. Williams, Assistant General Attorney, succeeds Mr. Bond as General Attorney. Herbert R. Preston, Assistant General Attorney, has been appointed General Solicitor.

Butte, Anaconda & Pacific.—M. S. Dean, Vice-President, has been elected First Vice-President. B. B. Hayes has been elected Second Vice-President.

Erie.—W. J. Harahan, Vice-President of the Illinois Central, has been appointed Assistant to the President, succeeding C. S. Sims, now Second Vice-President of the Delaware & Hudson.

Gulf & Interstate.—Charles H. Moore, formerly President of the Peach River & Gulf, has been elected Vice-President of the Gulf & Interstate. George Sealy has been elected Secretary. R. W. Smith has been elected Treasurer, succeeding W. C. Brothers. The offices of all are at Galveston, Tex.

Illinois Central.—See Erie.

Isthmian Canal Commission.—E. S. Benson, General Auditor, has resigned.

Manistee & Grand Rapids.—W. T. Joyce, President of the Minneapolis & Rainy River, has been elected also President of the Manistee & Grand Rapids. John Crocker has been elected Vice-President.

Minneapolis & Rainy River.—See Manistee & Grand Rapids.

Northern Pacific.—The authority of all officers of the Northern Pacific will, on July 1, be extended over the Washington & Columbia River.

Pan-American.—The general offices of this company have been removed from Mexico City, to San Geronimo, Oaxaca.

Panama Railroad.—E. S. Benson, General Auditor, has resigned.

San Pete Valley.—F. R. Coates, formerly Chief Engineer of the Chicago Great Western, has been elected President, and T. H. Fitzgerald, Vice-President.

Washington & Columbia River.—See Northern Pacific.

Operating Officers.

Baltimore & Ohio.—J. H. Rosenstock, general yardmaster at New Castle Junction, Pa., and John Niland, general yardmaster at Cumberland, Md., have been appointed to the new offices of Inspectors of Yards, reporting to the General Manager, with jurisdiction over all yards on the road. Their inspections will have particular reference to car movement.

J. K. Graham, agent at Wheeling, W. Va., and C. L. Johnson, agent at Columbus, Ohio, have been appointed to the new offices of Inspectors of Station Service, reporting to the General Manager.

Gulf & Interstate.—F. N. Dever, station agent of the Gulf, Colorado & Santa Fe at Somerville, Tex., has been appointed to the new office of General Manager of the Gulf & Interstate.

Hocking Valley.—R. M. Connell has been appointed Trainmaster, succeeding C. L. Gardner, now Assistant Superintendent of the Toledo & Ohio Central.

Missouri, Kansas & Texas of Texas.—A. D. Bethard, Superintendent of Transportation, has been appointed Assistant General Manager, with office at Dallas, Tex. J. W. Walton, Superintendent of the St. Louis & San Francisco at Francis, Ind. T., succeeds Mr. Bethard, with office at Denison, Tex.

Northern Pacific.—Henry C. Nutt, who was recently appointed General Manager of the Northern Pacific lines west of Trout Creek, Mont., was born on November 20, 1863, at Council Bluffs, Iowa. He graduated from the Sheffield Scientific School of Yale University in 1883 and entered railroad service in that year on the Burlington & Missouri River Railroad in Nebraska, now part of the C., B. & Q., where he worked as rodman and resident engineer until 1889. In that year he was appointed Trainmaster of the Wyoming division, and in 1892 Assistant Superintendent of the same division, with headquarters at Edgemont, S. Dak. In 1894 he was Assistant Superintendent at Sheridan, Wyo., and in 1900 Assistant Superintendent of the Burlington lines in Iowa, with headquarters at Burlington, Iowa. After five years of service in this position, he was, in 1905, appointed General Superintendent of the Missouri district, with headquarters at St. Louis, and in the next year went to the Michigan Central as General Superintendent. He now leaves the Michigan Central to become General Manager of the western lines of the Northern Pacific, with headquarters at Tacoma, Wash.



Henry C. Nutt.

I. B. Richards has been appointed Superintendent of Transportation, with office at St. Paul, Minn.

St. Louis & San Francisco.—See Missouri, Kansas & Texas of Texas.

Southern Pacific.—W. A. McGovern, Superintendent of the Tucson division, has been appointed Superintendent of the Coast division, with office at San Francisco, Cal., succeeding J. C. Wilder, assigned to other duties. W. H. Averell, Assistant Superintend-

ent at Bakersfield, Cal., succeeds Mr. McGovern, with office at Tucson, Ariz. F. M. Worthington has been appointed Assistant Superintendent at Tucson, succeeding D. T. Costello, assigned to other duties.

The authority of A. H. Iliohan, Assistant Superintendent of Telegraph of the Pacific system, has been extended over the lines east of Sparks, Nev., of the Southern Pacific Company, and over the Arizona Eastern, the Arizona & Colorado, the Gila Valley, Globe & Northern and the Sonora Railway.

Tehuantepec National.—F. D. Hamilton has been appointed Superintendent of the Salina Cruz terminals, succeeding H. A. Tolle, resigned.

Traffic Officers.

Atlanta, Birmingham & Atlantic.—W. H. Leahy, division passenger agent of the Atlantic Coast Line at Savannah, Ga., has been appointed General Passenger Agent of the A., B. & A., with office at Atlanta, Ga., succeeding, as General Passenger Agent, J. J. Campion, whose title has been changed from General Freight and Passenger Agent to General Freight Agent.

Mississippi Central.—Walter P. Emerson has been appointed General Freight and Passenger Agent, with headquarters at Hattiesburg, Miss.

Engineering and Rolling Stock Officers.

Michigan Central.—W. H. Sellew, Division Engineer at Detroit, Mich., has been appointed Principal Assistant Engineer, with office at Detroit. Mr. Sellew is succeeded by W. C. Cleveland.

New York, New Haven & Hartford.—W. J. Black, Engineer of Maintenance of Way, has been appointed Assistant Engineer of Construction, in charge of the New Haven improvements.

Special Officers.

Erie.—Harrison Williams has been appointed General Land and Tax Agent, succeeding to the duties of W. E. Talcott, Real Estate Agent, who has resigned and whose office has been abolished. E. M. Hunt, Land and Tax Agent of the Ohio division of the Erie and of the Chicago & Erie, and G. H. Palmer have been appointed Assistant General Land and Tax Agents. H. M. Merrihew succeeds Mr. Hunt, with office at Cleveland, Ohio.

LOCOMOTIVE BUILDING.

The Southern has ordered four consolidation locomotives from the American Locomotive Company.

The Norwood & St. Lawrence has ordered one mogul locomotive from the American Locomotive Company.

The Williamette Construction Company has ordered two electric locomotives from the American Locomotive Company.

The C. H. Sharp Contracting Company has ordered two prairie locomotives from the American Locomotive Company.

The Sabina Coal Company, Mexico, has ordered one prairie saddle tank locomotive from the American Locomotive Company.

The Virginia & Southwestern, as reported in the *Railroad Gazette* of June 1, has ordered three consolidation locomotives from the American Locomotive Company.

The Angelina & Neches River, Keltys, Tex., has ordered one simple mogul locomotive from the Baldwin Locomotive Works. The specifications are as follows:

General Dimensions.

Type of locomotive	Mogul
Weight, total	79,000 lbs.
Weight on drivers	66,000 "
Diameter of drivers	48 in.
Cylinders	15 in. x 22 in.
Boiler, type	Wagon top
" working steam pressure	200 lbs.
" number of tubes	150
" diameter of tubes	2 in.
" length of tubes	9 ft. 2¼ in.
Firebox, length	49⅝ "
" width	34⅜ "
" grate area	12 sq. ft.
Heating surface, total	800 "
Tank capacity	2,500 gals.

Special Equipment.

Air-brakes	Westinghouse
Couplers	Trojan
Injector	Hancock
Safety valve	Crosby
Sight-feed lubricators	Nathan

CAR BUILDING.

The Atchison, Topeka & Santa Fe has ordered 35 way cars from the American Car & Foundry Company.

M. P. and J. T. Davis, Quebec, Que., have ordered 20 Hart convertible cars from the Dominion Car Company.

The Louisville & Eastern, Louisville, Ky., has ordered two express cars from the McGuire Cummings Manufacturing Company.

The Keystone Equipment Company, New York, is reported to be in the market for from 10 to 15 new dump cars and 40 second-hand dump cars.

The Waterloo, Cedar Falls & Northern, Waterloo, Iowa, has ordered 14 single truck cars from the McGuire Cummings Manufacturing Company.

The Union Pacific has ordered 40 oil tank cars of 100,000 lbs. capacity for September delivery from the Cambria Steel Company. The cars are duplicates of the 156 cars ordered last year, having tank capacity of 12,500 gallons.

The National Car Line Co., Chicago, has ordered 20 tank cars of 80,000 lbs. capacity from the Bettendorf Axle Co., for July and August delivery. These cars will be 31 ft. long and 9 ft. wide, over all. The special equipment includes:

Axles	Griffin Wheel Co.
Bolsters	Bettendorf
Brake-beams	Damascus
Draft rigging	Cardwell
Dust guards	Harrison
Trucks	Bettendorf
Wheels	Griffin Wheel Co.

The Chicago Great Western, as reported in the *Railroad Gazette* of June 14, has ordered 1,000 wooden box cars of 100,000 lbs. capacity from the Pullman Company. These cars will measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The special equipment includes:

Brake-beams	Simplex
Brakes	Westinghouse
Draft rigging	Street
Journal boxes	McCord
Roofs	Chicago
Trucks	Barber
Wheels	Griffin

The Atchison, Topeka & Santa Fe, as reported in the *Railroad Gazette* of June 14, has ordered three cafe observation cars from the Pullman Company for September delivery. These cars will measure 67 ft. 10 in. long, inside measurements, and 10 ft. wide over sills. The special equipment includes:

Brake-beams	Diamond special
Brakes	Westinghouse
Couplers	National
Curtain fixtures	Forsythe
Draft rigging	Miner
Journal boxes	Symington
Trucks	Atchison, Topeka & Santa Fe standard
Vestibules	Pullman

RAILROAD STRUCTURES.

Blaisdell, N. Y.—The Buffalo & Lake Erie Traction is planning to put up a new power plant near Athol Springs. Plans are also being made for a new car house to replace the structure recently destroyed at this place.

El Reno, Okla.—The Chicago, Rock Island & Pacific has given a contract to Sharp Bros. for grading at the site of its proposed new terminal here. The contract, it is said, amounts to about $200,000.

Halifax, N. S.—A steel bridge is to be built by the Halifax & Southwestern.

Lebanon, Pa.—Upon the completion of the new Fourth street overhead bridge of the Philadelphia & Reading, the same company will erect a similar bridge at Front street.

Lethbridge, Alb.—Bids will soon be asked for the construction of the new steel bridge, to be 5,500 ft. long and 300 ft. high. The estimated cost is $1,000,000. Address J. Schwitzer, Chief Engineer, Winnipeg, Man.

Montreal, Can.—Local reports state that officials of the Canadian Northern announce that machine shops are to be put up at Longue Pointe.

Ottawa, Ont.—Bids are wanted by P. E. Ryans, Secretary of the Transcontinental Railway Commission, for building five steel bridges.

Pittsburg, Pa.—The Pittsburg, Harmony, Butler & New Castle, it is said, will put up a car barn about six miles from this place. The proposed structure will be of brick 47 ft. x 60 ft. The Miller & Stewart Construction Company has the contract for the work.

San Antonio, Tex.—The Railroad Commission of Texas has decided to order the International & Great Northern to put up a new passenger station here. The cost of the improvements will be about $150,000.

Toronto, Ont.—The Railway Commissioners have authorized the construction of a steel bridge at Sunnyside, the cost to be borne by the city and the railroads over whose track the bridge will cross.

Plans are to be submitted for approval to the city authorities for a proposed viaduct and terminal station here.

Winnipeg, Man.—Contracts reported let to the J. McDiarmid Construction Company, of this place, for additions to the Canadian Pacific shops and car sheds. The cost of the improvements will be about $125,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Big Fork & International Falls.—See Northern Pacific.

Brooklyn Rapid Transit.—This company has begun operation on its Brighton Beach line, which it has been improving during the last two years. From Prospect Park south to Fiske Terrace the line is depressed; the rest of the way it is on an embankment. It is a four-track line which is to cost $2,000,000; half the expense is to be borne by the city and the rest by the railroad company. In addition, the railroad spent about $500,000 for new brick stations along the route and for other improvements.

Canadian Pacific.—Contract is reported let to W. F. Braden, of Strasburg, Sask., for building 40 miles of the new branch north from Strasburg.

Detroit Terminal.—An officer writes that this belt line from the easterly limits of Detroit, Mich., at the Detroit river to a connection with the Grand Trunk and Michigan Central, about five miles, has been finished and is now in operation. The Grand Trunk, the Detroit, Grand Haven & Milwaukee, the Lake Shore & Michigan Southern and the Michigan Central each have a quarter interest in the line, which is operated as an independent terminal railroad. H. B. Ledyard, President, Detroit.

Douglas & Coos (Electric).—Incorporated in Oregon with $500,000 capital and office at Marshfield. The company proposes to build an electric line from Roseburg northwest to Marshfield about 50 miles. The incorporators include: A. C. Marsters, P. L. Phelan, L. J. Simpson, L. H. Hazard, E. L. Wheeler and J. H. Flanagan.

El Dorado & Wesson.—This company, building from El Dorado, Ark., to Wesson, 10 miles, an officer writes, has track laid from Wesson north for three miles. James Harrington, Chief Engineer, Hot Springs, Ark. (Mar. 15, p. 383.)

Erie.—Work, it is said, has been resumed on the Genesee River Railroad building from Hunts, N. Y., south to Cuba, 30 miles. About half of the line was finished when work was suspended about April 1.

Frio Valley.—Surveys, it is said, have been made by this company, recently incorporated in Texas to build a line from the Southern Pacific near Chatfield, Tex., north to Leakey, about 40 miles. Grading work is to be started early in August. (May 24, p. 727.)

Genesee River Railroad.—See Erie.

Grand Trunk.—Contract is reported let to McRae, Chandler & McNeil for second track work on the St. Lambert-Ste. Rosalie branch between St. Lambert and Ste. Rosalie, Que., 32 miles.

Grand Trunk Pacific.—Contracts are reported let to C. P. Wright, of Portage la Prairie, Man., for grading three miles of line between Portage la Prairie and Winnipeg, Man.

The National Transcontinental Commission is asking bids for the construction of an eight-mile section of the line east from Chipman, N. B.

Hudson & Manhattan.—Work has been started on the proposed tunnel under Railroad avenue, in Jersey City, N. J., to form part of a line to Newark from the western end of the tunnel under the Hudson river.

Idaho & Wyoming.—See Oregon Short Line.

Interborough Rapid Transit Company.—See New York Subways.

Kansas City Southern.—Surveys have been made and rights of way nearly all secured for an extension of this road to New Orleans. The projected route is from Leesville, La., southeast via Oberlin and Eunice to Crowley on the Southern Pacific, which road is to be paralleled as far as New Iberia, thence east and southeast between the Texas & Pacific and the Southern Pacific to New Orleans, about 250 miles. While the question of building this extension has been under consideration for some time, no definite action has yet been taken to carry out the work.

Kentucky North & South.—This company, which has projected a line from Fullerton, Ky., on the Ohio river opposite Portsmouth, Ohio, south to Bristol, Tenn., about 250 miles, where connection is to be made with the Southern Railroad, has surveys made for about half of the distance, and 85 per cent. of the right of way secured. E. S. Parsons, Springfield, Ohio, is making surveys. (Mar. 15, p. 386.)

Keweenaw Central.—An officer writes that contracts have been let to J. J. Byers & Co., of Houghton, Mich., for extending the main line of this road from Mohawk, Mich., southwest to Calumet, six miles, and branches from Mandan to the Keweenaw Copper Company mines, four miles, and from Phoenix to Eagle River, two miles.

Minnesota & International.—See Northern Pacific.

Missouri & North Arkansas.—On the extension of this road from Seligman, Mo., northwest to Joplin, about 50 miles, for which contracts were let to L. S. Joseph and M. C. Burt, of Leslie, Ark., and Cape Girardeau, Mo., work is reported under way from Woodruff, in Barry County, northwest to Neosho, and grading is expected to be finished on this 30-mile section next month. On the extension from the southern end of the road at Leslie, Ark., southeast to Helena, it is expected to have grading finished this year to Searcy, 96 miles. Contracts for this work let to Scott & Dalhoff, of Neosho, Mo. Contracts reported recently let for building the first 40 miles from Helena, northwest, and additional contracts will probably be let this year for the remaining section to Searcy, about 40 miles. (March 15, p. 387.)

Missouri Pacific.—According to reports from Springfield, Mo., the Springfield-Crane branch of this road, recently finished, is to be extended north to the Missouri Pacific line at Bagnell, about 120 miles. Work, it is said, will be started from the northern end at Bagnell next month.

New York City Subways.—The Board of Rapid Transit Commissioners has given to the Bradley Contracting Company three contracts, aggregating $3,745,766, for the construction of the remaining sections of the subway loop to connect the Manhattan and Williamsburg bridges in the Borough of Manhattan; and additional contracts at $103,840 for pipe galleries in these sections. The work includes the section from Pearl street to Park Row, to cost $998,328 and $5,500 for the pipe galleries; from the new extension from Center street to the Bowery on Delancey street, to cost $1,518,302 and $29,040; and from the Bowery to Norfolk and Delancey streets to cost $1,229,136 and $69,300.

At a recent meeting of the Board of Rapid Transit Commissioners, New York City, the construction of a fourth track in the subway of the Interborough Rapid Transit Company, between 96th and 103d street, was authorized. The cost of the work will be about $850,000. (April 12, p. 531.)

Niagara, St. Catharines & Toronto.—This company is planning extensions to its system in addition to the lines it is building from St. Catharines to Niagara-on-the-Lake, to Welland and Grimsby Park. The St. Catharines-Welland line under contract to Joseph Battle, of Thorold, Ont., will soon be finished. An extension of the electric line is projected from Niagara Falls to Fort Erie. (Mar. 15, p. 396.)

Northern Pacific.—An extension of the Minnesota & International, from Big Falls, Minn., northeast via Grand Falls, Wakana, Littlefork and Nakoda, to International Falls, 34 miles, is being built under the name of the Big Fork & International Falls Railway. An officer writes that track is laid for 19 miles. Dempsey & Dougherty, Minneapolis, Minn., have the contract for the grading, which is nearing completion. There are to be two steel bridges, one 275 ft. long and the other 185 ft. (March 15, p. 388.)

Oregon Short Line.—An officer writes that location surveys have been made for building the Idaho & Wyoming from Elva, Idaho, east to Jackson, Wyo., 105½ miles. Work on this line has not yet been started.

Pan-American.—According to reports from Mexico City, this company may abandon the plan to extend this road beyond the Mexico-Guatemala boundary. Negotiations are pending in Guatemala and San Salvador for concessions, which it is said will be withdrawn. The road is in operation from San Geronimo, near Salina Cruz, on the Pacific coast in Mexico, to a point 60 miles from the Guatemala boundary. (May 10, p. 663.)

Panhandle Electric & Power Company.—Incorporated in Idaho to build an electric line from Sand Point, Idaho, northwest to Coolin at the outlet of Priest lake, about 15 miles. The incorporators include: T. W. Payne, Detroit, Mich.; A. Coolin, Priest River; A. J. Smith and H. H. Wallace, Spokane, and J. R. Jones, Hillyard. The project is to be financed by Eastern capitalists, and power is to be generated below the outlet of Priest lake near the Priest river valley.

Pullman, La Crosse & Columbia River (Electric).—Plans are being made to organize a company under this name in Washington to build an electric line from Pullman west to La Crosse and Hooper, 42 miles. Connection is to be made at Pullman with the Oregon Railroad & Navigation Company. J. O. Staats, of La Crosse, is the promoter.

Savannah, Augusta & Northern.—This company, projected from Savannah, Ga., northwest to Rossville, about 330 miles, with a branch from McDuffie County east to Augusta, 30 miles, it is said has sufficient capital to carry out the work, and is now securing the necessary right of way. Contracts for some of the work reported let to W. J. Oliver, Knoxville, Tenn. (March 15, p. 391.)

Yankton Southern.—Incorporated last year in South Dakota and recently in Oklahoma, with $100,000 capital, with an office at Yankton, S. Dak. The company proposes to build a line from Yankton south to Galveston, Tex. The incorporators include: F. Hill, T. Lewman, T. B. Paxton, A. Hill, J. W. Warrington and W. C. Proctor, of Cincinnati, O., and R. J. Gamble, W. J. Faulte and I. Piles, of Yankton, S. Dak. (Nov. 23, 1906, p. 146.)

RAILROAD CORPORATION NEWS.

Baltimore & Ohio.—Gross earnings for May were $7,370,849, an increase of $553,815; net earnings $2,451,609, an increase of $162,495. Gross earnings for eleven months were $75,047,837, an increase of $4,228,595; net earnings $24,915,596, a decrease of $609,749.

Boston, Revere Beach & Lynn.—A semi-annual dividend of 3 per cent. has been declared on the $850,000 stock of this road, which has a line from East Boston, Mass., to Lynn, nine miles, and from East Boston to Winthrop, four miles. Connection is made with Boston by ferry. This is at the rate of 6 per cent. a year, the largest paid since 1891, when 7 per cent. was paid. Since that time dividends have been from 2 per cent. to 5½ per cent., the previous dividend, in January, being at the rate of 4 per cent. a year.

Canada Coal & Railroad Company.—See Maritime Coal, Railway & Power Company.

Chesapeake & Ohio.—Potter, Choate & Prentice are offering at par and interest $500,000 one-year 6 per cent. notes dated June 28, 1907. The notes are part of a total issue of $1,200,000.

Chicago & Alton.—The agreement under which the Harriman interests and the Rock Island interests controlled the Board of Directors of the Chicago & Alton in alternate years by taking turns in electing the eleventh director each year, has been dissolved by mutual agreement. The agreement was made in 1904 and was to last until 1914. The Chicago, Rock Island & Pacific is understood to own an absolute majority of the stock, while the Union Pacific owns about 25 per cent. The stock held by both interests has hitherto been deposited with the Central Trust Company.

Chicago City Railway.—An issue of $10,000,000 5 per cent. bonds has been authorized; of this amount $6,000,000 has been sold to the First National Bank of Chicago and the Harris Trust & Savings Bank of that city. The proceeds are to be used to pay for rails and cars already ordered and other expenses of the first work of rehabilitation. The remaining $4,000,000 will be sold when necessary to finish the work.

Chicago, Rock Island & Pacific.—See Chicago & Alton.

Chicago Subway.—Officers connected with Armour & Co. have been elected officers and directors of the Illinois Tunnel Company.

Cincinnati, Hamilton & Dayton.—See Pere Marquette.

Colorado & Northwestern.—W. B. Hayes, Vice-President, Secretary and Treasurer, has been appointed Receiver of this company, on application of the United States Trust Company of New York. Interest on the $1,000,000 5 per cent. bonds of 1954 has been in default since July, 1905. The road runs from Boulder, Colo., to Ward, 26 miles, and from Sunset to Eldora, 20 miles, with five miles of branches. It has trackage rights over the Colorado & Southern from Boulder into Denver.

Corvallis & Eastern.—See Southern Pacific.

Dayton, Lebanon & Cincinnati Terminal.—This company has been incorporated with $1,000,000 capital to take over and operate the Dayton, Lebanon & Cincinnati, a steam road which belonged to the Appleyard interests and which was sold under foreclosure in April. It is 23 miles long, running from Lebanon, Ohio, to Lebanon Junction, about four miles east of Dayton; it is planned to extend the road into Dayton.

Erie.—A loan of $2,000,000 has been negotiated to finish the Genesee River Railroad, which is building a cut-off from Cuba, N. Y., to Hunts. The Genesee River was recently given permission to issue $6,000,000 first mortgage bonds.

Fitchburg.—Governor Guild, of Massachusetts, has signed a bill authorizing the Fitchburg Railroad to buy the Conway Street Railway, a small electric line in Conway, Franklin County, Mass.

Fitzgerald, Ocilla & Broxton.—See Ocilla & Valdosta.

Genesee River Railroad.—See Erie.

Lehigh Valley.—On June 19 the regular semi-annual dividend of 2 per cent. and an extra dividend of 1 per cent. on the common stock was declared. This is the same action as was taken six months ago.

Maritime Coal, Railway & Power Company.—This company has acquired all the property of the Canada Coal & Railway Company, which consists of 17 square miles of coal lands and 12 miles of road from Maccan Junction, on the Intercolonial Railway, to Joggins Coal Mines. The purchasing company, which was formerly the Maritime Coal & Railway Company, operates, for freight traffic only, three miles of road from Chignecto, N. S., on the Intercolonial, to Maccan Junction.

Maryland Electric.—A semi-annual dividend of 2 per cent. on the $1,133,400 outstanding capital stock has been declared, payable July 1. The first dividend on this stock was 1½ per cent. and was paid last January.

New England Investment & Security Company.—This company, the holding company for New York, New Haven & Hartford electric lines in Massachusetts, is to exchange its stock, share for share, for most of the $80,900 stock of the Uxbridge & Blackstone Street Railway, which owns 10 miles of road in and near Uxbridge, Mass.

New York, Ontario & Western.—The New York State Railroad Commission has given this company permission to issue $1,948,000 additional general mortgage 4 per cent. bonds of 1955, to provide for additions and improvements on leased lines and for new equipment. There is already outstanding $2,000,000 of the total authorized issue of $12,000,000.

Northern Pacific.—The operation of the Washington & Columbia River will be merged with that of the Northern Pacific beginning at midnight June 30, 1907.

Estimated gross earnings for May were $6,312,160, an increase of $949,984.

Ocilla & Valdosta.—The name of this road has been changed to Fitzgerald, Ocilla & Broxton Railroad.

Pennsylvania, New Jersey & New York.—See Pennsylvania, New York & Long Island.

Pennsylvania, New York & Long Island.—A special meeting of the stockholders was held yesterday to act on the proposed consolidation of the company with the Pennsylvania, New Jersey & New York. The Pennsylvania, New Jersey & New York is building the Pennsylvania extension from Harrison, N. J., under the Hudson river as far as the state line, and the other company is building the rest of the tunnel from that point and across New York City and under the East river into Long Island City.

Pere Marquette.—J. P. Morgan & Co. announced on June 19, the following plan for adjustment of the finances of this company, looking to the termination of the receivership. The holders of the $12,000,000 4 per cent. preferred stock are to be asked to subscribe to $5,000,000 5-year 6 per cent. debentures to the extent of 50 per cent. of their holdings. The preferred stockholders are to exchange their present stock for 115 per cent. in new 4 per cent. first preferred stock, which will differ from the present preferred stock in that it will be preferred as to assets and will be cumulative after 1910. New second preferred stock will be issued to present preferred stockholders who do not subscribe to the notes. The proceeds of the notes will be used to refund the company's present floating debt, most of which is in the form of receivers' certificates. The C., H. & D. lease of the Pere Marquette is to be ended. It is said that a new issue of $3,000,000 equipment trust certificates will soon be made to retire maturing equipment notes.

Philadelphia, Baltimore & Washington.—A special meeting of the stockholders has been called for July 31 to authorize an increase in the bonded debt. It is rumored that it is planned to consolidate with the P., B. & W. several other Pennsylvania lines which are now operated under their own organizations in Maryland.

Southern Pacific.—This company has bought, for a price said to be $4,000,000, the Corvallis & Eastern, control of which passed to Harriman interests several months ago. The road runs from Idanha, Ore., to Yaquina, 142 miles, and has outstanding $1,410,000 capital stock and $2,145,000 bonds. It crosses the Southern Pacific at Albany, Ore.

Toledo Railway & Light.—This company proposes to increase its capital stock from $12,000,000 to $15,000,000.

Union Pacific.—The stockholders on June 15 authorized $100,000,000 additional common stock and $75,000,000 convertible 4 per cent. 20-year bonds. (May 17, p. 696.)

See Chicago & Alton.

United Railways Investment Company of San Francisco.—It is said that the directors have decided to pass the semi-annual dividend, payable in July, on the $15,000,000 5 per cent. preferred stock. The last two semi-annual dividends have been paid in scrip.

Uxbridge & Blackstone Street Railway.—See New England Investment & Security Company.

Washington & Columbia River.—See Northern Pacific.

Wisconsin Central.—The members of the syndicate which last June bought $7,000,000 Superior & Duluth division and terminal first mortgage, 30-year, 4 per cent. bonds, have extended their agreement for one year; it was to expire on July 1, 1907. The bonds, which are part of an authorized issue of $8,500,000, were sold to pay for the extension from Owen, Wis., to Superior and Duluth. Only 75 per cent. has been paid on the bonds, and the syndicate was extended because it was evident that not enough of the road would be finished by July 1, 1907, to warrant the final payment on the bonds by that date.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

EDITORIAL:

A Disappointing Discussion on Rails. 919
Railway Telegraph Superintendents Convention 919
The Long Island Railroad Withdraws from the Per Diem Agreement. 919
"Boston's Hard Luck" 920
To Test the Reasonableness of a Two-Cent Fare Law. 920
The Railroads of the World. 921
The Working of the Rate Law 921

ILLUSTRATED:

The Telemagnophone 935

Railroad Track of the Present and Its Possible Future Development..... 939
The Saving of the "Suevic"..... 940

CONTRIBUTIONS:

Page Baseule Bridge 922

MISCELLANEOUS:

Interstate Commerce Commission Classification of Operating Revenues. 922
Car Accountants' Report 923
May Railroad Law 924
Seniority vs. Efficiency 925
The Master Car Builders' Convention.... 925
Topical Discussions 931
Solid Steel Wheels for Passenger Cars... 935

Railway Telegraph Superintendents..... 937
Production of Coal in 1906..... 940

GENERAL NEWS SECTION:

Notes 943
Interstate Commerce Commission Rulings 945
Trade Catalogues 945
Obituary 946
Meetings and Announcements. 946
Elections and Appointments. 946
Locomotive Building 947
Car Building 948
Railroad Structures 948
Railroad Construction 948
Railroad Corporation News 949

VOL. XLII., No. 26. FRIDAY, JUNE 28, 1907.

The discussion on rails at the meeting of the American Society for Testing Materials was disappointing. Before the meeting the general impression prevailed that some truths would be told by men qualified to tell them, and in anticipation of startling revelations the reporters of the daily newspapers were kept out. But not enough was said during the entire three hours of the discussion to tempt any representative of the rail makers to say a word in defense of their practice or output. Sad as this condition is, it is what might have been expected. The Society had here an opportunity to put itself on record against the commercialism which has led to the present conditions. It is true its members are made up of representatives of both the producer and the consumer, but both are equally liable for the loss of human life resulting from the use of defective material. Dr. C. B. Dudley, in his presidential address the evening before, said: "If it is shown that commercial considerations have led to the use of defective materials the moral responsibility must certainly lie with the one who has allowed these commercial considerations to have undue weight, be he either the maker of the material or the one high in authority who has allowed it to be used. * * * Is not the time near at hand when engineers and their principals will be compelled, if not legally, then by the force of public opinion, to acquire by the establishment of laboratories and means of testing, by the making and enforcement of specifications such knowledge of the materials they are putting into structures as will give the public greater security against disaster than it now has?" Yet with this strong text before them they contributed little to the common knowledge of how to make good rails.

The annual meeting of the Railway Telegraph Superintendents, reported in this issue, brought out as good a variety of profitable papers as any meeting in the history of the association; it was so profitable a meeting, in fact, that the members have decided to try the experiment of meeting quarterly hereafter—which will be a successful experiment if they don't try to make the meetings too formal, and if the members keep their study eyes open throughout the time that they are away from home. The output of the present meeting consists of interesting reading both in old fields and in new. For fresh subjects nothing could be of greater interest than the accounts of the experience of the New York Central in long-distance telephone work, and of the Chicago, Milwaukee & St. Paul in saving 80 per cent. in its expenses for battery power on certain lines. The use of reinforced concrete telegraph posts on the Pennsylvania Lines West of Pittsburg will also be of interest to all readers. Of fresh treatment of old subjects, Mr. Dailey's and Mr. Hope's papers afford excellent examples. If all railroads tested their operators with the thoroughness described by Mr. Hope, collisions would be less frequent. If all superintendents and despatchers would cultivate the high ideals set up by Mr. Dailey, the personnel of the telegraph and station service of American railroads would be so much better that the public would observe the improvement with the naked eye.

A notice was issued on Monday by the Secretary of the American Railway Association to the effect that the Long Island Railroad would withdraw from the per diem agreement on July 1, the date on which the rate is to be raised from 25 cents to 50 cents a day. The Long Island has been receiving from most of its connections a switching reclaim of four days ($1) on all cars consigned to points in its territory within the limits of Greater New York, but it claims that notwithstanding this reclaim and the enforcement of demurrage against consignees after 48 hours the present per diem arrangement has seriously reduced its net earnings. In view of the increase in the per diem rate the Long Island demanded an increase in the switching reclaim to eight days which, at the 50-cent rate, would amount to a bonus of $4 a car. This was refused by its connections, and as no compromise could be arranged the Long Island gave notice of withdrawal. If the Long Island was absolutely independent, its action could be understood as readily as that of the Chicago Terminal Transfer, which dropped out of the per diem agreement last year; but it is hard to understand why the Pennsylvania, which is profiting more by per diem than any other road in the country, should allow the Long Island a free hand in taking such a step, which threatens to establish a dangerous precedent. If the Long Island is allowed to name its own rates for the use of cars of other roads, many other terminal roads all over the country will probably demand the same privilege. No announcement has been made by the Long Island as yet as to the basis of settlement which will be offered for the use of foreign cars. What will probably happen is that its connections will withdraw the existing through rates

and routings. Then some shipper will bring a complaint before the Interstate Commerce Commission. The Commission will then have power to re-establish the rates and routes; and, if the roads do not agree on the division of the revenue, will itself prescribe the proportion for each road. Moreover, it would not be surprising if the Commission should also assume to prescribe car-service rates; for they may vitally affect the price of transportation to the consignee.

"Boston's Hard Luck" is the headline on a news item telling how the increase in the per diem charge on interchanged freight cars, from 25 cents a day to 50 cents, to go into effect July 1, will probably add $5,000,000 a year to the cost of delivering freight in Boston. This estimate is much too large, no doubt; and the real burden, large or small, will fall on a hundred towns, not on Boston alone. Moreover, the railroads themselves will have to bear most of the increase in the burden; they will not be able to find a way to shift it to the consignee. But why call it "hard luck"? Everybody agrees that cars are worth 50 cents a day and that the 25-cent rate has been a hardship on the lender. Boston should consider, not her bad luck, but her good luck in the past; she has been able to get cars for half what they were worth. She has also what seems to be good luck in the Connecticut demurrage law—virtually operative in Massachusetts—requiring railroads to bear the cost of standing cars till they have stood four days. This, however, is really bad luck, for it is unjust to the consignee who unloads his cars promptly. Boston will still enjoy unjust good luck in one direction; for the railroads have failed to agree on a penalty for diverting a car from its proper route, and each road will continue to use other companies' cars in its own local traffic if its conscience is tough enough to allow it to do so. If a railroad in Massachusetts receives a Missouri Pacific or a Southern Railway car loaded with cotton, and sees fit, after unloading the cotton, to keep the car six months for use in local business, it can do so at fifty cents a day; and can make it earn, perhaps, ten times that sum. In the freight car field, "luck" reverses its polarity with bewildering and irrational frequency.

TO TEST THE REASONABLENESS OF A TWO-CENT FARE LAW.

The decision on the Missouri two-cent fare law by Judge McPherson, of the United States District Court, sitting at Kansas City, Mo., handed down last week, is somewhat novel and may furnish a precedent for similar cases pending or contemplated in other states. Bills prohibiting railroads from charging more than two cents a mile for transporting passengers have been passed by legislatures and signed by the Governors of the States of Iowa, Ohio, Illinois, Indiana, Mississippi, North Carolina, Nebraska, Pennsylvania, Minnesota, Oklahoma, Arkansas and Missouri. The attitude of the railroads generally toward these bills is that they are confiscatory, and that the rates fixed are lower than the railroads can comply with without loss. Of course, if this proposition can be maintained, all such bills lack constitutional warrant and must fail of their purpose.

The general principle involved is now well settled. The doctrine laid down by the Supreme Court of the United States controlling these cases is that no legislature, either directly by statute or indirectly through railroad commissions, can establish rates of fare which do not bring a reasonable profit to the carrier upon the cost of the road and expenses of maintenance and operation.

It will be seen, therefore, that the question is now not so much one of law as one of fact. A two-cent fare might, so far as the law is concerned, be upheld in one state and overruled in another. Where the population is dense and travel frequent a two-cent rate may show an excellent profit upon the carrier's investment. In such a state a bill fixing that rate would be entirely constitutional and enforceable. In a state where the population is sparse and passengers relatively few, a two-cent rate would destroy all hope of profit. In such case the law would be clearly unconstitutional and void.

The simple question, then, in all of these cases is one of fact, whether in any particular state the two-cent rate gives a reasonable profit or not. Such an investigation involves a painstaking examination of all material facts bearing upon the question of profit and requires on the part of the court a patient and calm judgment based upon the evidence. Back of all this there is an old-fashioned principle well recognized and repeatedly enforced that the court will enjoin the operation of any law which may take property without compensation, and where such a claim is made with a reasonable showing of facts to sustain the contention, or at least uncertainty on the subject, it has been quite the universal practice of a court of equity to issue its mandate forbidding the operation of the law until its effect can in due course be ascertained.

It is, therefore, customary in cases under these compulsory rate bills to issue temporary injunctions until the carriers have the opportunity to establish their allegations.

The decision of Judge McPherson in the Missouri rate case is an unusual and interesting exception to the general rule. Starting with the proposition that the rates fixed by the legislature are presumptively reasonable and remunerative, the judge finds himself confronted with a claim to the contrary, and the old-time practice of the court in equity to stop threatened proceedings till their effect is ascertained. He realizes that a smart bookkeeper can make any showing that may be required of him, and prophecies of what may happen under new and untried conditions are a too speculative basis for judgment. Perhaps, suggests the judge, when the law is put into effect, it may so stimulate travel as to make the new rate profitable, even though it be unprofitable under the old conditions. If the legislature is presumed to have acted justly toward the railroads—and a co-ordinate department of the government cannot proceed, in the absence of evidence, upon any other supposition—why not act upon the presumption and, in fairness to the law-making power, allow its statute to operate until that operation demonstrates the confiscatory result. The courts are ever slow to declare a statute void, and never do so unless it be clearly unconstitutional. Applying the test of actual experience is much more apt to lead to a sound conclusion than indulging in speculation as to results of experiments untried except in imagination. By putting the law in effect and watching its operation for a reasonable period, presumption of validity is harmonized with that anxiety of a court of equity to investigate thoroughly a threatened wrong and to thwart it, if the apprehension is shown in fact to be justified.

Acting upon these views, Judge McPherson suspended the injunction process for three months, during which time the two-cent rate shall be operative. At the end of that period the parties are to show the results. If they demonstrate that the rate is incompatible with a reasonable profit to the carrier, injunction will issue pending the final hearing on all the evidence. If the contrary appears, or if the experiment is consistent ultimately either with profit or without it, injunction is withheld till the final proofs come in and show the real merits of the case.

The reasonableness of this disposition of the controversy seems to have so impressed counsel for both sides that they promptly accepted the decision of the court and put it into effect. The result will be awaited with interest.

But it is not the particular result in question that makes a case of this kind of value in the administration of justice. So far as that result is concerned, the scope of the case is narrow, and its effect temporary, even as between the litigating parties themselves. The decision can affect only the road in question. Some other road in the same state may show results, under the same experiment, which would require a different judgment. And what may be true of a given road at a certain period may not be true of the same road at a later period. The real value of this case is that it suggests a practice, a method of procedure in settling a controversy which may be singularly free from question or disturbance. What becomes of the railroad's claims, if at the end of the probation period, it appears that the new rate shows a reasonable profit? And what, on the other hand, can the state officials say for their case, when the experiment clearly demonstrates the absence of such profit?

This precedent ought to be seized with avidity by those carriers who confidently rely upon the justice of their cause. No witnesses can be so persuasive and credible as the mute results of arithmetical calculations. They overthrow contradiction and confuse and nullify sophistry. No document is so probative as the addition and subtraction, with some multiplication and division, of figures, taken from actual earnings and expenses. When they have done their work nothing remains to be said but the funeral obsequies of that cause that gainsays them.

But a far greater effect flows from such a method of trying out a dispute, than the mere effect of disposing of it. And this is the moral effect upon the public. Let a carrier show in this indisputable fashion, the unjust operation of a rate bill, which is accepted on probation and a public opinion is formed which so far as that carrier is concerned becomes the greatest barrier to future encroachments upon its rights, that can possibly be otherwise created. For it has dealt fairly and patiently with the public, and it has proved

its case to the satisfaction of the public, and the opinion of that public, so frightful when unfounded, becomes just as reassuring and helpful when appeased and gratified by a good cause.

THE RAILROADS OF THE WORLD.

The statistics of the railroads of the world published in the June number of the *Archiv für Eisenbahnwesen* give the mileage of the several continents as follows:

	Miles.		Miles.
Europe	192,251	North America	255,908
Asia	50,593	South America	32,859
Africa	16,538	Australasia	17,441
	259,382		303,398

making a grand total of 562,780 miles in the whole world at the end of 1905, or the nearest date for which reports are made. This is an increase of 12,525 miles, or 2.3 per cent., over the previous year, and is the smallest increase since 1900, it having varied since 1898 from 10,800 miles in 1900 to 16,754 in 1904, while the total additions to the world's mileage since 1898 have been 95,816 miles, an average of 13,688 miles yearly.

Of the increase in 1905, a little more than one-half was in America, 5,891 miles in North America and 426 in South America (including the West Indies). Canada is credited with 990 miles, against 533 the year before, but in Mexico the additions were but 150 miles in 1905, against 1,720 in 1904. In South America, Argentina opened 337 miles, Peru 39, Brazil 36 and the other additions were 12 miles in the West Indies.

In Europe, Germany opened 567 miles, followed by Austria with 466 and France with 430. Perhaps the most notable progress was in Belgium, already with the densest network, which added 3 per cent. to its mileage by building 135 miles, and in Spain, which opened 184 miles, which is more than in any previous recent year. European Russia is credited with but 165 miles in the year, which is the least for many years, and in the country which needs railroads most.

Progress in Asia keeps up, the 2,621 miles in 1905 being more than in any recent year, but not much more. None is credited to Russia, but in British India 1,052 were built and in China 1,019 miles. The latter is an increase of 83 per cent. in the Chinese mileage, and is significant. Japan is credited with but 270 miles, but Korea, which had but 37 miles in 1903, had 662 in 1905, and that is the work of the Japanese.

Only 480 miles were opened in Africa in 1905, but a great many different lines are under way on that continent.

In Australia, 632 miles were opened in 1905. The prolonged drought had prevented growth there. It (including New Zealand) had built but 1,793 miles from 1901 to 1905. It, however, had but about 6,000,000 inhabitants, and the addition was at the rate of 1 mile to 3,350 inhabitants, while in the same four years the 21,224 miles in the United States added but 1 mile to 3,707 inhabitants.

The *Archiv's* statistics of capital invested include all the European railroads except 915 miles, and show for them an average of $114,424 per mile. For the rest of the world the figures cover 83 per cent. of the mileage, the average investment in which has been $57,833 per mile. As in previous years, the capital invested in the railroads of this country is exaggerated by including the $2,638,000,000 which our railroad companies have invested in other companies' stocks and bonds with what they have invested in railroads. In this way, for instance, the $120,000,000 which the Union Pacific has paid for the securities of other companies is added to the face of the securities which it has bought with that sum, while those securities are still counted as representing the investment of the companies which issued them. Allowing for this, the capital per mile of United States railroads was $53,355, instead of the $65,475 reported.

The lowest capital per mile in Europe was $33,214, in Finland, a narrow-gage system owned by the state. The British railroads, of course, have cost most—$264,185 per mile. The investment in their 22,433 miles is considerably greater than in all the railroads (90,300 miles) in Asia, Africa, Australia and America, excepting that in the United States. Next comes Belgium, with $164,698 per mile; France, $121,361; Austria, $107,704; Switzerland, $103,796; Germany, $101,488; Italy, $100,151; Russia (in 1903), $79,419.

Outside of Europe, the low cost of the railroads of British India may be noted, $30,905 per mile. The Japanese railroads cost a little more.

The aggregate investment in all the railroads in the world in 1905, as nearly as can be ascertained, was $40,744,000,000, which is a mighty sum, indeed, yet amounts to but about $27 per inhabitant. But the railroad capital per inhabitant is $52 in Europe, and no less than $135 in the United States. This, be it understood, does not include street railways, trolley lines and their like. The increase in the world's railroad investment during the last year reported was just about $1,000,000,000. As Africa and Asia have only fairly begun to build railroads, and as in Asia especially there is actual need for scores of thousands miles more, while the improvement of old railroads in new countries is also a pressing necessity, it is easy to see that the world will find use for its savings for some time to come, and if peace is maintained rapid progress may be expected.

THE WORKING OF THE RATE LAW

The Rate Law, as the amended Interstate Commerce Commission act is generally called, went in effect August 28, 1906. It gave to the Interstate Commerce Commission larger powers in a wider field. In fact, the most important argument against its passage was that the commission was given altogether too much power. Exactly 10 months have now passed since its enactment. This is a long enough time to form an opinion as to the general results which so far have been obtained.

By far the most spectacular proceeding under the new law has been the so-called Harriman inquiry by which a large number of facts, previously matters of record but not generally known or realized by the public at large, were brought out, as well as certain important facts about purchases of the stocks of other railroads by the Union Pacific, which had not before been made public. The final results of this inquiry will not be known until the commission formulates its recommendations based upon it.

What is of more importance to railroads and shippers is the effect of the new powers of the commission on rates and service; that is the action of the commission on complaints brought under the new law. A considerable number of such complaints have been decided since the law went in effect. Perhaps the most striking group of these are cases in which it proved not to be necessary for the commission to pass judgment, because the transportation companies complained of, after the filing but previous to the decision of the complaints, made reductions in rates or improvements in service which were satisfactory to the complainants without further action. The recently settled case of the National Petroleum Association against the Pennsylvania Railroad and a large number of other carriers is a good example. Complaint was made last October that petroleum rates from Ohio and Pennsylvania points were unreasonable and discriminatory and that a charge of $105 for the return empty movement of tank cars from Pacific Coast terminals to Missouri River points was also unreasonable. Rates from Ohio and Pennsylvania to the Pacific Coast were made up of the local rates to Chicago plus the through rate from Chicago to the Coast. As a result the rates on carload lots of oil in tank cars and barrels from points in Toledo, Cleveland and Pittsburg territory were from 90 to 98 cents a hundred pounds, while the Standard Oil refineries at Whiting, Ind., secured the through rate of 78½ cents from Chicago common points to the Coast. The defendant railroad companies filed their several answers denying these allegations and the case was assigned for hearing on May 21, 1907. Before the date, however, the defendants published tariffs naming a through rate of 90 cents a hundred pounds on petroleum to Pacific Coast points, to apply uniformly to Chicago and the Ohio and Pennsylvania points mentioned, and abolishing the charge of $105 for return of empty tank cars. The complaint, therefore, on May 13, was dismissed without prejudice. Without attempting to go into the merits of this controversy, it is reasonable to suppose that if the commission had not possessed the rate making power these changes would in all probability not have been made by the railroads. A number of other cases have been dismissed without decision by the commission for a similar reason.

Two other cases recently decided show that the commission is willing to see the railroad's side of an argument. In one, complainants sought to have station facilities restored at a point in Indian Territory on a line of the St. Louis & San Francisco, from which the railroad station had been moved to a point 3½ miles distant. Although the new location apparently has few more people than the old, it is a junction point and the expense of conducting the station there is shared with another road. The commission decided that besides the economy in that arrangement, removal of the station had not interfered with the interests of the farming population that for-

merly was served at the old station, and therefore held that, without deciding the question of its own power to take action in a complaint involving station facilities, the complainants were not entitled to an order requiring the St. Louis & San Francisco to re-establish a station at the old location. The other case was that of the Board of Trade of Kansas City against four of the most important railroads reaching that city. Complaint was made that the charge of $2.00 a car for reconsignment of grain shipped to and from Kansas City was unreasonable and unjust as compared with similar practices at St. Louis, Minneapolis and Chicago. It was brought out before the commission that all cars of grain brought into Kansas City are held by the railroads on special tracks with 48 hours free time before demurrage charges begin to run; that this involves additional service, labor and expense to the railroads, particularly because it prevents the use of cars for other shipments; that it is a valuable privilege to grain dealers at Kansas City; that the charge is not made by the railroad when grain is reconsigned over its own line, and that when grain is milled or used in Kansas City this fact is used by shippers to claim absorption of the reconsignment charge on some other car that does go forward from Kansas City. For these and other reasons the commission held that the reconsignment privilege appears to be wholly in the interest of the grain dealers and of Kansas City as a market and that it is not excessive, unjust or discriminatory. This decision was given by the commission under the complete authority which it now has over terminal and special charges.

Perhaps the most important rate case recently decided by the commission is that in regard to rates on cotton and cotton products from points in the South to the Pacific Coast. Here the old controversy by which the South hopes to get as low rates to the Coast as New England, is passed upon. The importance of the decision lies in the fact that it specifically involves discrimination between localities. Southern points are nearer in distance to the Coast than New England points, but pay a lower rate, yet the commission sustains this state of affairs in the following conclusion:

"The fact that such rates from the southeastern states are higher than those obtaining from the New England states does not in and of itself establish the unreasonableness of the higher rates, as the conditions existing at the two localities are dissimilar. The New England mills, which suffer by the competition of the more favorably situated southern mills from the standpoint of production, are entitled to such advantage in rates as they have from being situated at points closer to ports where cheap water competition has been established to the Pacific coast points of consumption."

It is apparent from this decision that it is not the policy of the commission to interfere with the existing general arrangement of rates between different sections of the whole country.

These instances—and they could be supplemented by many others—do not seem to justify the fears of those who argued against giving the commission rate-making power. That body has not undertaken any wild campaign of rate reduction. Instead there seems to be a real and helpful co-operation between the railroads and the commission. In this connection the following remarks of Commissioner Prouty, recently quoted in the *Railroad Gazette*, are of interest:

"Scores of questions have been raised under the new law on which the railroads might have demanded a decision by the courts before obeying the orders of the commission, or accepting its construction of the law, but in every instance they have promptly and cheerfully co-operated with the commission. On the other hand, the commission has tried to avoid imposing unnecessary hardships on the railroads in meeting the new conditions. It is demonstrated beyond doubt that the railroads are in hearty sympathy with the Interstate Commerce law, and that rebates and kindred evils are practically abolished. The great majority of railroad officials are honest and fair-minded, but they have been living under a cloud raised by unscrupulous and dishonest men. To-day every railroad official can follow his inclination to treat all shippers alike, without fear that some official of a competing road will secretly pay rebates in one form or another. The law is designed to protect the railroads as well as their patrons."

This concluding sentence sums up the spirit of the Rate Law.

CONTRIBUTIONS

Page Bascule Bridge.

Chicago, Ill., June 17, 1907.

To the Editor of the Railroad Gazette:

We note in the *Railroad Gazette* of June 14, 1907, pages 836 to 840, an article by Mr. A. R. Ekstrom, Assistant Engineer of the Chicago & Alton, regarding the Page design of bascule bridge over the Chicago river, recently completed for joint use of the Alton, the Santa Fe and the Illinois Central. This is the first railroad Page bridge yet built. Mr. Ekstrom states that the Page design was chosen because of its being the most economical in cost of construction, and gives $165,000 as its cost. The bid on a Scherzer rolling lift bridge for this location was $153,364. This figure also included the furnishing of the plans and consulting engineering services of The Scherzer Rolling Lift Bridge Company. Mr. Ekstrom's figures on the Page bridge, it would seem, do not include the amounts paid for the plans of the Page design and for consulting engineering services. Mr. Ekstrom says that this Page bridge is moved by two 125-h.p. motors, and that approximately 70 h.p. is required to raise or lower the bridge in 90 seconds. The design for the Scherzer rolling lift bridge for this crossing required only two 50-h.p. motors. The double-track Scherzer bridge built for the Newburgh & South Shore Railway at Cleveland, Ohio, in 1904, is 10 ft. longer than the Page bridge mentioned, yet it is usually operated within 45 seconds with less than 30 h.p.

We trust that you will kindly give our statement the same publicity accorded the article of Mr. Ekstrom.

THE SCHERZER ROLLING LIFT BRIDGE CO.,
BY JOHN T. DICKERSON,
Assistant Engineer.

Interstate Commerce Commission Classification of Operating Revenues.

The Interstate Commerce Commission has issued its classification of operating revenues (First Issue) at the same time ordering that, beginning July 1, 1907, it be used by all railroads under the jurisdiction of the Commission. It is also ordered that, save for accounts kept in order to give comparison with the results of the fiscal year 1907, no account, record or memorandum of operating revenues, except as prescribed by this classification, shall be kept.

The following is a quotation from the letter of Prof. Henry C. Adams, in charge of statistics and accounts, accompanying and explaining the classification:

As indicating the purpose of this classification, it will be observed that the primary accounts are so drawn as to show, first, the amount earned for the transportation of freight upon which should be based the computation of revenue per ton per mile and of revenue per freight-train miles; second, the amount earned for the transportation of passengers, from which may be computed the revenue per passenger per mile; third, the amount earned from all transportation on passenger trains, from which may be computed the revenue per train-mile; and, fourth, other revenue from transportation service, namely, switching revenue, special service train revenue, and miscellaneous transportation revenue. In addition to revenue from transportation, the revenue account includes eight additional primary accounts which cover revenue from services incident to transportation, the expenses incident to which are included in operating expenses.

The aggregate of the revenues covered by the 19 primary accounts listed in the classification gives the "total operating revenues" for the period under consideration, which amount being reduced by "operating expenses" leaves "net operating revenue." If from "net operating revenues" taxes be deducted, the remainder, called "operating income," will represent the amount with which the income account is properly begun. It should be especially noted that taxes are not included in operating expenses, and should not be included when computing the ratio of operating expenses to operating revenues. The only charges in the nature of taxes included in the operating accounts are assessments for highways, sidewalks, sewers, and the like, which should be carried to the appropriate accounts in operating expenses, betterments, or construction, as the case may require.

The classification of operating revenues is as follows:

GENERAL ACCOUNTS.

Account.
I. Revenue from Transportation.
II. Revenue from Operations other than Transportation.

PRIMARY ACCOUNTS.

I. Revenue from Transportation.
1. Freight Revenue.
2. Passenger Revenue.
3. Excess Baggage Revenue.
4. Parlor and Chair Car Revenue.
5. Mail Revenue.
6. Express Revenue.
7. Milk Revenue (on Passenger Trains).
8. Other Passenger-Train Revenue.
9. Switching Revenue.
10. Special Service Train Revenue.
11. Miscellaneous Transportation Revenue.

II. Revenue from Operations other than Transportation.
12. Station and Train Privileges.
13. Parcel-Room Receipts.
14. Storage—Freight.
15. Storage—Baggage.
16. Car Service.
17. Telegraph Service.
18. Rents of Buildings and other Property.
19. Miscellaneous.

The accounts are defined as follows:

I. REVENUE FROM TRANSPORTATION.

1. FREIGHT REVENUE.

This account includes amounts earned by a carrier for the transportation of freight.

To this account should be credited a carrier's proportion of receipts for freight transportation; also overcollections made in excess of proper

rates, such over collections to be held subject to claim. To this account should be charged overcharges paid resulting from the use of erroneous rates, weights, or classification; amounts paid for switching charges absorbed; authorized allowances and localized freight arbitraries; also amounts paid for switching or to transfer companies for completing a haul or effecting store-door deliveries, when the cost of such service is included in the rate charge by the carrier; uncollected earnings on freight destroyed in transit and on short and lost freight; also uncollectible undercharges determined after delivery has been made.

2. PASSENGER REVENUE.

This account includes amounts earned by a carrier for the transportation of passengers.

To this account should be credited a carrier's proportion of receipts from the sale of tickets (including tickets for corpses) and the collection of cash fares; also overcollection made in excess of determined rates, such overcollections to be held subject to claim. The account should be charged with amounts paid for fares refunded; tickets redeemed; also amounts paid for transferring passengers and baggage between stations or depots, except in cases where the transfer of both passengers and baggage is provided in the division of the through rate.

NOTE A.—Cash fare penalty collections made by conductors and the proportion of amounts collected on sale of mileage tickets and mileage credentials subject to refund should not be credited to Passenger Revenue.

NOTE B.—Passenger Revenue should be credited with interchangeable mileage tickets only as the mileage therefrom is honored for transportation. Receipts from interchangeable mileage books when sold should be credited to an open account, which account should be charged and Passenger Revenue credited as the mileage is honored.

NOTE C.—When a lessee company transports passengers over the tracks of another carrier on the basis of a proportion of revenue, it should include the entire compensation in its revenues and statistics, charging the appropriate joint facilities expense and rental accounts with the amount paid the lessor company, and the lessor company should credit the same accounts.

3. EXCESS BAGGAGE REVENUE.

This account includes amounts earned by a carrier for the transportation of baggage in excess of free authorized allowances; also packages, articles, dogs, etc., usually transported in baggage cars, for which a charge is made. To this account should be charged all baggage refunds.

4. PARLOR AND CHAIR CAR REVENUE.

This account includes amounts earned by a carrier in fares collected from passengers for seats in parlor, observation, chair, and other special passenger cars operated by railway companies when the expenses of operating such cars are not separable from the expenses of operating trains. To this account should be charged authorized refunds and tickets redeemed.

NOTE.—When the expenses of operating cars of the above classes are separable from the expenses of operating trains, the operation of such cars should be treated as an "Outside Operation."

5. MAIL REVENUE.

This account includes amounts earned by a carrier for the transportation of mails and for the use of railway post-office cars, special facilities, and bonuses for special mail transportation. To this account should be charged fines and penalties imposed by the Government when not collected from agents or employees.

6. EXPRESS REVENUE.

This account includes amounts earned by a carrier for transportation and for facilities on trains and at stations incident to the transportation of express matter, not including the separate rents of offices at stations. (See account No. 18, "Rents of Buildings and other Property.")

When a railway company transacts an express business through its regular railway organization, the earnings therefrom should be credited to this account.

7. MILK REVENUE (ON PASSENGER TRAINS).

This account includes amounts earned by a carrier for the transportation of milk and cream on passenger trains. To this account should be charged refunds and overcharges on milk and cream so carried.

8. OTHER PASSENGER-TRAIN REVENUE.

To this account should be credited all amounts earned by a carrier incident to the operation of passenger trains not otherwise provided for.

9. SWITCHING REVENUE.

This account includes amounts earned by a carrier for switching service performed on the basis of tariffs. To it should be charged all overcharges on such switching.

10. SPECIAL SERVICE TRAIN REVENUE.

This account includes amounts earned by a carrier for running chartered trains, either on a basis of a rate per mile, or a lump sum for the train; for handling circus or theatrical company trains under contract when specific amounts are charged for transportation between designated stations; for running chartered trains for the Federal or State governments carrying troops, munitions of war, camp outfits, etc. To this account should be charged refunds and overcollections on such business.

11. MISCELLANEOUS TRANSPORTATION REVENUE.

To this account should be credited all amounts earned by a carrier from transportation not otherwise provided for.

II. REVENUE FROM OPERATIONS OTHER THAN TRANSPORTATION.

12. STATION AND TRAIN PRIVILEGES.

This account includes a carrier's revenues from weighing, vending and other automatic machines located at stations; from advertising at stations and on trains; from news companies or others for the privilege of operating news stands at stations and selling papers, periodicals, fruit, etc., on trains; from telephone companies for the privilege of installing and operating commercial telephones at stations; and from other similar sources.

13. PARCEL-ROOM RECEIPTS.

This account includes a carrier's revenue from the operation of parcel rooms, the expenses of which are included in operating expenses.

14. STORAGE—FREIGHT.

This account includes a carrier's revenues for storage of freight. To it should be charged authorized refunds.

15. STORAGE—BAGGAGE.

This account includes a carrier's revenues for storage of baggage. To it should be charged authorized refunds.

16. CAR SERVICE.

This account includes amounts accruing as penalties for delay in loading or unloading cars (demurrage). To it should be charged authorized refunds.

17. TELEGRAPH SERVICE.

This account includes a carrier's revenues from commercial telegraph business transacted by it when the expense of transacting such business cannot be separated from the expense of conducting the railway telegraph service; amounts received from telegraph companies, whether proportion of earnings or otherwise, for the privilege of transacting a commercial telegraph business in offices along the carrier's lines, when the carrier furnishes some service of its employees whose wages are included in operating expenses.

NOTE.—When a telegraph company rents the telegraph line of a carrier and pays all expenses incident to its maintenance and operation, the rent received should be treated as income.

18. RENTS OF BUILDINGS AND OTHER PROPERTY.

This account includes a carrier's revenues from rents of buildings, land, and other property, such as depot and station grounds and buildings, union depots, general and other offices, rooms rented at stations, docks, wharves, ferry landings, elevators, stock yards, fuel yards, repair shops, section and other houses, etc., when such property is used in connection with operations and the expense of maintaining and operating it cannot be separated from the expense of that portion used by the carrier.

19. MISCELLANEOUS.

This account includes a carrier's revenues from operation not otherwise provided for; also collections from individuals and companies for the privilege of handling freight and passengers over a carrier's wharves and docks; amounts received from others for mooring and anchoring boats at such wharves and docks, and for water furnished them when the water plant is operated by the carrier; receipts from coal and ore docks, stock yards, and grain elevators when not treated as "Outside operations;" amounts received as trackage for detouring trains; collections for the use of a carrier's bridge by pedestrians, street-car lines, vehicles, etc., when the expense of maintaining and operating such property cannot be separated from the expense of that portion used by the carrier.

NOTE.—When a bridge of one carrier is used by another carrier and such use is paid for either on the basis of a flat rent or a charge per train mile, or a toll per passenger, per ton, or per car, the revenue therefrom should be credited to appropriate accounts.

Car Accountants' Report.*

RAILROAD SERVICE MAIL.

The committee on this subject is not prepared to recommend a limit of size or shape but offers for consideration a resolution to limit to 10 lbs. the weight of parcels destined to connecting lines. For valuable packages, between points within the system, the committee recommends a label of distinctive color with instructions that such packages must be receipted for. The committee recommends that the supervision of railroad service mail be put in charge of a single designated officer, preferably the general baggage agent.

OFFICE METHODS.

The committee on this subject recommends that claims for unreported per diem be not made within three months, thus giving the debtor time to recheck his records. Where errors are found the unreported per diem should be included in the next monthly report as a separate item. The committee recommends that the responsibility for per diem charges of railroad companies' cars on non-per diem roads be fixed on the road making the delivery. Such roads should promptly report all such service without waiting for a demand from the owner. The committee recommends that interchange reports be made in quadruplicate by the delivering road. All copies should be certified by the receiving road, after being checked, the original and one copy then being returned to the delivering road. The committee recommends that when a home-route car is ordered under M. B. C. rules the order should be promptly acknowledged, and if not acknowledged within 10 days then to be repeated, with a reference to the date of the first order. The committee offers a proposed standard junction report for private cars. As to a proposed uniform agents' car report, embracing information required by demurrage managers, the committee thinks no action should be taken. Neither does it recommend a uniform method of handling per diem discrepancy claims.

To reduce the work of correcting errors the committee recommends that in recording cars memoranda of errors in reports shall be made on suitable tags, of distinctive color, and memoranda of omissions from reports be also made on distinctive tags. By sorting these two sets of tags and putting them in numerical order,

*Abstract of reports made by committees to the annual meeting of the Association of Transportation and Car Accounting Officers, at St. Paul, June 25 and 26.

the shorts can be matched up against the overs and a large share of the errors located.

PER DIEM.

The committee on this subject recommends that switching reclaims under rule 5 be incorporated, each as a separate item, in the regular switching bill.

CONDUCTING TRANSPORTATION.

The committee on this subject proposes that records of locomotive power be kept on the basis of a unit of 25,000 lbs. tractive power per hour, so that, for example, a locomotive of 25,000 lbs. tractive power, available for one whole day, would represent 600,000 units. Engines should be recorded under four heads: A, in the mechanical department; B, in the operating department in actual road service; C, operating department, all other service; D, reserve.

Respecting the building of freight trains according to destination of cars, the committee advises that in many instances it is desirable to hold freight 24 hours if necessary so as to follow the rule of strict station grouping.

The committee submits under 15 heads the essential instructions for a traveling car agent. The roads which have employed men in this work have found the service decidedly beneficial. We quote some of these instructions. The traveling man should see that interchange reports are kept as carefully as any report involving money; should see that agents and their men have the right ideas as to gathering data. He should make a thorough check of the cars in the yard and then compare his notes with the agent's on-hand report. The agent should keep a correct and permanent record of all facts connected with demurrage and cars liable to demurrage. Cars arriving during the night should, if possible, be placed before 7 a.m. in order to reduce the delay under the demurrage rules. The inspector should impress on the agent the absolute necessity of impartiality in furnishing cars to shippers. The inspector should ride over every division on the way-freight and converse with the conductors. He should inform agents in a general way of the nature of his report; that is to say, the agent should know how his record is going to appear at headquarters. The inspector should send his report, or parts of it, by telegraph, when necessary.

May Railroad Law.

The following abstracts cover important cases applying to railroads decided by the Federal courts in May. These include the important North Carolina Railroad Commission case, in which the Commission was sustained by the Federal Court:

Consolidation under Indiana Statute.—The Indiana Statute which provides that "any railroad company shall have the power to intersect, join and unite its railroad with any other railroad" and forbidding the companies to merge and consolidate their stock under certain conditions does not limit the right of consolidation to two companies, nor is it essential when more than two companies consolidate that the line of each shall intersect the line of the other. The stockholders of railroad companies hold their stock subject to the right of a majority of the stockholders to effect such a consolidation. Bonner v. Terre Haute & Indianapolis, 151 Fed. Rep. 985.

Assumption of risk.—Under the provision of the Federal Employers' Liability Act of 1906 that no contract of employment shall constitute any bar or defense to any action brought to recover damages for personal injuries to or death of such employee, the defense of assumption of risk—which is based on an implied contract—is abrogated, though the danger was obvious, according to a decision of Judge Hanford. Mallory v. Northern Pacific, 151 Fed. Rep. 1018.

Interstate Commerce defined.—Judge Speer in a recent charge to a grand jury defined the term "Interstate Commerce." He says: "Interstate commerce comprehends intercourse for the purposes of trade in any and all of its forms, including transportation, purchase, sale and exchange of commodities between the citizens of different states, and if any commercial transaction reaches an entirety in two or more states, and if the parties dealing with reference to that transaction deal from different states, then the whole transaction is a part of interstate commerce of the United States and subject to regulation by Congress under the Constitution." In re charge to Grand Jury, 151 Fed. Rep. 834.

Removal of causes.—The Death by Wrongful Act statute of Missouri imposing an absolute liability for injuries resulting in death does not give the representatives of one killed in a railroad accident a right of action against the employee responsible for the accident so that by joining such employee with the railroad company a removal of the case from the state to the Federal Court can be prevented. Chicago, etc., R. Co. v. Stepp, 151 Fed. Rep. 908.

Dressing rooms in sleeping cars.—Applying the rule that while a carrier is required to use the utmost diligence and care in providing reasonably safe cars, it is not an insurer of the absolute safety of its passengers, but has discharged its duty in respect to its cars when it has supplied the best instrumentalities that a highly prudent person would have supplied in the same business in the then known condition of the business, the Circuit Court of Kentucky has held that the failure of a railroad company to equip the ladies dressing room of a sleeping car with seats and handholds did not constitute negligence *per se*. Ozanne v. Illinois Central, 151 Fed. Rep. 900.

New Jersey statute of limitation.—The New Jersey statute providing that all actions for personal injuries against railroad companies must be brought within two years did not impliedly repeal a special provision in the charter of the Lehigh Valley Railroad as a successor of the Amboy Railroad which limited the same for bringing actions against it for personal injuries to one year. Lehigh Valley v. Comer, 151 Fed. Rep. 559.

Employer's Liability Act.—The Circuit of the Eastern District of Arkansas sustains the validity of the Federal Employers' Liability Act. Judge Trieber holds that the act is not void on the theory that it applies equally to intrastate and interstate commerce, but that its provisions are separable and it is valid where invoked by an employee engaged on a train actually employed in interstate traffic. Spain v. St. Louis & San Francisco, 522.

Another decision sustaining the constitutionality of the Federal Employer's Liability Act.—Judge Speer in the Circuit Court of the Southern District of Georgia proceeding on the theory that every judicial doubt should be resolved in favor of a statute and that a court should not adjudge a statute invalid unless in its judgment the violation of the constitution is clear, complete and unmistakable, has sustained the recent Federal Employers' Liability Act. The Federal courts are now hopelessly divided on this question and a decision of the Supreme Court alone can settle the vexed question. Snead v. Central of Georgia, 151 Fed. Rep. 612.

Lien of bank on deposits after receivership.—The bank in which the funds of a railroad company—the Pere Marquette—were deposited subject to check and which held the demand notes of the railroad company had no lien on funds received after the appointment of a receiver giving it the right to apply the funds on the notes. Under this view the deposits became the property of the receiver on his appointment. Horn v. Pere Marquette, 151 Fed. Rep. 626.

Rules for governing movement of trains.—A railroad company may be held liable for injuries to an employee injured on its premises because of the failure of the company to prescribe proper rules and regulations for the movements of its trains. Union Railway Co. v. Tate, 151 Fed. Rep. 550.

Service of process on foreign corporations.—The mere fact that a foreign corporation owns a majority of the stock of a domestic corporation, does not justify the service of process upon such foreign corporation on the theory that it is doing business in the state through the agency of a domestic corporation, if the domestic corporation retains its own officers, has property of its own and is responsible for its contracts and to persons with whom it deals.—Peterson v. Chicago, Rock Island & Pacific, 27 Sup. Ct. 513.

Doctrine of "Discovered Peril."—The Circuit Court of Appeals of the Fifth Circuit accepts the doctrine of "Discovered Peril" which makes a railroad company liable for an injury caused by its train to a person on its tracks, whether at a public crossing or other place, notwithstanding the contributory negligence of such person if the train operatives should, in the exercise of reasonable care, have discovered his peril in time to avoid injuring him, although they did not in fact make such discovery in time. Texas & Pacific v. Modawell, 151 Fed. Rep. 421.

Discrimination in demurrage charges.—A demurrage charge of $1 a day for the time cars are left standing on the tracks after the time given for unloading is not discriminative because at another station facilities are furnished for storing unloaded cars and the rate charged is less than the demurrage charge, if it is a fact that the demurrage charge for loaded cars is the same at both places, though there are no such facilities at the station where the complaint originated. Michie v. New York, New Haven & Hartford, 151 Fed. Rep. 694.

Power of state commission to compel railroad companies to make connections.—The Supreme Court holds that the power of the state to regulate railroads extends to securing to the public reasonable facilities for making connections between different carriers. Applying this principle it declares that an order of the North Carolina Railroad Commission requiring the Atlantic Coast Line to restore the connections at Selma with a train of the Southern Railway, which afforded the principal means of travel between the eastern and western parts of the state, is not so arbitrary and unreasonable as to amount to a denial of due process of law, or to a deprivation of the equal protection of the law guaranteed by the constitution, if other connections are inadequate for the public convenience, although it would involve the operation of an extra train at a loss, so long as the income of the railroad company from its business in the state affords adequate remuneration after allowing for the loss from operating the extra train. The question whether orders of a railroad commission in such a case are unreasonable or beyond the scope of the powers of the commission is regarded as a local and not a Federal question. Atlantic Coast Line v. North Carolina Corporation Commission 27 Sup. Ct. Rep. 585.

Service of process on foreign railroad company. A railroad company incorporated in one state is not regarded as doing business in another state, in the sense that process can be served on it in such state, merely by reason of soliciting business for its road through an agent therein. Green v. Chicago, Burlington & Quincy, 27 Sup. Ct. Rep. 595.

Seniority vs. Efficiency.*

Many railroads are hampered in placing preferred men, by seniority clauses in agreements existing between the operators and the company; but these seniority rules, as I have seen them, may be applied without forcing incompetent men into positions of importance. If the superintendent of telegraph creates these positions and arranges the salaries, seniority should be required to fully qualify, before a single position is filled.

Every telegraph office that is kept open under strained conditions, by reason of short or incompetent force, is a hazardous and expensive venture for the company; for as long as the wires are cut in at a station, despatchers will depend upon making some use of the office, regardless of the efficiency of the operator employed. Every operator employed must be relied upon for competency and safe judgment.

Possibly "scarcity of operators" is caused by an effort to maintain too many offices, with a blanket allowance for telegraph service. If the necessity of the number of offices maintained were as constantly and carefully examined into, one by one, as the salary of each operator is checked monthly by the auditor's office, would not many offices be closed? And if, when these practically useless offices were closed, an amount of the money saved could be used in making salaries at other offices more attractive, would the shortage of operators decrease, and would the reliability of the service improve? The insufficiency of reliable and expert operators is one of the telegraph problems of to-day.

The Master Car Builders' Convention.

The forty-first annual convention of the Master Car Builders' Association was held on the Steel Pier, Atlantic City, N. J., June 17, 18 and 19. The opening session was called to order at 10 o'clock by the President, W. E. Fowler (C. P. R.). Mayor Stoy, of Atlantic City, delivered the address of welcome, F. W. Brazier (N. Y. C.) responding on behalf of the association. President Fowler then delivered his address, which was in part as follows:

PRESIDENT'S ADDRESS.

* * * This association need fear no criticism on its work of the past; its history is stamped indelibly on the traffic of this country, for its rules for interchange of cars and its standards of construction have made it possible to load a railroad car in far-off Edmonton, in the Canadian northwest, and to deliver it, with its load undisturbed and unbroken, at Mobile, New Orleans, or the City of Mexico. This continent is in full possession of these benefits, and it is hardly possible to realize to what extent progress and civilization would have been retarded if these benefits had been absent. But, our work is not done. Never before in the history of railroading has there been so much attention given by the Government, by the public, and by the thinkers of this continent to the railroads and their operation. The railroads have become a vital part of national progress, and the most rapid, the most safe, the most convenient and the most economical is the kind of service that is required, and our part in the development of such service is so plain, so unmistakable, that we must more than ever give our best thoughts, our most earnest consideration to the problems thus set before us.

It is a matter of congratulation that the relations of this association and the Interstate Commerce Commission have always been of the most cordial character.

Your committees have under consideration, this year, matters extremely important, made so very largely by the larger carrying capacity of the freight car and the increased power of the locomotive, intensified by the immense growth of the business of the country, and these have made demands upon the railroads which have at times been impossible to satisfy. The report of the Arbitration Committee is indicative of these changed conditions, and embodies a number of suggested changes to the rules of interchange, which, coming from so conservative a body, indicates that operating conditions are changing very rapidly.

Here followed a brief résumé of the different reports, in the course of which Mr. Fowler said: As stated in the report of the Committee on "Cast Iron Wheels," the wheel-makers make an earnest request that the wheel recommended in this report as standard be generally accepted and adopted by the railroad represented in this convention, and your president is pleased to heartily recommend that this be done. It was stated by the wheel-makers, in the joint committee meeting, that one of the most serious difficulties they had to contend with was the great variety in design of wheels they were asked to make, entailing the expenditure of a large amount of money in making so many patterns, and making it impossible for them to carry a stock of standard wheels, which, if carried by them, would enable them to fill orders promptly and satisfactorily. As the general use of a standard wheel would result in great economy, I think this would appeal to you. * * *

The reports of the Committee on "Stresses to Which Wheels for 100,000-Pound Capacity Cars Are Subjected," on "Brakeshoe Tests," on "M. C. B. Couplers" and on "Airbrake Hose" indicate the necessity for a somewhat radical departure in the policy of this association. The problems which confront us as master car builders are becoming daily more complicated. In early days car construction was crude, and the relation of various parts of cars to each other were such as could be readily understood by men without scientific education. The means of improvement, made use of from time to time, were then not necessarily complex, but it appears quite evident that the future will not yield great improvements except as they may be reached by painstaking, laborious and continuous study and investigation.

While, therefore, this association may well look with pride upon its work of the past in the development of better designs, in the arranging of standards, in the unification of practice, and in making possible the rapid interchange of cars, we must not forget that the problems of the future will necessarily be more complicated, will require greater care in investigation, and increasing assistance from science. The work performed by the committees of this association has been productive of splendid results, and this association will necessarily for a long time to come, depend upon its individual members to serve upon such committees as faithfully as many have done in the past. There are, however, some committees, the work of which has fallen very largely, and, in some cases, entirely upon its chairman, and your president deprecates this, believing that in a great many cases the members could, by the exercise of a little self-denial, have attended one or more meetings of the committee to which they belong, and have thus added very much to the value of the report made by the committee.

Some of the railroads of this continent have, in times past, generously contributed not only the time of officials, but, in many cases, materials and equipment toward the advancement of committee research, and I believe that there will always be a spirit of this kind manifested by progressive railroads. But, the problems confronting the Master Car Builders' Association, which were in the past solved by the exercise of good judgment, by careful observation, or by averaging the experience of all interested parties, must in the future, in my opinion, be supplemented by the precise methods of science and materials which were unknown to our fathers, but which promise valuable assistance, must, in many cases, have their physical properties and chemical composition made known before they can be used in practical railroading.

Considerations such as these suggest to me the desirability of the organization by the Master Car Builders' Association, of an expert staff, which would be qualified by education and training to handle problems either mechanical, chemical or physical. Such an organization should have its home in a laboratory befitting the dignity of the great interests represented by this association, such as would be possible at Purdue University, or a similar institution. Not only would the members of such a staff be able to give their undivided attention to the problems of this association, but the sustained character of their efforts would make their work cumulative. Bringing to bear upon the problems with which they were confronted minds trained for scientific research and habituated to the study of railroad problems, the work of such investigators should be invaluable. Operated under the direction of the executive committee of the Master Car Builders' Association, and sustained by all the railroads of the country, such a laboratory and staff, actually in co-operation with the working committees of this association, would return many times its cost to the railroads of the country.

I am aware that this organization cannot be arranged for in a day, it must have a small and inconspicuous beginning; but, as that has been the history of the association I do not think that should deter us from entering, at any early date, upon a plan which will permit an early organization of a small staff of this kind, upon a permanent basis, and I would recommend that this convention request its executive committee to consider and act upon this idea if it deems it advisable.

It is hoped that the members will realize that the topical discussions, which take place at the noon hour, are quite often forerunners of more elaborate discussions at subsequent conventions, and some of the topics which will be discussed are, in my opinion, intimately connected with some of the important problems now confronting the railroads of the country, and I hope that the interest in these noon-hour discussions will not flag.

Your president is pleased to note, in the report of the committee on subjects for discussion at the convention of 1908, that the comprehensive problems of better and more economical service of freight cars seem to have been uppermost in the minds of the committee.

*Extract from a paper by J. C. Browne, Missouri Pacific, read before the Railway Telegraph Superintendents at Atlantic City.

Your president is of the opinion that the most important factor in this problem is the question of economical maintenance. Too little consideration has been given this matter in the past, freight car repair yards have been located in inconvenient, out-of-the-way places, repair tracks have been set too close together for convenience, the equipment for repairs, both animate and inanimate, has not been of the best, and the consequence has been that cars which should have been returned to service promptly, and with repairs properly made, have been held out of service longer than necessary and were not properly repaired. Never before has there been such pressing necessity for intelligent work, for proper tool equipment and for shelter for the men employed than at the present time.

Railroads all over this continent have, during the past year, been confronted with a demand for cars which it has been impossible to satisfy, and it would have been still impossible if all of the cars held out of service on account of being in bad order had been repaired promptly and put into service. The held out cars would, however, have helped very materially, and would have stopped criticisms made by persons without any real understanding of the situation. It is a reflection on good judgment when vehicles are held out of service for which there is a paying demand at the time, and it would appear that with the attention now concentrated upon the railroads that your best efforts are not desirable, but are absolutely necessary for a betterment of the conditions I have referred to.

The other subjects recommended by the committee for reports and topical discussions are all important, more particularly those relating to freight car pooling and the effect of hump yards on freight car damage.

Some problems in steel car construction are also recommended by your committee for investigation during the coming year, both with regard to freight car and passenger car design, and as there is no greater foe to the steel car than rust the subject of protective coatings must necessarily be of great interest, as it would appear that a coating which would be both elastic and tenacious would add very much to the value of our steel cars to-day.

The ventilation and heating of passenger cars being a matter under consideration by state and national governments, should also receive the consideration it deserves, and I hope that the committee appointed will arrange to furnish the convention next year some valuable data on this subject.

Although your former presidents have called your attention to the same fact, I must again call your attention to the increasing varieties of M. C. B. couplers, which entails the tying up of an enormous sum in repair parts carried in stock by railroad companies, and I believe that same restriction should be placed upon the introduction of new and untried couplers and a limit be placed on the number of couplers for which railroad companies must carry their parts, the listed couplers to be specified by name, railroads being permitted in case of failure to scrap couplers not on the list, or to return them to the owners at the owner's expense. This plan may not meet with the approval of some members of this association, but if this recommendation results in a restriction of some kind being placed on the flood of couplers, a much needed relief will be secured.

The reports of the proceedings of the recent convention of the Airbrake Association, at Columbus, Ohio, are now in circulation, and I would strongly recommend their perusal to the members of this association. I may say, however, in passing, that the essence of their conclusions appears to me to be better maintenance, and I am strongly of the opinion that we must have better maintenance of airbrakes if we are to meet demands for increasing rapidity in operation of our freight trains.

Your executive committee of this year in making up committees adopted a rule which I would much commend—namely, that of appointing no member on more than one committee, endeavoring also to so arrange committees that all members could be assembled with the least loss of time, and I would suggest that this precedent be followed as closely as possible.

To other associations, such as the Master Painters' and Master Blacksmiths' associations, we, as master car builders, are much indebted; the associations in their conventions, by discussing their specialties, relieve this association of much detail work and add very much to the general efficiency of the mechanical department of our railroads.

And the railway clubs—who can estimate the benefits received by this association and by the railways of this country from the work of the railway clubs? Their periodical meetings, which are preparatory and supplementary to these conventions, permit more detail discussion of many subjects than is practicable on the floor of this convention, and the continued growth of these clubs is a strong evidence of the value placed upon club membership by our practical men and they deserve our heartiest support.

The Secretary reported a total membership of 614, divided as follows: Active 377, increase for the year 21; representative 249, increase 6; associate 14, increase 1; life members 15. The number of cars represented in the association is 2,254,397, an increase of 207,070. Thirty-three railroads and private car lines have signified their desire to become subscribers to the Rules of Interchange. The expenses for the year were $13,072 and the balance in the treasury $6,641. The annual dues for the ensuing year were fixed at $4 by the Executive Committee.

E. A. Moseley, Secretary of the Interstate Commerce Commission, addressed the convention. His address was printed last week.

John T. Chamberlain was elected a life member of the association.

DISCUSSION OF COMMITTEE REPORTS.

Revision of Standards and Recommended Practice.—C. A. Seley (C., R. I. & P.) read the report by paragraphs.

The recommendations covering revision of standard journal box 5 in. x 9 in. were referred to letter ballot for adoption. Mr. Seley pointed out that while the proposed change making a lip on the inside of the box was not objectionable, the committee did not think it necessary or an improvement over present practice and hence did not recommend its adoption with the other modifications as standard.

The recommendations covering revision of standard journal box 5½ in. x 10 in. were referred to letter ballot for adoption as standard without discussion.

The proposed changes in standard axles were referred to letter ballot, Mr. Seley explaining that the changes in the size of the fillets to ¾ in. was largely a matter of improving shop practice.

The form of wheel tread and flange was laid over pending the report of the committee on "Cast-Iron Wheels."

All that part of the report relating to brake-beams and other parts was accepted and referred to letter ballot for the adoption of the recommended changes in the drawings and text.

G. W. Wildin (L. V.): I object to cutting out recommendation G in the committee's report. There is a standard width of truck, and you can also construct a truck beam that will go in this truck. There are many brake-beams made to-day that will not go into the M. C. B. truck.

Mr. Seley: The committee on arch bars this year recommends increasing the wheel base, which will have some bearing on this point. If they lengthen the wheel base it will take care of that.

Mr. Wildin: It will, unless the brake-beam manufacturers go to a still deeper beam after we get a longer truck.

Mr. Seley: This matter of brake-beams is not in as good shape as we would desire to have it. We have had available for years in brake-beams on a large number of cars standard rolled sections, which are available, yet the 7,500-lb. limit cuts out everything but an uneconomical section. I cannot see the necessity for the 15,000-lb. beam in freight service, and in my opinion we would be better off if those limits had never been set. We are doing good braking with brake-beams made of I-beams of 12¼-lb. section under cars of moderate weight, and we have thousands of such cars. If you adopt this 7,500-lb. section you are using a beam which does not correspond to the requirements, and I believe that it would be wise, that these limits should be reduced to 6,500 lbs. and 12,000 lbs. instead of 7,500 lbs. and 15,000 lbs., with the same limit of deflection as now specified. I do not wish to have it understood that I recommend to reduce the efficiency of braking. On heavy curves, and curves requiring a high braking power, we must put on a heavy beam, but for the vast majority of light weight and medium weight, cars already on our tracks, and which will be there for a number of years, we have no beam which will properly fit those cars and for which we can use an economical section.

The recommendations to and including paragraph 87 were referred to letter ballot without discussion.

Paragraph 103 relating to the position of brake shaft caused considerable discussion.

Mr. Seley: There are a large number of cars with brake staffs on the right side, and a number of cars with double brakes, one right and one left, and if the inspection of cars is going to be very close this recommendation for shafts to be located on the left side might work a hardship. The committee proposes to add one word in paragraph 98, making it read, "The brake shaft should be *preferably* placed on what is the left-hand corner of the car." The word "preferably" then indicates that the practice of the left-hand side as carried out in the remainder of the standards would be the preferable location.

Mr. Demorest (P. L. W.): The location of the brake staff on the right-hand side of the car permits the drawing in of the ladder nearer to the center line of the car. There have been a number of instances of trainmen being injured when going up the ladder rounding a curve where the end ladder was located as near the outside edge of the car as the sketches show, and in order to get a safer position the end ladder could be drawn nearer the center of the car by placing the brake staff on the right-hand side.

R. P. C. Sanderson (S. A. L.): The standard sheet has called for a brake shaft on the left side for some time, and the purpose of the association is to get uniformity. I do not want to see alternatives put in a sheet that is manifestly for the purpose of obtaining uniformity. It is not my purpose, however, in objecting to the change to require all cars fitted with brake staffs on the right-hand side to be altered.

C. A. Schroyer (C. & N.-W.): This is a guide for the construction of new equipment and not the alteration of old.

Mr. Seley: Mr. Schroyer's statement that this is applicable only to new equipment is not correct, as the standards for the protection of trainmen is the guide of the association and also for the inspectors of the Interstate Commerce Commission in the examination of cars all over the country, and while the location of the brake staff is not a point which comes under the law, at the same time we do not want to have this inspection tangled up by the practice on what might be new cars and what might be old cars.

The recommendation of the committee with the word "preferably" inserted was referred to letter ballot for adoption.

Paragraph 111 was amended by striking out the words "not less than" and inserting the word about making the sentence read, "The steps to be *about* 12 in. long * * * and the tread *about* 8 in. below the bottom of the sill." It was then referred to letter ballot.

Referring to paragraph 120 Mr. Seley said: Since the committee's report was printed, the construction of a large number of hopper cars has been brought to our attention, and particularly cars in which there are two posts in the center of the end of the car, which are very convenient for the application of the end ladder. It would be well to standardize on hopper cars an additional location of the end ladder, either at the side as noted for ordinary cars, or in the center, and the committee would make a recommendation therefore that an additional cut be added showing this optional arrangement on hopper cars for the location of the ladder, and that a paragraph be inserted in the text to cover the construction.

W. F. Bentley (B. & O.): Referring to paragraph 115, I do not agree with the committee in regard to the location of grab irons and handholds. On many refrigerator and other cars it is impossible to locate the handholds on the roof of the car about 15 in. from the edge of the car. If the distance was made from 2 in. to 18 in., you would cover that class of cars.

The suggestion that the location of the roof handhole be changed from about 15 in. from the edge of the car to not less than 2 in. nor more than 18 in. from the edge of the car was accepted and referred to letter ballot.

The suggestion that the word "coupler" be substituted in place of "drawbar" throughout the standards was carried.

All the recommendations of the committee down to paragraph 157, including the proposed new drawings, were accepted and referred to letter ballot for adoption.

At the suggestion of R. L. Klein (P. R. R.) the committee agreed to revise paragraph 158 making it optional to place a vertical side handhold on drop end gondola cars, and the paragraph as amended was adopted.

Referring to paragraph 182 Mr. Seley said: The question has been brought up since the report was printed, relating to tank cars which have a tank so large that a side railing is not applicable, and where handholds directly attached to the tank can be used. The committee was asked to provide for them. The present class of tank cars should be provided with horizontal grabirons or handholds about 24 in. long on the sides over the steps, but cars provided with safety railings on the sides do not require side grabirons or handholds. The first portion of the clause in paragraph 177 covers the situation, where it is desired to include handholds in connection with safety railings on tanks having large capacity. We would, however, recommend that an additional cut be made showing a tank car without side railings, but with the style of handhold which will be suitable for that construction. The present Fig. A-7 as shown should be revised in regard to the relative connection of the step and end of the handhold. The step is too far out, and the end of the hand-rail should be brought forward not to extend beyond the step. The recommendation of the committee was adopted and referred to letter ballot.

Subsequent recommendations to paragraph 217 were referred to letter ballot without discussion.

Under the head of "Collection of Salt Water Drippings" a letter from the Maintenance of Way Master Painters' Association was read asking that the Master Car Builders' Association endeavor to devise some plan whereby the salt brine from refrigerator cars can be retained in the cars to be discharged at designated points where no damage could be done bridges and other iron work. No action was taken on it.

In connection with paragraph 232 Mr. Seley read the following letter from W. F. Allen, Secretary, American Railway Association:

"Mr. Arthur Hale, Chairman of the American Railway Clearing House, has requested me to take up with the Master Car Builders' Association the question of marking cars with the standard initials, with the suggestion that the matter be referred to a committee with power to act.

"Mr. Hale also suggests that the initials and numbers should be painted in some uniform place on each car and not too high up.

"I will say in this connection that Mr. Hale has also taken up the subject of standard initials for marking freight cars, with the Association of Transportation and Car Accounting Officers."

The object of this suggestion is to facilitate car checking, particularly at night, the intention being to recommend a uniform location and height of the initials and numbers of cars, and with this understanding the suggestion was approved by the committee which offered the following additional paragraph to the section on stenciling cars and reading as follows:

"The initials and number of all cars having a superstructure, which will permit, shall be placed about midway between the door and corner post on the left-hand side of the side of the car and be arranged at a height 4 ft. 9 in. from the rail to under side of the bottom row. It is further recommended that the name of the railroad should also be placed on this end of the car over the initials and number and that the space at the right-hand end of the side of the car be reserved for the marking, showing capacity, dimensions, weight, etc." The matter was referred to the executive committee with power to appoint a special committee to give it proper consideration.

The meeting then adjourned.

SECOND DAY.

First Vice-President G. N. Dow (L. S. & M. S.) in the chair.

Arbitration Committee.—The committee at a meeting on the previous day reconsidered some of the recommendations made in the advance report distributed. These modifications, which were read by the Secretary, are as follows:

"(1). That the recommendation relating to the placing of advertisements on cars be reconsidered.

"(2). That rule No. 40 be changed to read: Damage of any kind to the body of the car due to unfair usage, derailment or accidents; also temporary advertisements tacked, glued, pasted or varnished on cars—delivering company responsible.

"(3). That the following prices be inserted in Rules 106: Removing temporary advertisements tacked on cars, per car, 50 cents. Removing temporary advertisements pasted, glued or varnished on cars, per car, one dollar."

Owing to the fact that the standard specifications for air-brake hose adopted by the association are now being subjected to a chemical analysis, and as the final determination of this analysis will not be reached until the next convention, the committee recommends that the date for final equipment of cars with M. C. B. standard hose be extended from March 1, 1908, until September 1, 1908, so that the rule will read:

"Cars equipped with air-brake hose other than M. C. B. standard hose on and after September 1, 1908, owners responsible, except cars offered in interchange, where delivering company is responsible."

In order that there may be uniformity of action in the matter of handling of cars not equipped with air-brakes just prior to the date when this rule becomes effective, the following resolution was adopted:

"That in order to comply with the requirement of the rules of interchange whereby cars in interchange will not be accepted without air-brakes after September 1, 1907, it is the opinion of the committee that loaded cars in interchange not equipped with air-brakes should not be accepted after July 20, 1907, unless homeward bound."

That the Secretary be instructed to at once issue a circular to the members calling attention to this resolution.

It was decided that the recommendation of the committee with regard to rule 37 be reconsidered, and in lieu thereof a paragraph be added as follows:

"On and after September 1, 1908, all cars not originally equipped with retaining valves, owners responsible."

It was suggested that the provisions of rule 98 regarding the correction of bills, and the use of a letter of authority for counter bill to cover acknowledged errors, conflicted with the requirement of the auditing department of certain roads and the rules of the Association of Accounting Officers. It is suggested that a committee be appointed to confer with the Association of Railroad Accounting Officers to prepare a suitable rule.

On motion the entire report with all changes and recommendations was accepted and adopted.

Triple Valve Tests.—The brief report of the committee was accepted as a report of progress without discussion.

Brake-Shoe Tests.—Following the presentation of the report by Prof. Goss, chairman of the committee, the privileges of the floor were extended to F. W. Sargent (Am. B. S. & F. Co.) to present a summarized report, covering the work of the brake-shoe committee during its life of more than 10 years, which he had prepared at the request of the committee and which was distributed as a supplement to the committee report. This supplementary report will be printed in a subsequent issue.

G. W. West (N. Y., O. & W.): I would call the attention of the association to a point raised by Mr. Sargent:

"The M. C. B. record of shoe tests, while most important and valuable, will remain incomplete until checked up by service tests. The brake-shoe testing machine records results under ideal conditions—a steady wheel moving true with a constant uniform braking load and perfect contact between shoe and wheel, with clear, dry surfaces in contact under practically uniform climatic conditions. In actual service we have the reverse, namely, an unsteady wheel pounding along over uneven track, more or less elasticity in brake-

beams and brake connections, and fluctuation in braking pressure, coupled with the varying contact between wheel and shoe with extremes of climatic conditions from cold to hot and wet to dry. The test wheel is uniform in its bearing against the shoe, and always moving in the same direction, the projections tend to bend away from the shoe and the surface of the wheel to polish up and to smooth over and afford a better contact than in the case of the wheel in service conditions. With the ordinary car wheel the unflanged brake-shoe covers that part of the wheel not in contact with the rail, as well as that part of the wheel which is in contact with the rail, so that there are two distinct surfaces under the shoe. The side motion of the brake-shoe is continually varying the amount of contact between the shoe and these two surfaces, while the inequalities of track condition and the pounding of the wheel cannot but fail to break the grip of the shoe on the wheel, all of which means that the actual coefficient of friction from the service tests is much less than that indicated in the shop test. To make the records complete, therefore, some connection should be made between machine and service tests, and to my mind this can be done without very much trouble and expense."

I think that is quite an important point, and should be taken into consideration. Such a test should be made. We have a train on our road that gives us ideal conditions, as far as load tests are concerned, and we shall be glad to conduct it on a milk train we have, which makes 200 stops in 250 or 300 miles.

Secretary Taylor: Inasmuch as Mr. Sargent has made some recommendations concerning the brake-shoe tests of the future, his recommendations should be referred to the Executive Committee in connection with the recommendation of Mr. West, so that in formulating a programme for next year the Executive Committee can make up the committee.

A motion to submit such a recommendation to the Executive Committee was carried.

Tests of M. C. B. Couplers.—In the absence of the chairman of the committee, R. L. Kleine (Penna.) presented the report.

F. W. Brazier (N. Y. C.): We averaged during the last 30 days, or up to the time that I came to the convention, 2,492 broken couplers on the New York Central. That shows that we are not paying attention enough to the recommended practices of this association. One of the most important matters relative to purchasing material is that the parts that are bought for the different couplers should be like the original parts. The tendency to buy repair parts from outside foundries on account of their being a little cheaper has made considerable trouble.

I recently saw a large number of repair parts bought for a certain make of coupler which, had they been applied to the couplers, would have made them inoperative; and the only way to maintain couplers is to know that the repair parts are purchased from reliable parties and are exact duplicates in size and quality of material of the original. We cannot be too particular to get nothing but the best of material for knuckles, and I am of the opinion that a drop forge knuckle, even if it costs more, would be a move in the right direction.

R. P. C. Sanderson (S. A. L.): I make a motion that the recommendations of this committee be submitted to the Committee on Standards to be taken into consideration with a view to making them definite recommendations in regard to the standards next year. In doing so, however, I would like to call attention to recommendation No. 1. I think the recommendation is too accurate. I do not believe a precise center line is absolutely necessary. I believe a little latitude, as long as the lift is approximately in the central position, will be all right.

Recommendation No. 10 I also question. It would be all right for the common slab form of follower, but if it were made mandatory it would shut out all draft gears which are arranged so that the follower is a part of something else and has a combined function to perform.

J. J. Hennessey (C., M. & St. P.): I question the judgment of having 2½ in. on any coupling device at any time between the horn of the coupler and the face plate. I was called out on the repair track the day before I left. I found two steel cars there with the center sills bulged out. In one case the rivets were pulled through the rear draw lugs. The cause of that was that the full movement of the coupler had been taken up before the horn of the coupler gave any relief to the buffing shock. If the horn of the coupler had struck the striking plate we might have broken the horn of the coupler, but it would not have been as expensive as having to remove the center sills and straighten them on those two cars.

Another thing. I am inclined to believe 2½ in. of side clearance is excessive. This gives relief to the end of the car, the draft timbers and center sills, but every pound that you relieve the draft timbers and center sills of you are putting on to the flanges of the wheels. The flange of the wheel is the weakest part of the car structure.

C. A. Schroyer (C. & N.-W.): The amount of backward and forward motion of drawbar considerably affects the trouble we are having to-day with broken links and clevises of our uncoupling apparatus. The bent uncoupling rod also is due largely to that.

We are having an infinite amount of trouble on our line because of the chains and clevises being broken by having freight cars coupled to passenger cars and having the buffer of the passenger cars strike the uncoupling rod and breaking these chains and clevises. It would be an excellent idea to have a committee to investigate these questions and to report to this association on the use of a standard uncoupling apparatus, whereby these difficulties could be avoided. The use of any uncoupling apparatus that will do away with the trouble we are having under those conditions would be an excellent thing for us to have.

W. McIntosh (C. R. R. of N. J.): The trouble that Mr. Hennessey anticipates that would result from liberal clearance on either side of the drawbar I do not think would be realized. We have been operating some cars for the past two years with a total clearance of 3 in. very satisfactorily. We have considered that this additional clearance has a rather favorable effect on the flanges of the wheels, instead of an unfavorable effect, for the reason that it relieves the flanges from rail pressure that would be brought against them, providing the clearance for couplers is limited.

T. H. Russum (B. & O.): The time will come, if it is not here now, when we must have more lateral movement for our couplers. When on a curve the trainman cannot uncouple a car from the fact that the coupler is gripped so tightly by the binding he is forced to move the train to uncouple. On our large journal axles the collars are wearing more rapidly than the journal reduces in diameter, and in a short time we will be scrapping axles, due to the wear of the collar on the journal. If there is more lateral movement in our couplers, that will be reduced; also, the wheel flange will be considerably helped by more lateral movement of the coupler.

R. L. Kleine: In regard to the additional side motion, the committee recommended "not less than 2½ in. This seems to be about the maximum side clearance at which couplers will mate. If you get more than 2½ in. side clearance, and the car is somewhat off center, then the point of the knuckle will strike on the guard-arm. With an increased side limit it will be necessary to bring the coupler back to the central position of the car, and we will have to guard against that. In regard to the motion of the draft gear, 1¾ in. for spring and 2¾ in. for friction, the committee does not feel that the best place to overcome the shock is on the horn of the coupler, not for the reason that you could not strengthen the horn of the coupler to withstand that shock, but for the more vital reason that the buff and pull should be in the central, longitudinal plane of the car.

Mr. Sanderson: In reference to the matter of clearance between the coupler shank and the carrier iron or sills. I made some very thorough tests some years ago to see what the lateral pressures would be under curving of cars, the angling of couplers, under rough ordinary conditions, and found, as I remember, lateral pressures exceeding 20,000 lbs. would have to be taken by the pressure of the flanges against the rails. As a result, we increased the clearance to 1¼ in. a side, or 2½ in. total, which this committee now recommends, which practice I have been following for some time. I have every reason to believe that the effect on the flanges of the wheels has been beneficial. I did not find that if we got beyond that that we encountered the difficulties which the committee has mentioned in coupling cars.

F. F. Gaines (C. of Ga.): In regard to recommendation 1, with the explanation which has been made as to the intent of the paragraph, I suggest that the committee so word it that it is understood not to eliminate the consideration of other forms of uncoupling devices.

John J. Tatum (B. & O.): We have in the last three years arranged something like 15,000 cars with about 2¼ in. side clearance to the couplers, and we have got excellent results from that additional movement.

W. E. Symons: I think the committee suggested by Mr. Schroyer should be appointed, and they should co-operate with the committee on draft gear, to the end that all objectionable features mentioned by the members and by Mr. Moseley should be eliminated in future coupler construction and locking arrangements.

Mr. Schroyer: I move the appointment of a committee to co-operate with the committee on couplers relative to use of an unlocking apparatus that will do away with chains and will eliminate the difficulty now occasioned by the breaking of chains at clevises in the coupling and uncoupling of our equipment. My attention has recently been called to a device that will do it, and one of the most important railroads in the country is using it. It is a patented device, and while this association cannot recommend the adoption of a patented device as a standard, it can let it be known that there is a device which will accomplish the ends we are aiming at.

W. McIntosh: While it would be desirable to eliminate the use of chains in this connection, we might go from the chain to some other connection that would be fully as bad or worse. I think the motion should be modified to embrace an uncoupling device of the simplest and most effective form. There is some good apparatus now in use, and it would hardly seem fair to condemn the use of

chains when you are not prepared to advance a substitute that is superior.

Mr. Symons: It is my understanding Mr. Schroyer's motion specified a certain difficulty to be removed which we now have in the use of certain uncoupling devices, regardless of the method used or employed in applying the remedy.

The motion thus amended was adopted.

Rules for Loading Long Material.—On motion, the recommendations of the committee were allowed to prevail and will go to letter ballot in regular form for adoption as a standard.

Cast Iron Wheels.—Wm. Garstang, chairman of the committee, presented the report, following which he read a communication from J. E. Muhlfeld (B. & O.), a member of the committee who dissented from the views of the majority of the committee, and another from the committee of the wheel-makers.

Mr. Muhlfeld said: I would not care to approve the committee's report, as I understand it has been prepared. Therefore, as a matter of record will you kindly note the following exceptions:

(1). From our experience, chills made the same as the profile of a 1-in. 20-taper wheel will not produce wheels of the same taper.

(2). Taking wheels of nominal diameter for test purposes would not eliminate the hard-iron wheels.

(3). Leaving out the 2 per cent. variation clause makes no limit to the maximum weight when purchased on the pound basis.

(4). To reduce the liability for derailment of new wheels that may come in contact with worn or sheared rail we do not consider it advisable that the radius at the throat of the flange shall be more than 5/8 in.

(5). We consider that cast-iron wheels under cars of less than 80,000 lbs. capacity having flanges 1 in. thick and wheels under cars of 80,000 lbs. and over capacity having flanges 1 1/16 in. thick are safe to run.

(6). Our opinion is that the conclusions should state that the new standard shall be accepted as the minimum limit of the wheel to be used.

The wheel-makers' committee said in part: As to the designation "for 33-in. cast-iron wheels, having minimum weights of 600, 650 and 700 lbs. for cars of 60,000, 80,000 and 100,000 lbs. capacity" wheels made according to the design and section adopted in 1905 by the M. C. B. Association, with the proposed increase of thickness of flange and tread, cannot be made without adding about 15 lbs. to the weight of wheel, unless the thickness of section is decreased elsewhere, and would ask to have the weights for 33 in. wheels as above designated as 615 lbs., 665 lbs. and 715 lbs., with the usual allowance of 2 per cent. for variation and weights. Such variation is inevitable and should be provided for to avoid misunderstandings as to the weight of wheel to be furnished. * * * We would urge that the subject of wheel service generally be given farther attention with particular reference to the matter of wheels removed from service for causes beyond the control of the manufacturer—*i. e.*, sharp flanges when wheels are sufficiently chilled, shelling out and brake burning, due to excessive brake application, flat or shelled out spots occurring opposite each other on the same axle. Considering the heavy increase in loads carried, car mileage and general conditions of the service, wheel removals for these causes are rapidly increasing and the necessity of proper action with regard to claims made against wheel-makers is of vital importance.

President Fowler: Unless there are objections, the report will be considered as received and open for discussion.

John J. Tatum (B. & O.): The gage for the limit of wear on the flange has been changed, limiting the wear of flanges on 100,000 lbs. capacity cars to 1 1/8 in.; on 80,000-lb. cars to 1 1/16 in., 1 in. remaining for the 60,000-lb. cars. I am of the opinion that the inch limit should apply to the 80,000-lb. car and the 1 1/16 in. to the 100,000-lb. car. Otherwise the mileage will be very much reduced, and I do not see that the factor of safety will be very much increased. If you check up the number of wheel flanges that have been broken the number will probably be greater with the full flange than those having the worn flanges that would be detected by this gage. It would be very interesting if we could have a table showing the flanges of wheels that have broken, giving the sizes of flanges, so that a comparison could be made showing the reason for limiting the wheel flange wear 1 1/8 in. in place of 1 1/16 in., and why we should have gone to 1 1/16 in. on the 80,000-lb cars in place of 1 in.

R. L. Kleine (Pa.): Our experience is that the wheel flanges which fall below 1 1/8 in., due to breakage on 100,000-lb. cars, is about 50 to 60 per cent., showing that if the limit should be increased from 1 1/16 in. to 1 1/8 in., we just save that many broken wheel flanges, and it is of vital importance, because every one of them causes an accident.

The committee has gone a little further on the safe side than probably we should go at this time, in that they have made the radius at the fillet or throat of the wheel 3/8 in. instead of 3/16 in., our present standard. We had a gage made according to the committee's report and gaged up a number of worn wheels under cars. We found that it depends altogether on how the flange wears. In some cases the new gage of 3/8 in. at 1 1/16 in. would condemn the same wheel that the old gage, with the 3/16-in. radius, condemned at 1 1/8 in.; but that is only under certain conditions, and I would move that the gage which the committee recommends be adopted with the radius changed from 3/8 in to 3/16 in.

W. F. Bentley (B. & O.): The B. & O. has been for some time having all cases of broken flanges looked into very carefully. There have been very few broken, due to being below the 1 1/8-in. thickness, unless it has been due to a seam in the throat of the flange. That is the trouble we are having with our cast-iron wheels to-day, the seam in the throat of the flange. There is a very large percentage of the flanges breaking off that are above the 1 1/16-in. limit, and we find the cause is the same in the throat and not the flange being worn below the amount specified.

A. W. Gibbs (Penn.): We were very much alarmed by the tremendous increase in the number of failed flanges from all causes, and more particularly on the 100,000-lb. cars. In 1904 we voluntarily increased our thickness to 1 1/8 in., which was above the M. C. B. limit. In 1903 we began putting in the coned tread. From 1902 to 1905 the failed flanges were on a continual increase and it was very alarming to us. It eased a little in 1905, and I am glad to say that notwithstanding the increase of the number of wheels under 100,000 lbs. capacity cars since then, 1905 was the high-water mark; 1906 showed a decided recession in the total number, and so far 1907 has borne that out. Something has caused that—I do not think it is any one cause—perhaps both the coned tread and the increase of thickness have contributed.

As for this increase in thickness, there is a very good reason to believe that the peening action on the rail spreads the surface and wedges the flange off, so that the flange breaks, not because it is thin, but because during its long course of wear there has been so much peening on that point that it cracks; so that the thin flange is the measure of the amount of peening that the rail has received. While I will not say that any one of those causes produced the result, we certainly should have expected an enormous increase, considering we have been adding nothing but 100,000 lbs. capacity cars to the equipment. The cost of renewal of wheels has become very large. No doubt the thickness prescribed has had an influence, but we think it is wiser to spend the money on new wheels.

J. J. Tatum (B. & O.): When our inspector detects a seam in the throat of the flange of a wheel, the wheel is removed and the flange broken off and sent into the office. We can see just what the thickness of the flange was, and whether it had worn materially. We found in a number of cases that the flanges were practically full size, yet that seam is in the throat of the flange. The gage, as it has been limited for the wear of the flange, would not detect that.

F. F. Gaines: While probably 90 per cent. of our broken flanges are with full flanges, occasionally we have a broken flange that is thin. One wreck will cost more than the decreasing of the limit, and I agree with the committee that we should adopt a stronger standard on that throat.

W. G. Menzel (Wis. Cent.): We have found invariably with broken flanges that the flanges exceed the gage. Also that the break was probably due to the shape into which the flange wore, and that it is principally governed by the vertical height. We concluded that the thickness of the flange did not cut as much figure as the vertical height of the wear. I believe the rules should be so changed that they would cover the shape of the flange more than the thickness or the vertical height.

Mr. Sanderson: I would ask the committee whether any consideration has been given in the last year's work to the question of a further increase in the radius of the throat of the flange. I believe that a good many railroads have gone further than the 11/16-in. throat, and I think the results have been beneficial.

Mr. Garstang: I think the committee has gone about as far as it can on the thickness of the flange. It took us quite a good while to get our superior officers to let us put on the 1/8 in., and I feel that is as far as we will be able to go. In regard to the radius of the throat, there has been nothing contemplated by the committee. We found that there are a great many wheels running on some prominent roads with a 3/4-in. radius, but the committee felt that the 11/16 in. would better meet the requirements.

W. E. Symons: The association should be actuated by a spirit of liberality toward the wheel-makers, not only, in the manufacture of wheels, from a purely engineering standpoint, but from a financial standpoint. It is not many years ago that in my own experience I found we were using a wheel weighing 600 lbs., and we were buying it for $6. I do not understand how any one can invest in a plant and make wheels for a price less than the cost of the pig iron, which was $20 a ton at that time. The recommendations and suggestions of the Wheel Makers' Association should have full consideration, and in so far as possible should be complied with.

A. W. Gibbs: Mr. Symons is right, because we should bear in mind that the section of the rail is in a transitory condition. I do not think this is an opportune time to ask the committee to put in something new which might tie them up in connection with the rail committee.

Mr. Symons: I move the report of the committee be adopted and referred to letter ballot.

C. A. Seley (R. I.): I suggest that new wheels be given an arbitrary symbol by which they can be noted in comparison with old wheels, and that the committee add to their recommendations a symbol designating a new wheel.

Mr. Garstang: I accept that.

R. L. Kleine (Penna.): I would take an exception to paragraph 4, to the words "wheels of normal diameter." The inspector should have a choice of taking any wheel at random, instead of being limited to a wheel of normal diameter. I move that the words "normal diameter" be stricken out and the sentence read "representative wheels shall be taken at random."

Mr. Seley: Regarding the matter of weights as referred to in the communication of the wheel makers: While we want to pay for everything we get, I suggest that the use of the present weights, 600, 650 and 700 lbs., are but arbitrary measurements and that the committee make a suggestion to the wheel makers that they revise their core and hub measurements, so as to take the 15 lbs. out if necessary, to agree with the standard.

Mr. Symons: I accept Mr. Kleine's amendment.

Mr. Gaines: I move an amendment, that instead of taking the excess weight, due to the increased flange, from the weight of the wheel, that we have a maximum and minimum to be decided upon.

Mr. Garstang: Your committee found the weights recommended were best suited for the different classes of cars they are going to be used under. The question of the maximum weight is a local one, and is generally decided upon between the purchasing agent and the wheel manufacturer.

The motion of Mr. Symons was carried.

Air-Brake Hose Specifications.—This committee, as well as the special committee on Chemical Analysis of Air-Brake Hose, submitted a progress report and both were continued for another year.

THIRD DAY.

High-Speed Brakes.—F. M. Gilbert (N. Y. C.) presented the report and called attention to an error in the report as printed. On the sixth line from the end of the report it should read 28,000 lbs. instead of 22,000 lbs. The report was received and referred to letter ballot.

Height of Brake Staff.—The Secretary read the report.

C. A. Seley (C., R. I. & P.): I would suggest that if this matter goes to letter ballot, the last portion, relating to the distance from center, be eliminated, as being already covered in the standards for protection of trainmen.

C. A. Schroyer (C. & N.-W.): To limit the height of brake staff to 14 ft. is going to interfere with many of our cars. On the standard cars recommended by the American Railway Association, we have 4 ft. from the track to the top of the floor. We have 8 ft. from the floor to the underside of the carlines, and some have a 12-in. car line, 2-in. roof and 4-in. running board, or a total height of the car about 13 ft. 6 in. With 6 in. above the height of the running board you have to get down pretty low. There has not been a sufficient amount of investigation to justify the recommendation of any special maximum height of this brake staff. Our furniture cars are 9 ft. high in the clear.

J. W. Marden (B. & M.): The standard height of brake staff on the Boston & Maine system is 14 ft. 6 in.

H. L. Trimyer (N. Y., N. H. & H.): The clearance line for the New Haven road is 14 ft. 3½ in. from the top of the rail.

The suggestion made by Mr. Seley was put in the form of a motion and adopted.

Automatic Connectors.—This committee did not send in any report.

Tank Cars.—C. M. Bloxham (Union Tank Line) read the report. There is one important change in the specification for testing the tanks, extending the period from five years to ten years. Another provision is that every tank shall be inspected by some railroad, and preferably by the railroad on which the car is at home, and if it meets the specifications, it shall be stencilled across the head of the tank so that the car can move freely on the different divisions of that road or any connecting road. If it is properly stencilled, the time of the inspectors will not be taken in going over the car carefully to see that it is in accordance with the specification.

One of the objections to stencilling the maximum capacity in pounds on tank cars is that it would be entirely misleading. Suppose, for example, a 10,000 gallon car is stencilled capacity 80,000 lbs. When the railroads bill this car loaded with oil they bill it at the actual average weight used for petroleum and its products, viz., 6.4, or 64,000 lbs., while the car may contain light or heavy products the actual weight of which would run from 52,000 to 72,000 lbs. Liquid freight is sold per gallon, the price often running to three decimal points. The traffic department of the railroads recognizing the necessity of a clear and definite per gallon basis as between the seller and the buyer have fixed actual weights per gallon for all liquid freight. The freight charges in all cases are computed at the maximum capacity in gallons on each tank. Now if the capacity of these cars in pounds is stencilled thereon it leads to endless confusion caused by delivering agents setting up the freight charges on their waybills to the maximum capacity in pounds. Railroad tariffs filled with the Interstate Commerce Commission and published all over the country show definite fixed actual weights for all kinds of liquid freight, and the traffic departments of these railroads understand the impossibility of handling liquid freight at so-called actual weights obtained by weighing on railroad scales without causing great confusion, annoyance and loss as between the producer and the consumer. As there is nothing to be gained by the railroad in inaugurating any plan for handling liquid freight at scale weights, and as they are now getting freight revenue on the maximum cubic capacity of every tank car at a weight per gallon established by the railroads themselves there seems to be no reason for injecting in this well-established commercial and railroad situation the question of the maximum capacity of tank cars in pounds. As the case stands to-day the railroads in the end get the actual weight on every gallon of liquid freight shipped in the United States. If they do not get it in one car they do in another, and they are saving the enormous expense of cutting out such cars and weighing them on track scales both light and loaded. The shipper of liquid freight furnishes the car and the railroads bill it at the maximum cubic capacity at the weights they themselves establish. There is no class of traffic in the United States to-day on which the railroads assess their freight charges so closely on an actual weight basis as they do on liquid freight, and it would be a great hardship, loss and annoyance to all concerned if this well-established, fair and equitable plan of handling liquid freight is interfered with.

These same objections apply to the plan of stencilling tare weights on the car as it would surely bring about in the end the same complications as would arise from stencilling the gross weights on the car.

The weight carrying capacity of all of the Union Tank Line equipment is considerably in excess of the actual load put in these cars. Take, for instance, U. T. L. car No. 4,209, with a cubic capacity of 6,001 gallons. The tank at 6.4 lbs. to the gallon, which is the average weight applied to petroleum products, has a weight capacity of 38,406 lbs., and it is on this weight that all freight charges should be and are collected. The actual weight that is loaded in this car with petroleum products would vary from 5¼ lbs. on naphtha, or 31,505 lbs., to 7½ lbs. on lubricating oil, or 45,007 lbs. The actual weight carrying capacity of this car is at least 50,000 lbs.; in other words, we can load this car to its full tank capacity with a product weighing 8⅓ lbs. to the gallon, and if we complied with rule 23 we should stencil on the tank, capacity 50,000 lbs. The result of this would be, that as all oil tariffs call for the minimum weight on tank cars to be their maximum capacity, if the car was billed out (as we would be correct in doing at 38,406 lbs.), railroad inspectors and other employees, seeing on the car the stencilled weight of 50,000 lbs., would in many cases correct the billing capacity to the maximum weight carrying capacity. This would result in overcharges, claims and endless confusion to all concerned. The U. T. L. Co. has no cars which cannot be loaded with the heaviest product, and still be under the weight carrying capacity of such car. The railroads all have handbooks showing the actual cubic capacity of every U. T. L. car and its equivalent weight capacity, based on 6.4 lbs. These cars are seldom, if ever, loaded with other than petroleum products, but when they are leased for other purposes, we stipulate the maximum weight that can be loaded in the cars.

There has been action taken on this matter by the Association of Transportation and Car Accounting Officers, and I wish to add to what I have said a resolution passed by that Association in June, 1904, as follows:

"Resolved, That the Secretary be instructed to incorporate the information which has been presented to the committee on the subject of marking tare weight on tank cars as part of the permanent records of this committee; and, furthermore, that the Secretary be instructed to insert a note in the minutes of the Washington proceedings to the effect that the Executive Committee have considered this subject and have obtained data bearing on it from railroads and from tank car owners, and they are satisfied that it is not necessary to stencil the tare weight on tank cars; also to the effect that the subject was effectually disposed of by the International Association of Car Accountants at their New Orleans meeting February 23 and 24, 1897, and by the Central and Western Association of Car Service Officers at Saratoga June 19, 1899, and to call attention to the fact that the tare weight will be cheerfully furnished by tank car owners at any time."

I have stated as clearly as I could the side of the matter from the traffic standpoint. If there are good reasons why the tank cars should carry the stencil of tare weight and capacity weight, the same as other cars, then this association should take the responsibility of taking action specifically on that point, so that every one will know why it is done; if, on the other hand, the reasons I suggest appeal to you as reasonable and fair, then it seems to me that the association should take action and provide for the omission of stenciling on these cars by putting into rule 23 of the Rules for Interchange these two words "except tank cars."

D. F. Crawford (Penn. Co.): It is necessary for us to have on the tank car a marking which will give our inspectors the opportu-

nity of determining whether the axles under the cars are of proper capacity, in the interest of safety and of transportation. I do not think the contents capacity means very much, but I do believe that it is necessary to stencil on the car the maximum weight of the car and lading. This would give our inspectors necessary information to determine the proper size of the axle, and at the same time would not interfere with the points brought up by Mr. Bloxham.

R. P. C. Sanderson (S. A. L.): Is there not also need of stenciling the light-weight and capacity so that the ordinary tonnage rating for train service and yard service can be readily obtained.

J. J. Tatum (B. & O.): We cannot afford to do other than stencil a car with the maximum capacity and tare weight, for the reason that we want to facilitate the prompt movement of our cars, and we must assist the inspector and give him the information on a car by which he can render his decision promptly.

A motion that the recommendation of the committee be accepted and referred to letter ballot, eliminating the capacity of the cars, was carried.

Stresses to which Wheels under 100,000 *lbs. Capacity Cars are Subjected.*—The report was presented by J. F. Walsh (C. & O.)

George L. Fowler: I have been at work on this problem for about a year and a half. I have designed a dynamometer to be put in the track which has been submitted to the engineering department of the Pennsylvania Lines West and approved. A piece of track on the Hickory branch, near Pittsburg, has been placed at my disposal, and the instrument is now about ready to go into the track. I expect to have it there within the next two or three weeks. The main difficulty has been in getting a registering apparatus that would be sensitive enough to work with extreme rapidity and at high pressure. The calculations show that on some locomotives the stresses run from 6,000 to 10,000 lbs., but I made my apparatus strong enough to carry 40,000 lbs., with an ample factor of safety. I only want to get the upper registration; the lower registration of the pressures I have no interest in whatever. My intention is to key the instrument up pretty close to the upper margin at all times with a permanent stress and then simply register the difference between the permanent stress and what is actually put on the rail. The apparatus consists of a floating piece of rail in the track, which is perfectly free to move out. It cannot move in, and its ultimate limit of movement will be restricted to a very small amount, something less than $^1/_{16}$-in. The actual movement will probably be less than one thousandth of an inch, so that the rails are practically stationary. The tests will be made on freight roads where there are no passenger trains. After that I expect to go on to the New York Central, where a piece of track has been placed at my disposal, and make a further investigation. I have, of course, an exceedingly short interval of time in which to make these measurements. A freight car running 40 miles an hour gives about one-twentieth of a second in which to make a record and get ready for the next one, and the paper will have to travel pretty rapidly. The apparatus, which has been designed, can readily register down to one-fiftieth and one-seventy-fifth part of a second.

The report of the committee was accepted and the committee discharged. Mr. Fowler was asked to present an individual paper on the subject at the next meeting.

"Clearances for Electrical Equipment."—The Secretary read a letter from J. F. Deems (N. Y. C.):

"This matter is now in the hands of a committee of the American Railway Association, * * * and included in this committee are practically all the members who were formerly on the Master Car Builders' Committee. No report will be made at the coming convention from the Master Car Builders' Committee."

Subjects.—W. E. Symons presented the report. He said in explanation: The second subject (Side Bearings) contemplates a thorough analysis of the question of the best form, type and proper location of center plates and side bearings. We do not contemplate any change in the location of the center plate, but there is a diversity of opinion as to the proper location of side bearings, their distance from the center plate and the amount of vertical clearance. The study of the behavior of cars when rounding curves and the relation of the center and side bearings to possible causes of derailment will require a thorough analysis of the influence which the steel car body has on the structure when rounding curves and in general service conditions. The report was accepted and referred to the executive committee for action.

J. W. Marden (B. & M.) was given the privilege of the floor and made a short address to the association on the value of maintaining standards. He said in part:

Our standards ought to be kept up to the highest degree of efficiency and reliability possible. I have taken great pride in learning that they are considered throughout the United States and Canada, and in foreign countries as well, as standards to be recognized as such and to be quoted as authority, and I want to impress upon the younger members particularly the importance of carefully considering all of the subjects that are brought before this meeting for a personal vote at your respective offices.

The rules of interchange have the same importance, and while they are not safeguarded in just the same way, by a letter ballot of the association, yet in voting on the Rules of Interchange and in discussing those rules sufficient time and deliberation should be taken to make them as effective as possible.

Just before I came to the convention one of my foremen said he found an M. C. B. standard journal bearing that would not go into an M. C. B. standard oil box. I find that the lines of our standards are not as rigidly followed as they should be, and I want to impress that upon your mind, that after we vote for a standard and make a standard, that we should follow it.

The officers elected for the coming year are: President, G. N. Dow (L. S. & M. S.); First Vice-President, R. F. McKenna (D., L. & W.); Second Vice-President, R. W. Burnett (C. P.); Third Vice-President, T. M. Ramsdell (C. & O.); members of the Executive Committee, D. F. Crawford (P. L. W.), T. H. Curtis (L. & N.) and F. H. Clark (C., B. & Q.).

Topical Discussions.

UP-TO-DATE CLEANING OF PASSENGER EQUIPMENT.

P. H. Peck (C. & W. I.): On the terminal road with which I am connected from 6,000 to 7,000 cars per month are cleaned. Our coach cleaning yard is elevated and holds about 350 cars. Our force consists of a general foreman, a foreman for each yard (north and south), a night foreman and about 130 men all told. The entire force is paid by the day. The power house is in the north yard and furnishes steam, air and electricity for the entire yard. The pipes and wires are carried in a conduit 5 ft. square, so that in case of derangement they are easily accessible. A Bowser oil storage system is installed at the center of the yard, and we have pumps 400 ft. each way from the center of each sub-yard, which avoids carrying oil any great distance.

From what I have observed and been told, I am led to believe that the vacuum system is not as well adapted for the floors and carpets of cars as the compressed air system, but for seats and draperies the vacuum is probably preferable. In order, therefore, that really up-to-date cleaning of cars can be obtained, a yard should be equipped with both systems, because cars could be cleaned better and in less time.

For the proper cleaning of cars the carpets should first be removed to permit a thorough cleaning of all corners and under pipes, etc., in the car. While the carpets are removed and being cleaned the floor of the car should be thoroughly cleaned by compressed air and then scrubbed. The carpets should be replaced and the vacuum system used to clean the seats, draperies and other parts of the car.

Coach cleaning may be divided into three parts:

(1.) *Inside Cleaning.*—This is for sanitary purposes and for the health and comfort of the passengers.

(2.) *Outside Cleaning.*—This is for outside appearances and to preserve the paint and varnish. For this purpose nearly all roads use some kind of a cleaner; some buy it, others make it themselves. Personally I believe a good cleaner is beneficial to the varnish.

(3.) *Trucks and Under Rigging.*—I visited all the coach terminals in Chicago and find that trucks are wiped chiefly by the use of a brush and a bucket of oil. This makes the trucks look very fine before a train leaves the station, and also has a tendency to prevent the springs and bolts from rusting, but after the car has run a few miles in dusty weather, the trucks bear very little evidence of ever having been cleaned.

The road with which I am connected does the cleaning of passenger equipment in Chicago for the Wabash, Monon, Erie and Grand Trunk roads besides our own equipment. I have some figures showing the average cost of cleaning the different kinds of passenger equipment cars.

Sleeping car	$1.06
Suburban coach	.82
Coach with oil lamps and closets	.78½
50-ft. baggage car	.59
50 ft. combination mail and baggage	.57
60 ft. mail car	.47
60 ft. baggage car	.72
Wide vestibule coach	1.29
Combination coach and baggage	.93
Wide vestibule chair car	1.48
Platform coach	.48
Dining car	1.85
Parlor car	.76

During the year 1906 we cleaned 89,026 passenger equipment cars at an average cost per car of 77.8 cents.

President Fowler: Mr. Peck probably has charge of the largest car cleaning establishment on the continent, so that the information we get from him is extremely valuable.

Wm. McIntosh (C. R. R. of N. J.): The road I am connected with has a vacuum system installed in the passenger cleaning yards at Jersey City. It has been in operation for about two years and is doing satisfactory work, especially with the upholstering and interior trimming. We are so well satisfied with it that we consider it indispensable to a well-equipped passenger car cleaning yard.

F. W. Brazier (N. Y. C.): We do a great deal of what we term "E" cleaning. We give our cars an "E" cleaning once in every three months if they require it. Then we try to keep water off our cars as much as we can; we believe that the dry wiping main-

tains a better surface on the car, and that the longer you keep water off the better off you are. We use on our limited trains what we call "thinner oil," very thin, wiped down so as to make you think when you get on the car that you are in a new train.

B. Julien (U. P.): On the Union Pacific, prior to two years ago, we used the straight air. Since that time we have been using the vacuum system, something that we fixed up ourselves. The vacuum system is better for the plush; it does not strain it as much as the straight air does, and we have better results all around. Also, it is a cheaper system of cleaning than the straight air, as there is not so much wiping to do afterward.

C. A. Schroyer (C. & N.-W.): We clean about 400 cars a day in Chicago. We have one yard fitted up in what we consider a modern manner, with steam, air and water. We use straight air for blowing out the dust upon the varnish and in the blinds and curtains, blowing it out of the cushions and backs. I have thought that I would like to have the vacuum system, but we cannot have it in our yard unless we use it in connection with the straight air system, and we think that that costs too much money, because straight air is pretty expensive. I have also thought that it would be wise to use the vacuum system in connection with steam, running steam pipes out into the yard and producing the vacuum. Both of those methods are now in use, but I think a better one would be to have a little exhaust fan run by a motor and take that right along from car to car, running a wire down from an electric line for power.

President Fowler: The lack of facilities, poor yards, etc., is a point that ought to be brought to the notice of the parties responsible. It is impossible for those in charge of car cleaning to get good work done unless the cars are set where the conveniences are located.

W. E. Symons: I ask what character of cleaning Mr. Peck's figures referred to. If in the sleeping cars it covered the sleeping car equipment and also the outside of the coach body, and if so, the quality of cleaning material used on the outside of the car.

Mr. Peck: The figures I gave were the general average for all cars. Some roads run fine trains and are very particular about dust and thorough cleaning. Other roads run a great many common cars—express cars and so on—and they do not cost so much.

Mr. Symons: Does the average include sleepers?

Mr. Peck: No. The Pullman Co. tends to its own cleaning, with the exception of the Grand Trunk, which does all the inside cleaning of Pullmans, and we the outside.

Mr. Schroyer: On the North-Western it is costing around $8.75 to clean a sleeping car.

R. F. McKenna (D., L. & W.): Where the terminal is of sufficient size to warrant it, there should be a shed capable of holding a number of cars in proportion to the equipment handled at that point, and at stated periods, whatever may be deemed necessary according to the service, the cars should be taken out of service and given what might be termed a light shopping; that is, giving them a thorough exterior cleaning with an emulsion of some character, and having the interior finish rubbed down with polish. At the same time, it permits of painting the trucks and platforms and gives a tone to the car which keeps it in good condition up to the time of its next shopping.

J. W. Marden (B. & M.): I should like to know whether the car cleaning is done entirely by day-work or by piece-work; and if piece-work, what success has been attained?

Mr. Peck: Ours is entirely day-work. There is some piece-work in Chicago, and I find they have less men, but the less number of men draw as much pay as the larger number of men in day-work.

PASSENGER CAR VENTILATION.

W. McIntosh (C. R. R. of N. J.): There have been but few thoroughly scientific schemes of car heating and ventilation worked out to a finish, and it is doubtful, all things considered, if these ever produced results that would justify the elaborate efforts and accompanying expense involved in the attempt. The aim naturally is to provide ways and means of introducing into the car, in the most direct manner, sufficient air to replace the vitiated air that rapidly accumulates in a compartment with many occupants. This air should be heated so that by the time it reaches the travelers it will be raised to a reasonably comfortable temperature, and in order that this operation may be continuous, means must be provided to exhaust, in some manner, as much air from the compartment as is being forced in at some other point. Economy and convenience leads to the adoption of the movement of the car through space to impound and direct the required volume of air into the car, in some instances passing it over a nest of heated pipes to raise the temperature from outside conditions to what is required inside. In other cases no concentration of this kind is attempted, but the air is directed into the car and an endeavor made to train the currents in such a manner that a thorough mixing of the heated air inside and the cooler air entering takes place, and, in continuation of this movement, a proportion of the part that has become vitiated it is endeavored to exhaust. In just such a degree that this is accomplished will the results prove satisfactory. It will necessarily require some very fine apparatus and some thoroughly worked out theories to accomplish this accurately. It, however, seems unnecessary to reach any such degree of refinement, but, on the contrary, some very simple appliances serve to accomplish such commingling, circulating and ejection, and well within the limitations allowed. And not only is it possible, where careful attention is given to the proper adjustment of such appliances, to admit a liberal supply of fresh air, warm it comfortably, and distribute it throughout the car so that each passenger will obtain his allowance, but, in turn, the foul air will be gathered up and moved out, and all be done without any inconvenience and without attracting the attention of the ordinary traveler. When it is possible to secure such fairly satisfactory results in such a simple and reliable manner, it hardly seems necessary or justifiable to try more elaborate and costly methods.

A moving railroad passenger car affords in action the necessary functions to bring about ideal ventilation. If the natural forces at hand could be properly directed, this would be about as follows: Suitable openings or hoods would have to be provided at the end of the car, in the direction in which it is moving, to guide the air into a system of heated piping under the hood, the pressure engendered by the moving car forcing the air through suitable ducts extending over the interior of the car, toward the rear, with branches directed downward toward the seated passengers, the exhaust taking place through suitable openings in the floor, and produced by the vacuum developed under the moving train as it is driven along. It would not be possible to furnish very complete ventilation in this manner unless runs were continuous for a considerable distance and proper mechanical arrangements were made to close the floor ducts and open the hood ventilators when the train stops. All systems are deficient here, ventilation ceasing when motion stops, and it is only by some independent forced system of ventilation that proper circulation of air can be kept up while the cars are standing. That some method will yet be evolved for a forced system of ventilation, controlled by independent motors, is quite possible, but it will necessarily be complicated and expensive.

G. E. Carson (Penna.): We have a system we have had in use for a number of years, and we are very well satisfied with it. The only trouble is that it does not ventilate a car when it is standing still.

C. A. Schroyer: We have on our passenger cars a ventilator that comprises a jack located on the roof of the car practically of the same shape as the old Spear jack. The forward motion of the car scoops the air into this jack, and by means of a pipe connecting the jack with the radiator, having 60 or 70 sq. ft. of radiating surface, which is located directly inside the end doors of the cars, we force air through this pipe down into the body of the radiator, where it is heated during the winter season. This does in a very marked manner change the air in a car under the speed of the train and the extent to which that change is effected depends entirely on the speed. When the train is standing still it is useless as a ventilator. The problem of ventilating a passenger car, however, is an entirely different one from that of ventilating a sleeping car, and what is good for one doesn't do at all for the other.

SOLID STEEL WHEELS FOR PASSENGER CARS.

The full discussion by George L. Fowler is printed in another column.

WHAT CAN THE MASTER CAR BUILDERS DO TO SECURE THE MORE RAPID MOVEMENT OF FREIGHT CARS AND PREVENT DELAYS UNDER REPAIRS AND INSPECTION?

J. E. Muhlfeld (B. & O.): It is a well-known fact that a freight car, in addition to performing its legitimate work of transporting traffic, is required to withstand a 25-mile per hour impact when loaded and passed through gravity and hump yards; to be kicked, poled, roped and cornered; to be mauled and turned upside-down for dumping; to receive red-hot lading, such as billets, pig iron and slag; to resist the steam, fire and dynamite that is used to loosen frozen loads of coal, sand and ore; to submit to the depreciating action of acids, alkalis, water and weather; to retain any load that can be safely got into or on top of it; to endure loading by crane hoist; to undergo removal of lading by clam shell, scraper or plow; to be able to lose any part of itself that may facilitate loading or unloading, and withal to retain its identity and return to its owners after a year's sojourn in Canada, Mexico and the United States with a clear record against delay, failure, personal injury, loss or damage, and the Interstate Commerce Commission inspection. Assuming, however, that the transportation and traffic departments may have exhausted their means to increase the movement of freight by the greater lading and quicker handling of cars, there is no doubt that the Master Car Builders can render additional assistance. From the past year's experience and considering only equipment now in use, it appears that consideration should be given to the following:

(1.) Regulations to facilitate the handling at interchange points of loaded freight cars that are safe to move.

(a) If the Master Car Builders' rules are to facilitate the disposition of cars in interchange service and to properly place the responsibility for defects which may or may not make them unfit for movement, what objection should there be in stimulating car

owners to make substantial repairs to equipment before it leaves the home lines by the inauguration of a rule such as:

"When a loaded car contains specified owner's defects which do not render it unsafe to move but make it liable to develop a delivering company's combination of defects, it must be accepted from owner's line if covered by a liability card authorizing repairs to, or acceptance of car on the owner's line with such a combination of defects as may properly be the result of the specified owner's defects."

Such a rule should not only facilitate the handling of loaded cars and keep them moving as long as in a safe condition, but it would also require the owners to apply the necessary betterments and repairs to equipment that they offer in interchange for the purpose of maintaining it in substantial condition and thereby relieve themselves of extraordinary expense due to cumulative repairs that are now made necessary on account of not taking "the stitch in time" when they have the cars in their possession.

(b) Another matter that should be given consideration is to make loaded and empty cars acceptable at all interchange points on such roads as will insure proper accounting for repair charges. This can be done by agreements between connecting lines providing for the appointment of joint inspectors who will prevent the holding of equipment and transferring of lading on account of too much or unintelligent inspection and on technicalities.

(c) It would also be well to establish the fact that progress is being made in interchangeability and shop practice by specifying that bad order cars shall be no exception to the rules governing serviceable cars except where they are unsafe to load on account of general worn-out condition due to age or decay. The continuance of the per diem on foreign cars during the period they are held for owner's material for repairs would certainly result in much less time being taken to make the repairs than what now occurs.

(2.) Competent interchange and terminal car inspectors.

Taking into consideration the regular and special rules covering the inspection, condition, repairs, loading, clearances, billing and movement of freight cars, as issued by the Master Car Builders' Association, Interstate Commerce Commission and the railroad transportation and mechanical departments, it is not difficult to understand the urgent necessity for labor capable of performing the interchange and terminal inspection in a way that will accelerate rather than retard movement. Instructions and criticisms have become so frequent and voluminous that we can certainly expect a vigilant car inspector, when loaded down with the same, to be able to determine upon one or more details in each car passing his inspection, that will delay its movement. It, therefore, becomes most essential that the chief, foreman, joint, leading, or other similarly classified car inspector whose duty it may be to supervise regular inspectors, shall be a man of such general qualifications that he can be depended upon to direct compliance with the rules in a manner that good judgment may decide to be safe and proper for all concerned, as well as consistent with the least delay to traffic and the greatest economy in maintenance.

(3.) More substantial repairs to cars when on home lines.

In consideration of the fact that the average serviceable freight car may have an earning capacity of from $2.50 to $3 per day, even when standing still for about 21 out of every 24 hours, it is easy to approximate the increased revenue that might be derived if the Master Car Builders could reduce the number of bad-order loaded and empty system and foreign revenue freight cars held over each day for all classes of accident and ordinary repairs (exclusive of defective cars held under load at destination and excepting after Sundays and legal holidays), to a basis of 3 per cent. of the total system and foreign revenue cars on the line.

However, it is an expensive procedure to clear the "cripple" tracks by the making of indifferent repairs, and where desirable system cars reach the shop tracks in an empty condition they should receive such renewals and betterments as will put them in a substantial condition, so that the repetition of the class of repair work that results only in temporary maintenance can be discontinued in order to reduce the successive line failures of equipment and detention to cars and traffic, as well as the continually increasing expenses for non-productive labor and material.

It is, therefore, especially urgent that the Master Car Builders shall promote the best interests of the shippers and dealers, as well as of the railroads they represent, by the inauguration of substantial repair practices that will insure the minimum delay of cars on the shop tracks and line of road chargeable to their general condition.

(4.) Thorough inspection, repairs and adjustment of cars before loading and careful attention to brakes, lubrication and lading after classification at load originating terminals.

Cars set off on the line of road due to bad order condition of couplers, draft attachments, wheels or brakes, heated bearings, shifted lading and other similar causes are usually the outcome of lack of proper originating terminal attention which results in accidents, destroyed lading and cars, reduced train rating, delays to traffic, blocking of passing sidings, engine and train crew overtime and extraordinary expense for sending labor and material out on the line to make repairs. Regardless of whether system, foreign or private line equipment is involved, the Master Car Builders should see that all receive the same attention in this respect, as a foreign or private line car is liable to cause just as much, if not more, line trouble when under load than a home car.

(5.) Cars damaged by accident, but safe to move, should be repaired for return loading instead of being routed home empty.

Where at all practicable to do so, light mileage on account of condition of equipment should be eliminated, and when cars can be made safe to run and lading is available they should be put in condition for return loading.

(6.) The restriction to home lines of cars that are not suitable for interchange service.

At the present day nearly all railroads are offering in interchange some loaded and empty cars that are of such capacity, design or condition as to make them entirely unfit for the service to be performed. This class of equipment, which cannot be depended upon to promptly pass interchange inspection, should be restricted to those owners' lines where it can haul the maximum amount of commercial or company's use lading with the least liability for delays, transfer or repairs. Such a practice would assist materially in increasing carload-lot minima that may now be established in consideration of the Master Car Builders' capacity restrictions for certain cars containing double and triple loading.

(7.) Cars unsuitable for either company's or commercial use to be dismantled.

When a freight car of undesirable class and capacity has outlived its usefulness from the standpoint of commercial utility and reaches the home shop tracks in such bad order condition due to age, delay, corrosion or accident that the expenditure necessary to put it in serviceable condition is not justified, it should be dismantled. Connecting railroads handling either interstate or intrastate traffic should be assured of the absolute elimination of this class of equipment from further service on their lines.

In conclusion it may be stated that the great demand at the present time for increased facilities for moving industrial and agricultural products to market makes this topic of universal interest. The public insists upon railroads providing safe, fast and frequent freight service, such as can only be obtained from equipment receiving the most substantial attention in the way of repairs and inspection. The freight yard and train operations have become most severe on rolling stock. Relieving switchmen and brakemen of the necessity of going between cars to make couplings is no doubt responsible for much rough usage and failure of equipment. The gravity and hump yards and longer trains have also contributed generously to the cripple tracks. Furthermore, the conditions imposed by the placing of cars of light capacity and design between those of heavier types at the head end of trains, in combination with double, triple and overloaded equipment and the frequently reported "bad triple" and "burst hose" must also be met.

In view of the large number of cars in service that were designed and constructed long before the results from the changed conditions could be realized, the Master Car Builders deserve much credit for the progress that they have made in promulgating general practices and facilitating transportation. However, the urgency for the handling of freight now awaiting movement gives them an opportunity to further demonstrate their resourcefulness and broad, progressive methods by stimulating such action as will eliminate whatever sluggishness may still exist in the repair and inspection practices.

COUPLER SIDE CLEARANCE.

Le Grand Parish (L. S. & M. S.): On account of considerable difficulty having been experienced with broken wheel flanges on cast-iron wheels under cars of 80,000 lbs. and 100,000 lbs. capacity, it has been necessary to pay particular attention to the specifications and design of cast-iron wheels, and in a number of cases it has been considered necessary to use steel wheels under cars of 100,000 lbs. capacity. It would appear, however, that the most important thing to consider is the coupler side clearance. The draft gear committee of 1905 considered it important to recommend that the coupler clearance be increased from 1 in. to 2½ in. This recommendation was adopted. A number of roads have increased the coupler side clearance over 2½ in.

The Lake Shore has given this matter careful attention and for the past two years has allowed 4 in. coupler clearance with excellent results. The wheel flanges show very little wear and the general condition of the car indicates that 4 in. clearance is approximately correct. Dynamometer tests were made on the Lake Shore in 1905, which indicated a considerable increase in tonnage over a division having moderately short curves, on account of additional coupler side clearance. Owing to heavy business it was not possible to continue these tests to a definite conclusion.

J. J. Hennessey (C., M. & St. P.): I do not agree with the report. On sharp curves by giving more clearance you do not relieve the shock on the flange of the wheels but increase it. There is no question but that the strain on the end of the car and on the platforms is relieved. Where the flange shock and wear takes place is on the outside rail if there is any speed. In yards it is the

outside rail which is worn all the time, the lead wheel being crowded against the rail. If you set a block and tackle off at an angle of 45 deg. and pull on it with sufficient force, you will slide the wheel entirely away from the high rail toward the low rail. In street car service they have sharp curves, but they allow the couplers to pull in straight line, and the flange wear is very great.

J. J. Tatum (B. & O.): If a car is entering a curve, unless the coupler takes its position with the curve, great straining occurs, and such straining will finally reduce to a strain on the wheel flange and on the track. A swing motion truck is used simply to get a free movement of the truck under the car. It is as important to get a free movement of the cars coupled in a train, in order to get the train around a curve in a satisfactory manner, as it is to have a free movement of the truck.

J. F. Devoy (C., M. & St. P.): Some time ago, at the suggestion of Mr. Hennessey, we attempted to conduct some experiments which would definitely show just what pressure or strain there was on a car moving around a curve. It was only possible for us to take the car in its standing position. We coupled the cars together, marked the position of the coupler to the car at that time, and attempted then by calibrating springs, placing jack screws behind them, to determine just what amount of pressure it took to place the car uncoupled in the same position that it was in when coupled on a 20-deg. curve. It required as much as 4,200 lbs. A large coupler clearance aggravates wheel wear and flange wear. In passing around a curve with only 1-in. or 1½-in. clearance on one side of the coupler there would be a tendency to lead the car away from the track, thereby relieving the flange wear.

F. W. Brazier (N. Y. C.): The New York Central has 25 cars which have been running now about 2½ years, with 2½-in. side clearances. Our record up to two months ago with these cars was two pair of sharp flange wheels removed. These cars had a centering device. They are almost unnecessary, from the fact that the tandem spring, or Westinghouse, or any other draft spring, made with the tail straps, are so wide that the springs will bring the couplers back to center, unless there is too much slack in the pockets. We might as well wear out the flanges of the wheels as to pull the cars to pieces.

J. J. Tatum (B. & O.): We made some tests on a 27-deg. curve, and also on a 69-deg. curve. We found in taking two cars in on the curve, having ¾-in. side play on either side of the coupler, 1½-in. total play, that the car could not be coupled or uncoupled on the 27-deg. curve. It had to be backed out on straight track to get the car coupled or uncoupled. We also found in going around a 69-deg. curve that you could not get a 40-ft. car to curve around without uncoupling the car and pushing it around as a single car. We did find, by giving the coupler more lateral movement, that we could get the cars around the 27-deg. curve and a 69-deg. curve. One long car, which was very limited in its lateral movement, had the coupler badly worn on the side, the yoke on the rear end was badly worn and the center arms of the draft carrier were forced down. There was considerable strain there which should have been relieved.

C. A. Seley (C., R. I. & P.): It is important that we get a maximum safe clearance that can be utilized in coupling cars for the reason that the amount of swing at the end of a car varies so much, due to the overhang beyond the truck and the varying wheel base in trains of cars, all kinds and types coupled together. If you get a 2-in. clearance on one car and the adjoining car has a 2-in. clearance also, you never use all of that. A general movement toward increasing the maximum movement is desirable and should be encouraged.

W. F. Kiesel, Jr. (P. R. R.): Mr. Seley touched on one important feature—the varying length of cars. There are two other features—reverse curves and irregular curves. These are the three features which necessitate increased coupler clearances. We made tests with cars having ¾-in. clearance on each side, on irregular curves, and we found the wheels on the outside rails raised off the track as much as an inch. That would not have happened if we had had 1¾-in. clearance on the side. All of the tests we made indicate the necessity for increased coupler clearances.

LeGrand Parish (L. S. & M. S.): We have several thousand cars that have coupler clearances of 4 in. We adopted these clearances to prevent broken flanges. On the cars which have been equipped with 4-in. coupler clearances we have yet to report a single case of broken flange. Some of these cars have been in service nearly two years. We found another important feature—the reduced wear on the brass.

C. E. Fuller (C. & A.): Nothing has been said relative to the steel or wooden car. The steel car requires greater clearance than the wooden car. We are considering very carefully the clearances on steel cars. We do not have any trouble with wooden cars. We are hauling long trains of coal cars, and it is noticeable how much easier we get the wooden car, with the same tonnage, over the road than we do the steel car of the same tonnage.

P. H. Peck (C. & W. I.): The pressure on the flange is very great. When we put some couplers on ordinary coaches we could not get around some of our short curves, and consequently we put a drawbar with a movement of 2½ in. either way, and we got relief at once. If we put a rigid coupler on these cars, they will go off the track.

R. L. Kleine (P. R. R.): We made some tests in connection with coupling of cars on short curves and laid a special test track from 75-ft. radius up, varying about 10 ft. We found, especially with the steel cars, that with the wider coupler clearance, we could couple a curve of much less radius than we could where the clearance was limited. We went further and made the tests on a straight line to see approximately how much "off center" we could couple. We found that the center line of the car, in relation to the center line of the track, had quite a bearing. In some cases we found the body of the cars, due to the movement of the wheel flanges on the rail, movement of the bearings, etc., were off center as much as 1 to 1½ in. In coupling we found that from 2½ to 3 in. was the maximum at which we could couple on straight line. You will often hear trainmen say that they have difficulty in coupling on straight line, and that might explain some of these conditions. In fixing the maximum coupler clearance the committee should take into consideration the amount that the cars would be off the center.

We also had some experience with derailments, due to narrow coupler clearances. In going off on some of the branches with coke cars we found the cars would derail when they were running at a speed of from 4 to 6 miles an hour, and the train crews told us that they invariably got the derailments at these slow speeds. When they took the curves with the train stretched and going at a higher rate of speed they had no trouble. That indicated that the coupler shank was back in the car, which decreased the coupler clearance. Therefore, the wider coupler clearance would seem to be essential.

WOULD NOT TRUCK SPRINGS FOR FREIGHT CARS BE BETTER LAID ON THE JOURNAL-BOX THAN UNDER THE BOLSTER?

F. W. Brazier (N. Y. C.): That arrangement of the springs which will most effectually cushion all moving parts is the arrangement which should be adopted. Such an arrangement will not only protect the moving parts of the car, but will materially protect tracks, bridges, etc. If springs are placed on journal-boxes of freight cars, the non-spring supported parts are reduced to the wheels, axles, journal-boxes and contained parts. This will reduce the non-spring supported parts of our trucks to a minimum.

The rapid deterioration of truck frames, bolts, fastenings, etc., on arch bar trucks has long been recognized by the average car repair man. The increase in weight of the non-spring supported parts, which in the arch bar truck consists of the entire truck, excepting the truck bolster, taken in connection with the increased velocities, is fast becoming seriously destructive to trucks, tracks and structures.

The weight of the non-spring supported parts of an arch bar truck having M. C. B. axles 3¾ x 7 in. is about 6,000 lbs. The weight of the non-spring supported parts of the heaviest arch bar truck having M. C. B. axles 5½ x 10 in. is about 11,000 lbs. This uncushioned weight, by placing springs over journal-boxes, may be reduced to 3,600 lbs. for 3¾ x 7-in. trucks and to 5,200 lbs. for 5½ x 10-in. trucks.

The principle involved has long been understood, and the proper remedies applied in our modern passenger car trucks, and also in our locomotive leading trucks. However, we have sought to overcome the trouble in freight car trucks by increasing the weight of the falling members rather than by reducing the stresses in them. This increase in weight of uncushioned parts has not given us relief, and sooner or later we will recognize the true cause of the trouble and apply the proper remedy.

The race between the rigid and swing bolster freight trucks has been a long one, and the issue is not yet settled. We are suffering, however, from too much vertical rigidity, and this would be much reduced by getting our springs nearer the disturbing forces, which are at the point of contact of wheel and rail.

The New York Central has 30,700 cars equipped with trucks having springs over journal-boxes. Of these 30,700 cars 72 per cent. are cars of 60,000 lbs. capacity; 28 per cent. are of less capacity. The cars were built from 1898 to 1902. We have also 200 tender trucks, 5½ x 10-in. axles, and 800 tender trucks, 5 x 9-in. axles, built about the same time as the cars. The service given by trucks on above equipment has been very good. I am not here to defend the Fox trucks, but we have had less trouble with a truck of that character than with any other type of truck which we are running. All of our Fox trucks are sent to Buffalo for repairs, which are done at an average of $8, and 75 trucks are sent to Buffalo on an average each month. We have less than 1 per cent. of derailments with this class of truck.

C. W. Wildin (Lehigh Valley): Do you keep the box lids on the Fox truck in rough track? Do you not have more trouble keeping the box lids on the Fox truck than with the springs in the center? On the Lehigh Valley it was almost impossible to keep the lid on the Fox truck or any truck that has a spring over the box. During the winter and spring, when the track is in bad shape, we have always had considerable difficulty with the lids on boxes of that type.

The Telemagnophone.

The telemagnophone is an arrangement by which one person can speak into one telephone transmitter at one point and have his words repeated at a number of other points simultaneously. It is really a loud-speaking telephone with numerous extensions. This system has just been installed in the Grand Central Station at New York for announcing trains, and was first tested there on June 25. Announcing instruments are at present situated in the main waiting room only. They are shortly to be placed in the restaurant, the ladies' room, the smoking room and the baggage room and on the concourse. In the main waiting room there are six instruments, five of which are placed on top of rows of seats and one over the information desk.

The telemagnophone is an aggregate of electrical devices. Connection is made by an ordinary copper wire from the transmitting station, charged with a small battery current. The sound reproducing instruments, two types of which are shown, are about 8 in. high, 4 in. wide and 4 in. deep. The horns are "S" shaped and about 9 in. long, with a bell about 4½ in. in diameter. The instruments shown are the double type, arranged to sound in two opposite directions, and the type with six horns to sound in two opposite directions like the double type, and in addition in four other side directions. The primary advantage of this system is that by it one man can operate, if necessary, more than 100 different speaking instruments. This system is the original invention of L. J. Lippmann and has been worked out by A. G. Kaufman. It is manufactured by the American Callaphone Company, of 51 West Thirteenth street, New York City.



Two Models of the Telemagnophone Reproducing Instrument.

Solid Steel Wheels for Passenger Cars.*

It has been my privilege for the last two years to be engaged in an investigation of the merits of wheels of various character for use in passenger and in freight service under the patronage of one of the manufacturers of solid steel wheels.

The first thing that I did was to gather from all of the makers of steel tires in the country samples of steel tires. I want to go back for a moment and say that as I understand the question, it is not a question as to whether a steel wheel should be used in passenger service, because we have already decided that a steel tired wheel, or a steel wheel, is the proper thing to use, but it is a question as to whether a solid steel wheel can be made that will be safe and reliable for ordinary passenger service. The cast-iron wheel for the time being can be regarded as entirely out of the race.

In this investigation I first obtained these samples of steel tires that were in good, first-class condition. I went to my railroad friends, and they gave me a sample of all of the steel tires that are on the market that had failed—not all the tires that had failed, but a sample from each make that had failed by what is known as shelling out. In working out the comparative value of the metal of the wheels, I cut tensile test pieces from three points in the tread and tested those in the ordinary way for maximum strength, elongation, elasticity and contraction of area, and then in addition to that I tested all of the material on what is known as the Martel scale for hardness. The Martel scale is one that has been adopted by the French government, as a standard of hardness, and it was originally developed by Colonel Rodman of the United States army, in the test of pressures of his guns. It consists in dropping a wedge of pyramidal shape, with a given weight behind it and a given height, upon the body to be tested. Experiments made in France have shown that the amount of metal displaced with a given form of wedge, or knife, and a given weight, varies directly with the hardness of the material. As far as the tensile strength is concerned, in all of these tires there is very little difference. It runs up with the carbon. The lowest carbon of any tire that is in standard use today that I was able to find was about 0.57 per cent. The highest was 0.716 per cent. The maximum tensile strength of these metals ran from 113,000 to 124,000 pounds per square inch. This does not mean, however, that the limit of elasticity was at all in accordance or in exact ratio to this tensile strength of the material. I found that the elongation varied practically with the carbon, and that it ran from 6.87 per cent. up to 29½ per cent., 29½ per cent. being, naturally, with the steel tire that had the lowest percentage of carbon.

I found that the elastic limit of these wheels ran from 72.63 per cent. of the ultimate strength up to 86 per cent. and you know that limit of elasticity is really the factor which we always work upon when we are using any metal in any kind of construction; and the peculiar thing about this is that while there is so comparatively little variation in the actual strength and the quality of the metals, it was the solid steel wheels which had the highest percentage of elasticity in relation to its ultimate strength.

As to hardness, there is also very little difference. That has some slight connection with the carbon content of the tire, but it is practically what we call 375 degrees, running from a minimum of 783 degrees to 1,125. In this also the maximum of hardness was obtained by a solid steel wheel.

The carbon content varied from 0.573 up to 0.716 per cent. so that the carbon content is practically in accordance with ordinary general specifications.

From this it would appear that as far as the physical qualities of the metal are concerned, and as far as it can be determined by purely laboratory tests, the metal that is put in the solid wheels, the forged wheels, is something that can be entirely depended upon as far as safety is concerned.

The economy of the wheel depends upon its rate of wear per 1-16 inch, its usual cost and the value of the scrap after it has been worn out. In regard to the scrap value, and its initial cost, I have nothing to say. I can only refer the members to the manufacturer, and they will obtain there, probably, the information that will enable them to settle the matter definitely as to whether it will be economical to use the steel wheel or not.

In regard to the wear of the wheels in actual service, I have here the records of steel wheels that have made a mileage of 25,618 miles per $^1/_{16}$-in. wear, and with a total mileage of from 154,700 to 184,000 miles before the first turning, and the wheels are still in good condition. These wheels are also used very extensively for street railway service, where elements enter into their use which are not a factor in steam railroads. That is, the rapid wear of the ordinary wheel and the value of the car in saving or preventing it from going into the shop for wheel renewal. There because of brake action, the condition of the rail, and other things, the wear of these wheels per 1-16-inch drops very much below what you get on the

*Topical discussion at the Master Car Builders' Convention, by George L. Fowler, Associate Editor of the *Railroad Gazette*.

ordinary steam road. It runs from 7,000 to 9,000 miles per 1-16-inch wear.

As to the cause of shelling out, there are a great many theories advocated and promulgated. Some claim that there is a cleavage along the ferrite lines in the wheel, i. e., that there is a shortness in the metal that causes it to grow in cold weather, but it is a curious fact that of all the shelled out steel wheels that I was able to obtain, slag was the cause of shelling out in every instance. In all of these wheels, both new and old, I took sections and had microphotographs made, some 500 in all, and I have some most beautiful examples of slag in steel, and in every case where the wheels have shelled out the wheel was simply impregnated with slag everywhere. My first section was taken right through the shelled out spot, so as to get the bad conditions that had caused that immediate trouble, but by taking a sound part of the wheel where there was no indication whatever that shelling out had taken place or was likely to take place, I still found that that tire was full of slag. There may be other reasons for the shelling out of steel wheels, but I did not find them. That, of course, is no reason for saying that they do not occur.

In both solid and ordinary steel wheels shelling out occurred more frequently in winter than in summer, and more under a tender than under an ordinary passenger car. The reason I would suggest for that is this, that the line of cleavage following down the slag lines, as I could follow out very readily with the microscope, the cold weather renders the metal brittle to a certain extent, and that cleverage naturally runs along more rapidly under those conditions and under the hard service of winter wear, and the result is that we have a shelled out spot more in the winter than we do in the summer. In tender service, it is due, I think, entirely to the excessive intensity of the service which the tender is called upon to perform. A tender is practically running a great deal of its time without any springs. Springs are put under the tender to carry full load. Those springs are very stiff, and when the tender is nearly empty at the latter part of the run, both in coal and in water, the springs are so stiff that they give almost no spring action whatever to the body of the tender. The result is a pounding on the wheels that is exceedingly severe. On the ordinary freight car, running at ordinary speed, with the springs in position, the load is from 25 to 40 per cent. in excess of the load that is put on the bolster. With the springs off the car entirely what the load on the wheels may be I do not know, but certainly it will be more than the 25 or 30 or 40 per cent. in excess which I have found by actual measurement to be the case with the springs in position under a freight car. The solid wheels that have been successful and have obtained any wide amount of adoption have been those upon which work has been put, I mean work in the form of rolling that is similar, or forging that is similar, to that which a tire receives while it is cast from the blank, and the earlier wheels were so cast; the wheels that have been made in this way, have thus far not been satisfactory.

I do not think that there is any doubt whatever but that the cast blank can be made so that it will be perfectly safe for ordinary purposes, but in casting the blank there is always more or less slag carried from the surface of the mold into the tread of the wheel, which makes it very liable to shell out when it is put in service, and this occurs also in those tires where the ingot is not properly cropped and properly trimmed before it is rolled into the tire. I have found quite a number of tires that had evidence of slag from the surface of the ingot in them, from being improperly taken care of at the mills where they were made. That is practically the trouble that we had with the cast blank. I make a distinction between a cast blank wheel where the wheel is cast approximately into the form of a wheel and then given some surface rolling, and one where a slice is simply cut off the ingot, cut and rolled, and that the whole shape of the wheel is changed.

By examining those wheels with the microscope, we find that the penetration of the rolling into the solid steel wheel is about the same and is very similar to the penetration due to the rolling that we find in the ordinary steel tire. You can see surface indications and you practically can count the number of heatings that have been obtained with the wheel, and see how it has worked down into the centre of the wheel by a careful examination with the microscope, and in this connection I want to say that upon defective metal, or the metal upon which any doubt is brought to notice, there is nothing in the world that will show things out so clearly as the microscope. I had a case a little while ago of a large drawbar which had broken between the engine and the tender. It was a most beautiful fracture; there was absolutely nothing that you could see with the eye to show why that should break, but when it was etched and looked at under the microscope the story was as plain as day. It was simply full of slag, and there was very little metal in it. These causes of shelling out are all that I have been able to find, that is, the slag, and I do not know how much further it will go.

I want to say one word in regard to the relative values of steel and cast-iron wheels for all services. I have had some very peculiar results. I do not feel like saying that they are absolutely sure, but they certainly are peculiar indications. I took a pencil from a cast-iron wheel, just as though I had bored down into the tread with a hollow bit, and I had a piece about as long as my finger and a half inch in diameter, which I put on an emery wheel and loaded with a fixed weight, and measured the number of revolutions to grind off each ⅛ inch. I did that with all my steel tires also. To my intense surprise, I found that my cast-iron ground off about four times as rapidly, even in the hardest part of the chill, as any of the steel tires or wheels, though I got the apparatus for the purpose of grinding steel. I went to the manufacturers, the carborundum people, told them what I wanted to do, but said nothing at all about cast iron. They gave me a wheel from which they said I would obtain the best results, and the most satisfactory data for the purpose. I used it, and it was not until afterward that I put the cast-iron pieces on. After I had obtained these results, another manufacturer of emery wheels told me I was entirely wrong in my conclusions, because a wheel that was adapted to grinding off steel would not grind cast iron with equal efficiency. In other words, it was not adapted to grinding cast iron, and yet this wheel that was not adapted to grinding cast iron did grind it four times as rapidly under identically the same condition as it did the steel wheel. I then put a cast-iron wheel and a steel wheel in the testing machine, and skidded them, weighing the load and weighing the pull required to slip it, and my previous experiments with the metal pencils were simply checked; that is, that every spot that I got on my cast-iron wheel accounted for just almost exactly four times as much metal as I removed from the steel wheel under the same conditions. That was further checked by the fact—now probably I will receive any number of contradictions—that on a certain railroad we found that it took us about four times as long to grind off steel as cast-iron wheels. To take the thing still further, I upset my porridge completely. I put a steel and cast-iron wheel on the same axle with a load of 24,000 lbs., and put a brakeshoe upon each side of the wheel so as to be able to skid it under any conditions. I then pulled it over a piece of track about 1,800 feet long that was in thoroughly good surface and alinement, and then I did the work at a speed of from 2½ to 3 miles an hour. I found that the metal removed, as accounted for by the flat spot, was about four times as much for the cast-iron wheel as for the steel wheel. But when I increased this speed to from 16 to 17 or 18 miles an hour, I exactly reversed the conditions. The heat that was developed by the high speed simply reversed the wearing qualities, as far as skidding was concerned, of the cast-iron and the steel wheel. But inasmuch as almost all skidding is done at comparatively low speed and comparatively short distances, the fact is that the cast-iron wheel does flatten more rapidly under those conditions than the steel wheel. This accounts for the almost universal experience that flattening is more common with cast-iron than with steel wheels, because the work was done while the metal is cool, and in all my laboratory experiments I took great pains to keep the metal cool. It is this element of heat which reverses the action that is found elsewhere.

Another peculiar thing, perhaps a little off of the subject, is the effect of the weight of steel and cast-iron wheels on the rail. I think in 1887 the Master Mechanics' Association had a discussion in regard to the proper weight to put on the wheels, and it was decided in that meeting that about 12,000 lbs. ought to be the limit. Now we are putting on 28,000 lbs. In some cases 20,000 lbs. is not an extreme case for a high capacity car. By loading cast-iron and steel wheels on the rail from 500 lbs. to 150,000 lbs. I found that at 20,000 lbs., with the ordinary steel rail of 55 carbon, there was a spot left in the rail, that is, that there was a depression you could see. That was checked off not only by the wheel and rail in ordinary conditions, but by a wheel and rail that had been polished to smoothness, and the same thing occurred at about the same figures, between 19,000 and 20,000 lbs. On the other hand, at 150,000 lbs., I could find no effect on the wheel, either on cast-iron or steel wheel. I started out to smash the cast-iron wheel and failed. I could not do it by simply loading it vertically on the rail. I have here diagrams which show that after the wheel has gotten up to about 37,000 lbs. it begins to break down the rail very rapidly under the cast-iron wheel; in other words, that the whole of the compression or depression is in the rail between the two metals, and that the cast-iron wheel does not partake of this at all, so that the rail has to take the whole strain, and that this excessive load put on the rail breaks down the metal and causes it to give way and the size of the spot to grow, and it grows very much more with cast-iron than it does with steel wheels, simply because the cast-iron wheel does not take up part of that compression itself.

That is the case I have to present for the solid steel wheel, that its metal is fully equal to that of the ordinary steel tire, and in this connection I want to add one word more. You will remember those very valuable experiments of Professor Goss, two years ago, I think, in which he gave the strength of the flange of a cast-iron wheel as ranging from 40,000 to about 90,000 lbs., with an average of 70,000 lbs., though in my own work I did not obtain one wheel that broke at 116,000 lbs. That is to say, that is the pressure that was required to break the flange directly back off from the wheel.

On a solid steel wheel the pressure required was 556,000 lbs., so that so far as the strength and wearing qualities are concerned they stand fully on a par with the steel tire. There is no doubt but that the steel wheel is simply sufficient to do the work. So that in summing up the case it seems to me that so far as the physical and chemical qualities of the metal in the wheels are concerned, and as far as the results of wear in service are concerned, the solid steel wheel, in showing what it has accomplished and what it can be depended upon to accomplish, is fully equal to the steel-tired wheels, and it simply remains a question of price and the value of the scrap and the other elements which enter into it, to decide as to whether the solid steel wheel shall be used in passenger service, or whether it shall be laid aside and the built-up steel-tire wheel be used in its place.

Railway Telegraph Superintendents.

The Association of Railway Telegraph Superintendents held its annual meeting at Atlantic City June 19, 20 and 21, President E. A. Chenery (Mo. Pac.) in the chair. After the completion of routine business the first paper was one by Mr. H. C. Hope on the examination of telegraph operators for railroad work. This will be published in the *Railroad Gazette*. In the discussion of the paper, Mr. Griffith of the Erie invited the members to visit the training school maintained by his company at Elmira, N. Y. At that school students are taught a number of branches of railroad work, but the telegraph course must always be taken first.

This finished the forenoon, and in the afternoon papers were read by Mr. F. E. Bentley on the Superintendent of Telegraph and by John D. Taylor, of the General Electric Company, on Inductive Disturbances of Telegraph Wires by Parallel High-tension Lines. This question was also the subject of a paper by W. C. Stowell (C. & A.). Discussion on this subject was long and detailed, members telling of their experience and of means which had been taken to overcome disturbances. Mr. Griffith, of the Erie, said that in the vicinity of Rochester, N. Y., he had had to put up metallic circuits to get rid of inductive interference.

The second day was begun with a paper by S. L. Van Akin, Jr., Assistant Superintendent of Telegraph of the New York Central Lines on the operation of long distance telephone lines. Mr. Van Akin described the organization of the telegraph and telephone service on his lines, emphasizing the features in which a railroad is at a disadvantage as compared with the telephone companies. The railroad has, however, an advantage in that it can use the Wheatstone bridge for locating trouble. The speaker described the duties of the monitoring wire chief as follows:

> He should watch the lines closely for any irregularities in the service, such as line trouble, noisy connections or unlawful use of the lines. He should see that employees are attentive to duty, that the rules and instructions for the operation and maintenance of the service are complied with, that employees are courteous in the performance of their work, and that all calls are promptly and properly established, and no partiality shown in the matter of precedence to establish connections. He should assist in any lawful way to accelerate the service, establish morning test calls and, whenever necessary to improve transmission, place telephone repeaters in the line and see that they are always in good condition. He should be responsible for the prompt clearing of the line of all switchboard connections on through calls, test the line to ascertain positively whether all switchboard connections, simplex coils, bells, etc., have been removed, and the line connected through at test boards and test panels before establishing the connection. He should keep a complete record of all interruptions and trouble on the line, and inform the Superintendent of Telegraph promptly of such interruption or trouble and advise him when communication is restored. He should check the standard of insulation and resistance of the entire line at least once each month.
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> Wire chiefs should be located at division terminals if possible, as is also the case with the monitoring wire chiefs. The latter, however, must be located at telephone repeater stations, where repeaters are used, and these stations should be equipped with every convenience for the proper handling and supervision of the service.
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> The telephone set on a monitoring board should be equipped with a high impedence receiver, so that the monitor can remain in on connections without noticeable loss in transmission; and, if a small switchboard is necessary at such a point for switching long distance connections, he should, to be in close touch with the operators and operation, handle it personally when on duty, and closely watch the nature of the business transacted.

One of the most important duties of a monitoring wire chief is to see that all stations have equal opportunity to establish calls. He must promptly forbid unauthorized calls.

To transact a maximum amount of business, it will be found necessary to limit calls during office hours to three minutes, excepting those made personally by certain company officials, whose communications should be unlimited. In order to protect unlimited service calls, a list of those entitled to unlimited service and precedence should be compiled and embodied in the fixed rules.

On the New York Central Company's line between New York and Buffalo, and the Lake Shore Company's line between Buffalo and Chicago, precedence and unlimited service are accorded to the President, Vice-Presidents, General Managers, Assistant General Managers, General Superintendents, Superintendents of Telegraph (who are responsible for the service) and Chief Engineers.

On account of the lines referred to being used for both short and long connections, the direct New York-Chicago circuit is connected into nine private branch exchanges, and at each of these points the line is bridged with 2,500 ohm bells; and, to operate Morse over the New York-Buffalo section, the line is equipped with six No. 37-A repeating coils. The impedance offered by each of these coils is equal to about 40 miles of No. 8 B.W.G. open copper line metallic circuit.

It was impossible to obtain good transmission on the line "bridged" with bells at seven intermediate stations, and with, approximately, the equivalent of 240 miles of additional circuit, due to the repeating coils, therefore it was necessary to inaugurate a system to quickly clear the line of everything that would impede transmission, as follows:

The signal symbol "39" is authorized by operators and wire chiefs on all calls between points on the New York Central lines and points on the Lake Shore lines exclusive of Buffalo. The operator at the originating station immediately clears the advance line of limited service calls, and passes the symbol, naming destination to the advance station, and then notifies the home wire chief. Operators at intermediate advance stations immediately clear the advance line, relay the symbol and notify their wire chiefs of the "39" connection. The wire chiefs so notified, immediately acknowledge the symbol call notice to the monitoring station and connect the line straight through at the line jacks. As soon as the monitoring wire chiefs are in communication on all New York-Chicago calls, it requires about 30 seconds to test the line between Ravena, N. Y., and Elkhart, Ind., a distance of 700 miles, to see that it is absolutely clear of all office equipment. If they find that some one has failed to connect the lines straight through, which is very seldom the case, it may take an additional one minute to remove the remaining equipment. Assuming that the line is found to be clear, they immediately notify the originating and terminating stations to proceed, and at the same time insert the telephone repeaters in the line. To follow these instructions to the letter and establish a call between New York and Chicago covers a period of about six minutes, and the quality of transmission is dependable. By the process described, all difficulties due to the "bridging bells" have been removed. The line is shortened, approximately, 240 miles by the removal of the simplex coils and, as the two sets of telephone repeaters are equivalent to 360 miles gain in transmission, the total 970 railroad miles is reduced to 610 open line transmission miles.

After a through "39" call is completed, the monitoring wire chiefs, who are monitoring the service at the repeaters, immediately notify all intermediate wire chiefs, by Morse, that the line is released from the through service. The intermediate wire chiefs watch a designated wire until the notice of release is received, whereupon they connect all equipment normal and notify their switchboard operators accordingly. The telephone circuit is cleared and placed in local service in 30 seconds.

In the local operation of the line no two stations are allowed to hold the line to establish more than six calls or for a time period of thirty consecutive minutes. Unless the use of the line is so limited, it would be impossible to transact business between all points without protracted delays at one point or another.

Telephone service on the New York Central Lines was proposed in 1902, authorized in June, 1903, and the line construction completed December 3, 1904; but the quality of transmission obtained between New York and Chicago was very unsatisfactory up to August, 1906. Established precedent in the operation of the line was the principal cause for much of the confusion and difficult transmission experienced previous to this date; the radical departure outlined above has brought about the present satisfactory conditions. The New York Central officers now believe that their New York-Chicago service is decidedly better than what they can get from the commercial lines.

In the discussion of Mr. Van Akin's paper, reference was made to an underground telephone cable between New York and Philadelphia, which it was declared has not proved economical. Pupin coils are used in this cable.

Mr. Chetwood described a new design of telephone instrument which is used for transmitting train orders on a branch of the New York Central.

In the afternoon Mr. G. A. Cellar, of the Pennsylvania Lines West of Pittsburg, described some concrete telegraph poles which he has put up.

Mr. Cellar prefaced his account of the concrete poles which he has erected with a brief review of the history of timber poles. As long as timber poles are used he believed that they should be treated with a good preservative for 2 ft. above and 2 ft. below the surface of the ground, feeling sure that this will amply repay the cost of the work. Steel poles of various designs are in use for telegraph lines and kindred service, but steel is not much longer lived than wood unless the inside as well as the outside of the structure is open to inspection and for reapplication of preservative. Reinforced

concrete, however, has unlimited possibilities. Moreover, the railroads, with their better protected rights-of-way, are now prepared to use shorter poles than heretofore. In Europe where trespassers are kept off the right-of-way short poles are the rule.

Concrete poles were used on the Panama Railroad in 1856, but they were not of good design. In late years a few poles have been put up at Hampton, Va., and Brooklyn, N. Y., those at Hampton being of triangular section measuring 12 in. on each side at the bottom and 6 in. at the top. These poles are 30 ft. long. The Brooklyn poles are 60 ft. high. At Brownsville, Pa., there are poles 150 ft. high supporting a wire 1,014 ft. long stretched across a river. These poles, however, have anchorages.

Mr. Cellar's first concrete poles were put up at Maples, Ind., 53 of them. These he described. He calls his description a progress report, and does not claim to have yet hit upon the most suitable shape.

The poles are 30 ft. long and of two shapes, one square and one octagonal. The upper third is solid and the lower two-thirds hollow, the thickness of the walls being from 1¾ in. to 3 in. These poles weigh 3,500 lbs. each and withstand any strains that are likely to be put upon them by a line of 50 wires, with each wire coated with enough ice to make it 1 in. in diameter. In testing these poles they were set in concrete bases 3 ft. x 3 ft. x 5 ft., and they were compared with cedar poles of the same length set in the same kind of base. The concrete poles are reinforced with four round iron rods 24 ft. long, ¾ in. in diameter, close to the surface, and four similar rods ⅛ in. smaller. The octagonal poles are 13 in. in diameter at the base and 8 in. at the top, tapering 1 in. to 5 ft. Holes are cast in the poles for cross-arm bolts and wooden blocks are set in at suitable places to support galvanzied iron steps and cross-arm braces. The poles were tested by a horizontal pull 10 in. from the top. The concrete poles failed by breaking near the ground line after being pulled from 25 to 39 in. from the perpendicular with stresses of about 3,000 lbs. After the concrete had broken the reinforcing rods resisted a pull nearly as great as that required to break the concrete, the wooden poles bent to arch shape before breaking. The concrete mixture was 1-3, but Mr. Cellar thinks that 1-2-4 would be better. He is not sure that the hollow post is the best design. Cement is a good insulator.

Mr. Cellar proposes to put up some steel poles embedded in just enough concrete to serve as a preservative; also some steel poles covered experimentally with a cement paint. He is also experimenting with reinforced concrete cross arms.

In the discussion of this paper, Mr. Camp, of the Canadian Pacific, told of the experience of his company in building telegraph lines. On the 11,000 miles of railroad owned by this company, all of which is equipped with telegraph lines, every pole is cedar; and timber is so cheap in Canada that concrete is not likely to find much favor there for a long time. Prices of poles are, however, advancing because of the great demand from the United States. On the western prairies the Canadian Pacific has to haul poles in some cases 550 miles. Thirty-foot poles now cost $1.30 on the cars at points on the Atlantic division of the road; $1.50 on the Lake Superior division; $1.85 on the Central division, and $1.20 on the Pacific division. Experiments with preservatives have proved too costly to be continued. The life of cedar poles is extremely variable. On lines erected in 1877, about half of the poles are still good for a few years' more service.

The next paper was one by U. J. Fry (C., M. & St. P.) on dry batteries, the use of which for short block signal circuits has proved highly economical on Mr. Fry's road. This paper will be printed in a future issue.

A brief paper was presented by Mr. R. L. Logan, Superintendent of Telegraph of the Kansas City Southern, describing his practice in connection with error sheets received from the Western Union Telegraph Company. He has a regular form for sending such sheets to the managers of offices along his line, in which he warns the manager that after a given date the original messages for the month in question are to be destroyed. The manager is to send postal card inquiries to offices with which there is a disagreement, and if a response is not received in 10 days he is to send a duplicate postal card to Mr. Logan's office. An agent who leaves the service at his station while an error sheet is pending must take a receipt for it from his successor. He must keep a memorandum of the correspondence and make all remittances by express.

Mr. Logan sends these sheets to agents by registered mail, and if in 10 days he does not receive a receipt he calls the agent to account; in 20 days he sends a sharper notice. Where a message has been sent collect and the receiving office has come back with a demand for collection from the sender and has not been satisfied, Mr. Logan calls for the settlement of the error within five days. He keeps a full record in his office of all error-sheet communications, so that the loss of one of them need not cause serious delay. The Western Union now requires original messages to be preserved eight months instead of six months as formerly.

Mr. G. W. Dailey, of the Chicago & North-Western, read an interesting paper on Opportunities in the Telegraph Service, in which he held up a high ideal of efficiency for operators, despatchers and all classes of telegraph employees. Describing the ideal agent, Mr. Dailey said:

> He realizes the importance and responsibilities of his position. He is the color sergeant of his company. He knows he is practically the General Manager and everything else at his station, and that the road he represents is gaged by his calibre and is judged as he is judged. It stands in the estimation of the community largely as he stands. He is representative of it. He keeps peace in the family and in the vicinity; keeps his officers posted as to everything of interest in his community; knows he can do more good advertising for the company than any one else, and does it. He does not complain that his salary is too small, but says he will make himself so valuable that they cannot get along without him, and that they will have to promote him, when he will receive more salary. He reasons that so long as he is a part of the organization he wants to be a strong part and do everything to further its interests while he is a part.
>
> He does not disparage the company he works for, as that would disparage himself. If he can't get in line he will get out. He isn't carrying water on both shoulders. If a member of a labor organization, he is loyal to both and to the advantage of both. If he has any trouble or grievances he does not proclaim them from the house tops, but wisely keeps them in the railroad family and doesn't trouble the general public with them. When his townsmen feel that they should be in fashion and do a little legislating against the railroads, he knows that he can do more than any one else on the road to offset it, and does so. He tells his neighbors some of the good things his company does; gets out and shows people where they are misinformed and what the road has done for their town, even though they won't admit it; explains many things that are not understood; stands by his colors so well that even his opponents respect him for it; tells his town people that his company is the best on earth, and says it so often, and stands by his guns so well that by and by they think so themselves. They also think he is the best agent on earth, and wouldn't have any other. After a while the company finds it out and he is promoted. He has made and improved an opportunity.

Mr. Dailey holds that the train despatcher, who has to look after cars and motive power as well as trains, should not be charged with the duties of examining, appointing and supervising the station telegraph operators. He urged his hearers to go over their lines often enough to keep acquainted with their men. The man at a small station has no opportunity to talk with the officers, and if he is to improve himself he has to perform the task under constant difficulties. He absorbs his ideas from the men with whom he works, instead of from an approved and authoritative source. The night operator especially, at a country station, may be a failure or may quickly qualify himself for a higher place, according as the despatcher guides, counsels and encourages him, or fails to do so. A supervising officer, whether a superintendent or despatcher, should find ways to keep in touch with the operators and agents. By proper effort these men can be shown that belonging to a brotherhood does not necessarily prevent them from being loyal to the company.

Owing to lack of time, papers on Standard Time, by W. J. Camp (C. P.); on the Railway Telegraph Service, by J. Browne; on the Visible Supply of Telegraph Poles, by W. W. Ashald, and on Uniformity in Office Installation, by E. Parsons, were ordered printed without being read.

Montreal was selected as the place for next year's meeting, and the date is June 24, 1908. The election of officers resulted in the choice of E. P. Griffith (Erie), New York City, President; W. J. Camp (Canadian Pacific), Montreal, Vice-President, and P. W. Drew (Wisconsin Central), Milwaukee, Secretary and Treasurer.

The foregoing completed the business of the second day. On the third day a paper on Wire Testing was read by L. M. Jones (A., T. & S. F.).

The convention having voted in favor of holding quarterly meetings in the East and in the West, the new President, Mr. Griffith, announced the appointment of Charles Selden, of Baltimore, chairman; L. B. Foley and A. B. Taylor, of New York, as a committee to have charge of the quarterly meetings in the East; E. A. Chenery, of St. Louis, chairman; John L. Davis, of Chicago, and C. S. Rhoads, of Indianapolis, as the committee to have charge of the quarterly meetings in the West. These committees will notify the individual members of all quarterly meetings and the nature of the business to be transacted.

E. H. Grace, of Chicago, chairman of the standing committee on wire crossings, reported the work of his committee during the past year. Its labors consisted, among other things, in furnishing information to legislators regarding wire crossing on railroad rights of way. The report also included extracts from the state laws on the subject as found in various western and southern states. Loose practice in the construction of wire lines across railroads is still prevalent.

The committee on uniform pole construction has submitted to the members a list of questions, and from the answers a paper will be prepared on this subject for the next annual meeting.

Mr. J. L. Davis, of Chicago, read the report of the committee on Uniform Transfer Blanks, which were designed for the purpose of transferring incomplete business from one operator to his relief when his duties have been finished.

While in Atlantic City the members were invited by Mr. Marshall, of the United Wireless Company, to visit the wireless station there, which was in constant communication with ships at sea and with stations along the coast.

Railroad Track of the Present and Its Possible Future Development.

At the May 29 meeting of the Western Society of Engineers, Mr. J. W. Schaub, Consulting Engineer, Chicago, presented a paper on the above subject. The wave motion in track, with its attendant creeping of the rails and possible breakage of rails, particularly where the ballast and substructure are frozen to uneven hardness and there are low joints, was touched on first. Reference was made to the investigation of the New York Railroad Commission on rail breakages covering the first quarter of the current year and reported in tabular form in the *Railroad Gazette* of May 17 in connection with the article on "Defective Rails." This article, and the extracts from letters from railroad officers accompanying same, were referred to in the paper and the illustrations of defective 100-lb. rails in connection therewith were reproduced in the stereopticon views with which the paper was illustrated. The quality of rails was next referred to, following which the paper said:

Is the difficulty due entirely to the poor quality of the rail? We have heard much of the speed with which rails are rolled, and of the high temperature of the steel when on the cooling bed. This may account for some of the difficulty; but, on the other hand, is the structure upon which the rail rests free from blame? To be sure, the quality of the steel can be improved, but so can the sub-

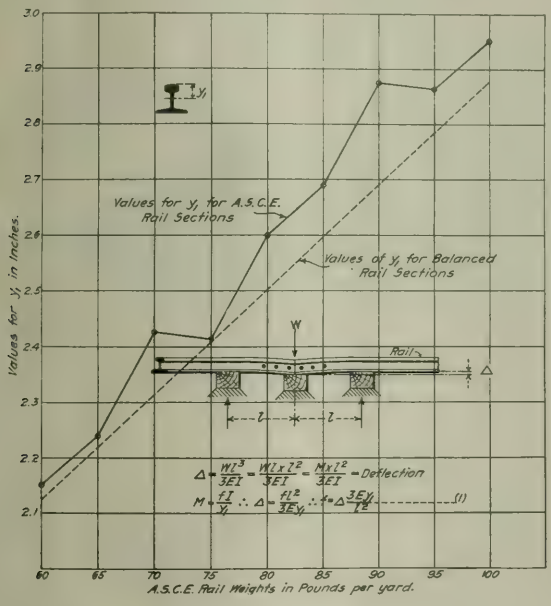


Fig. 1.

In the values for y_1 for A. S. C. E., and for balanced rail sections, it will be observed that the 75-lb. A. S. C. E. section comes practically on the balanced-section line, while the 90-lb. is the farthest away.

structure upon which it rests in the track. If it is true that the heavier rail sections have shown a higher percentage of breakages than the lighter sections under the same conditions, then the cause of the rail breakages should not be hard to find.

Increasing the weight of the rail in a track does not necessarily make a better track than a lighter rail does. Something must be left for the ties, ballast and substructure to do. If the original form of railroad track, with its strap rails laid on longitudinal timbers resting on cross-ties, had been developed along these lines to its logical conclusion, the present form of railroad track would have been unknown. Let us see what are some of the defects of the present cross-tie system of rail support. In the first place it is not mechanical. Given a line of rails which have to carry moving loads reaching 20,000 or 30,000 lbs. and more per wheel, the loads which they carry must be distributed over large areas. The cross-tie system accomplishes this by inserting 16 to 20 independent supports under each 30 ft. of rail, and upon the track department is placed the impossible task of so adjusting these supports that each shall bear an equal part of the load. This is the real secret of the enormous amount of labor spent on surfacing a track in order to carry trains at high speed, and it is a work that goes on forever. Moreover, assuming a joint has not been kept up to surface, what happens when a wheel passes over it? Within certain limits the ends of the rail will deflect until the tie receives a firm bearing; and all track shows, more or less, the effect of the lack of continuity in the rail by the dip of the rail at every joint. This happens in an instant, the operation is repeated by the next wheel, and so on (Fig. 1). Assuming the deflection of the end of the rail to be "Δ" when the tie reaches a firm bearing:

Let W be the wheel load
Let l be the space between the supports
Let E be the modulus of elasticity of the steel
Let I be the moment of inertia of the rail section

Then

$$\Delta = \frac{W l^3}{3EI} = \frac{Wlxl^2}{3EI} = \frac{Mxl^2}{3EI}$$

Let f denote the fiber stress on the rail due to bending
Let y_1 denote the distance from neutral axis to extreme fiber

$$M = \frac{fI}{y_1} \qquad f = \frac{My_1}{I} \qquad \Delta = \frac{fl^2}{3Ey_1} \qquad f = \Delta \frac{3Ey_1}{l^2} \qquad (1)$$

Equation (1) shows that for a given deflection of a rail the fiber stress varies directly with the distance of the outer fibers from the neutral axis, and nothing else. In other words, if the rail deflects until the tie brings up on a firm bearing regardless of the wheel load, then the stiffer the rail the more work it will be called upon to do, and consequently the higher the fiber stress on the steel will be. Now, is this not approximately what takes place under ordinary conditions? The load comes on the rail and if the rail lacks a firm bearing it will deflect until it finds a reaction. Equation (1) tells us that in order to reduce the work done by the rail it will be necessary to reduce the value of Δ. In other words, make the ballast and substructure as unyielding as possible so that the rail will be relieved from a duty which it is not qualified to perform, and which it should never have been called upon to perform.

To illustrate, let us assume that a fiber stress of 15,000 lbs. per sq. in. is acceptable for a working load, and y' for a 60-lb. rail to be 2.15 in., E = 30,000,000, and l = 40 in.; then for a 60-lb. rail,

$$\Delta = \frac{15{,}000 \times 1{,}600}{3 \times 30{,}000{,}000 \times 2.15} = 0.124 \text{ in.} = \tfrac{1}{8} \text{ in.}$$

Whereas, the fiber stress for an 80-lb. rail corresponding to a deflection of ⅛ in. is 18,000 lbs. per sq. in. In other words, for the

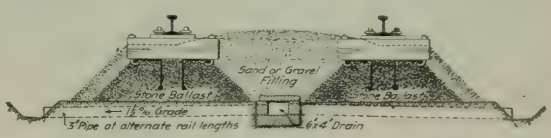


Fig. 2.

same deflection the 80-lb. rail should have 20 per cent. more breakages than the 60-lb. rail, all other conditions being exactly the same. To be sure, this is only approximately true, but it goes to show that if the track could be made as smooth and unyielding as a planer table, an ideal condition would be realized. If this is true, then the railroads are wasting their money in buying heavier rails.

But the usual argument against an unyielding roadbed is offered by the railroad manager about as follows: "The track must be elastic, otherwise the rails would be destroyed or broken, and therefore the present form of track must be maintained." Yet this same manager will order the heaviest rails to be placed in the track, to be supported on the heaviest ties that he can procure, and laid on the deepest ballast, to make a firm and unyielding roadbed as near as can be made by such devices. If a rail could be laid on a solid bed uniform throughout its entire length, so that every part is supported exactly the same as every other part, where will the rail break?

But how shall a roadbed be built that will meet such conditions? In the first place, the substructure upon which it is to be laid must be absolutely unyielding, and its foundation must be free from all moisture, or below the action of frost. In some cases concrete walls must be built upon which the superstructure is to rest. In other cases piles must be driven, each case being treated as the conditions require. Upon this the superstructure must be laid. This must be some departure from the cross-tie laid on ballast. Nothing can be expected from any longitudinal support laid on ballast, for it can be shown that unless some transverse support is given to the longitudinals, it will be impossible to keep such a track in surface.

In the *Railroad Gazette* for March 15, 1907, there is an article by Mr. Gustav Lindenthal, M. Am. Soc. C. E., showing a form of steel longitudinal support for track rails (Fig. 2.) This shows a rock ballast under two longitudinals, covered by a sand or gravel filling. Think of putting down a bed of clean rock for ballast and then covering it with sand, as though the difficulty in keeping the ballast clean is not enough without mixing it with sand! Referring to the cross-section of the steel longitudinal system shown above, it will be seen that when the system is in place as the author shows, there will be a nice little prism of broken stone supporting

the steel girder upon which the rail is to rest. Now, when with a good deal of labor this broken stone is packed into just the right shape, why not put something into it that will keep it there, instead of having it jarred out of place by the traffic? This form of track is being tried experimentally by the Pennsylvania Railroad on the Philadelphia division and the experience they are having with it is exactly as should be expected. It is impossible to keep such a track in surface. The reason for this is not difficult to find. Just turn the cut showing the cross-section upside down, and if you assume the pressure on the ground as uniformly distributed you can at once realize the tendency of the prisms under the rails to flatten out, and this is exactly what takes place in this form of track to-day. The system of longitudinal support will never prevail unless combined with some transverse support.

But how can this be accomplished? Take the present form of track, with cross-ties sawed to dimensions and surfaced on one side to uniform thickness, laid on a rock ballast at least 16 in. deep. Insert steel I-beams *temporarily* under the ends of the ties, so that each tie will have a full bearing on the beam at each end (see Fig. 3). The steel beams are to be of the "Special" type with broad flanges rolled only by the Bethlehem Steel Company. The beams are to be tied together by tie rods spaced 2 ft. centers, so as to confine the ballast between the beams. On the ends of the ties previously laid place a bond timber notched over the ties at least 1 in. and hold the same down by means of a hook-bolt passing through the tie and anchored to the inside flanges of the beams. An angle-iron nosing on the inside of the bond timber serves as a guard rail. After all is in place, the extraneous ballast, that outside of the beams, is removed. No part of this operation need interfere with traffic. In bringing such a track to surface, the entire structure is to be lifted by means of track jacks placed under the flanges of the beams. After the ballast is once in place very little work should be necessary to keep such a track in surface. The ballast is confined between the beams, so that an arch action can

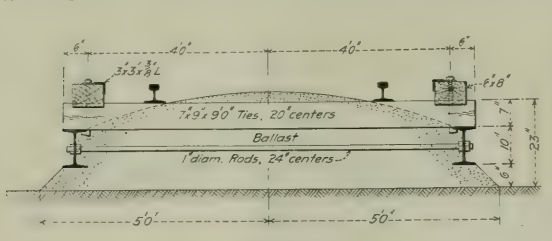


Fig. 3.

take place, with the thrust of the arch taken up by the tie-rods. This assumption makes it possible to find the tension on the rods and properly proportion them.

But, how does this form of track offer any advantage over the present form of track? Solely in the introduction of the longitudinal beams. These beams are to perform two distinct functions. First, the special beam, with a moment of inertia equal to five times that of an 80-lb. rail, and with 8 per cent. less metal, should do just five times the work done by the rail when both are working together under the same conditions, neglecting the work done between the cross-ties in either case. The work done by the rail would then be principally to distribute the load over the ties, and not to make up for the deficiencies in the substructure as it does now. Second, in confining the ballast, and thereby preventing the track structure from working its way down through the ballast as it does now in the present form of track, where under heavy traffic the ballast is kept in constant motion during the passage of trains, and the particles of the granular mass being free to move, they follow the line of least resistance, that is, out from under the ties. This explains why the ballast is so unstable and accounts for the enormous amount of labor necessary to keep a track in surface and alinement. With the proposed form of track, on a solid substructure, this should largely disappear. After this form of track has been proven by experiment to be correctly designed, the timber should be removed, and the ballast replaced by concrete flush with the tops of the beams, forming a permanent substructure upon which the superstructure is to be placed. At the same time the steel beams can be removed. This superstructure should be some form of longitudinal support bedded in concrete, so as to distribute the loads over large areas, offer perfect drainage and be absolutely imperishable and unyielding.

The authorities have directed that the best and most intelligent track hands on the Prussian State Railroads be organized into gangs whose special duty shall be to keep rail joints and switches in order. Badly drained joint ties, loose joint or switch ties, rails with differing levels at joints and all defects in frogs and switches are to be remedied as soon as discovered, and special efforts made to discover them as soon as they occur.

Production of Coal in 1906.

According to statistics compiled for the United States Geological Survey by Edward W. Parker, coal mining expert in charge, the total production of coal in the United States in 1906, was 414,039,581 short tons, valued at $512,610,744, an increase of 5.4 per cent. in quantity, and 7.5 per cent. in value.

Of the total production in 1906, Pennsylvania contributed 200,546,084 short tons, or 48.4 per cent. in quantity, and $262,182,935, or 51.1 per cent. in value, the larger percentage in the value being due, of course, to the higher value of anthracite, which is produced almost exclusively in that state. The anthracite production of Pennsylvania in 1906 was 63,645,010 long tons (or 71,282,411 short tons), valued at $131,917,694, while the bituminous production was 129,263,673 short tons, valued at $130,265,241. The anthracite production of Pennsylvania in 1906 was 5,694,142 long tons (or 6,377,439 short tons) less than that of 1905, with a decrease in value of $9,961,306, while the bituminous production showed an increase of 10,850,036 short tons in quantity and of $16,874,734 in value.

West Virginia has supplanted Illinois as the second coal producing state, showing a total output of 43,276,485 tons,* while the production of Illinois was 41,497,435 tons. This was due principally to the almost complete suspension of mining in Illinois (as in other states where labor union forces were strong) during all of April and a part of May, when the miners and operators were in conflict over the wage scale, whereas the majority of the operations in West Virginia were more actively worked, as a result of the suspension of work in the other districts. The West Virginia output increased from 37,791,580 tons in 1905 to 43,276,485 tons in 1906.

Notwithstanding the loss of from six to eight weeks in the states where mining operations were suspended, there was a general increase in production east of the Mississippi river, the only exception being in Michigan, Georgia and North Carolina. In Illinois, where the question of the wage scale is most sharply contested, the production increased from a total of 38,434,363 tons in 1905 to 41,497,435 tons in 1906. Indiana's production of coal increased from 11,895,252 tons in 1905 to 12,084,281 tons the following year. Ohio's production increased from 25,552,950 tons in 1905, to 27,729,843 tons in 1906, while the bituminous production of Pennsylvania increased from 118,413,637 tons in 1905 to 129,263,673 tons in 1906.

Among the other coal-producing states in which there was an increased production in 1906 were Alabama, Colorado, Iowa, Kentucky, Maryland, Montana, New Mexico, Tennessee, Virginia, Washington and Wyoming. In addition to the three states previously named in which decreases occurred, the following showed losses in tonnage: Arkansas, Indian Territory, Kansas, Michigan, Missouri, Texas, California, Oregon and Alaska. In California, Oregon, Arkansas, Indian Territory and Texas the decreases were due principally to the use of fuel oil.

Production of Coal in 1906, by States.

State.	Production.	Value.	State.	Production.	Value.
Alabama ..	13,107,663	$17,467,886	New Mex...	1,963,558	$2,635,571
Arkansas ..	1,864,518	2,999,774	North Dak..	300,998	437,894
Cal. & Alska	30,831	78,684	Ohio	27,729,843	30,386,297
Colorado ..	10,114,074	12,738,509	Oregon	79,731	212,338
Ga. and N.C.	363,463	407,247	Pennsylvania:		
Idaho & Nev	6,165	24,238	Anthracite	71,282,411	131,917,694
Illinois	41,497,435	44,742,440	Bituminous	129,263,673	130,265,241
Indiana	12,084,281	13,105,168	Tennessee ..	6,262,686	7,682,124
Ind. Ter. ..	2,859,450	5,481,053	Texas	1,160,707	2,058,731
Iowa	7,321,639	11,688,598	Utah	1,773,847	2,411,992
Kansas ...	6,010,858	8,935,195	Virginia ...	4,275,815	4,207,521
Kentucky ..	9,673,536	9,794,823	Washington.	3,276,184	5,908,434
Maryland ..	5,434,528	6,473,829	W. Virginia.	43,276,485	40,717,382
Michigan ..	1,336,338	2,402,529	Wyoming ..	6,138,152	8,019,486
Missouri ...	3,755,778	6,163,449			
Montana ...	1,787,934	3,186,620	Total ...	414,039,581	$512,610,744

The Salving of the "Suevic."

BY A. G. HOOD.
Editor of *The Shipbuilder*.

The salving of the White Star liner "Suevic," although not altogether unique, represents one of the most difficult engineering feats accomplished in recent years, and the success which has crowned the operations has created world-wide interest.

It will be remembered that on the night of the 17th of March last the "Suevic," a fine twin-screw vessel 550 ft. long and 12,500 tons gross register, struck a reef of submerged rocks about a quarter of a mile off the Lizard Point, Cornwall. Although a heavy sea was running at the time of the mishap all the passengers were safely removed from the ship without any loss of life.

From the beginning it was apparent that it would be impossible to save the whole ship. The fore end, for a length of about 150 ft., was badly pierced and firmly wedged on the rocks. At high water, the after portion, representing about 400 ft. of the vessel's total length, floated free. At low water, however, this after part rested heavily about amidships on two sharp projecting rocks, which, with the motion given to the vessel by the waves, threatened to pierce the bottom. The first duty, therefore, in order to prevent further damage, was to remove these rocks. Divers descended; with the

*This and following figures all in short tons.



Fig. 1—The "Suevic" at Low Tide Shortly After Stranding.



Fig. 2—Bow of the "Suevic" Left on the Rocks.

aid of pneumatic tools holes were drilled, and the pinnacles were removed by blasting.

Preparations were then made to cut the vessel in two about 180 ft. from the stem, and thus save about two-thirds of the ship, containing the valuable twin-screw propelling machinery and the passenger accommodation. The severance was to be made forward of the second mast, about the middle of No. 3 hold. This hold, which was insulated for cold storage and filled with carcases of mutton, had been flooded. Owing to the ship being loaded, the



Fig. 3—After End of the "Suevic" in Dry Dock at Southampton.

divers had to work from the outside of the hull, and the conditions of working were rendered extremely difficult by a strong spring tide race under the vessel's bottom. The whole of the cutting process was accomplished by exploding gelagnite cartridges, no drilling being attempted. As the work of blasting proceeded, the carcases of mutton constituting the cargo were liberated, and these, as may be imagined, were a source of considerable inconvenience to the men. On account of the heavy seas, work under water was not continuous, but during the periods of inaction below water progress was made with the cutting of the side plating above the water level and the deck plating. As the gap in the ship increased, the after portion began rolling independently of the fore part, and in conducting the blasting operations the men were in considerable danger.

Towards the completion of the severance, careful preparations to haul off the after end were made. Precautions were also taken to prevent the salved portion being driven end on to the fore part, or swung round by the sea or current. The engines of the vessel were kept under steam continuously for 24 hours previous to the completion of the cutting process, and heavy anchors were laid out astern with steel wire hawsers kept taut by the vessel's winches. In all, five anchors were used. Everything having been got ready, two tugs and one of the salvage steamers, aided by the vessel's engines and winches, were successful in towing off the after end of the ship April 2d, the herculean task of cutting the vessel in two having only occupied six days. The flotation of the after end was assured by the transverse watertight bulkhead dividing No. 3 hold (through which, as already explained, the severance was made) and No. 4 hold. The after end, floating on an even keel, was got under way, and, under its own steam and guided by three tugs, proceeded stern first up the English channel. Southampton was safely reached on April 4th, and the wreck berthed at the Test Quay, where it proved an object of interest to thousands of spectators. Much of the machinery on the abandoned fore part of the "Suevic" was also recovered, including the refrigerating plant.

The salving operations were performed by the Liverpool Salvage Association, under the direction of Captain McClellan, on the "no cure no pay" basis. Captain Murray superintended the work on behalf of the White Star Line. The Liverpool Salvage Association and the owners' officials are to be congratulated on the successful termination of their courageous efforts, which have resulted in the saving from destruction of the greater portion of a costly vessel.

Messrs. Harland & Wolff, the famous Belfast shipbuilders, by whom the "Suevic" was built in 1900, have now under construction a facsimile of the fore part of the vessel left behind near the Lizard. This will be launched in the same manner adopted with a complete hull, flotation being secured when the portion leaves the stocks by the aftermost transverse bulkhead. The new fore end will then be towed to Southampton, where the work of joining it to the salved portion will be carried out in dry dock. The principal dimensions, lines and tonnage of the reconstructed "Suevic" will be similar to those of the vessel before the accident, and great care will be taken to ensure the complete homogeneity of the united structure, so that when the liner is again put into commission she will be as stout and strong as any new steamship just leaving the hands of her builders.

As already stated, the idea of cutting a stranded vessel in two, in order to save part of the structure, is not new. The first ship so treated was the "Milwaukee," of 7,317 tons, now owned by the Canadian Pacific Railway Company, which ran ashore off the Aberdeen coast in the late autumn of 1898. As in the case of the "Suevic," the after part of the ship containing the propelling machinery was saved and towed to the River Tyne, where a new fore end was constructed, launched and fitted by methods generally similar to those being adopted for the reconstruction of the "Suevic." The fourth illustration is not a photographic trick, as one might well imagine on glancing at it, but an actual photograph of the new fore end and the old after end of the "Milwaukee" lying alongside each other at Wallsend-on-Tyne, before being joined together in dry dock. This feat, which attracted much attention at the time, was performed by Messrs. Swan, Hunter & Wigham Richardson, the original builders of the vessel.

The accident to the British torpedo-boat destroyer "Syren," which stranded during naval manœuvres in 1905, also necessitated the abandonment of the fore end of the vessel. Messrs. Palmers,



Fig. 4—The Bow and Stern of the "Milwaukee."

of Jarrow-on-Tyne, were responsible for the construction of the new portion, which was successfully joined to the salved after end. Very similar operations were performed in the case of the "Highland Fling," a vessel of 3,822 tons, which stranded off the Cornish coast a few months ago. The work at the "Suevic," however, constitutes the greatest of these interesting salvage feats owing to the size of the vessel and the difficulties under which the operations were conducted.

GENERAL NEWS SECTION

NOTES.

A reciprocal demurrage law is now in force in the state of Washington.

General William J. Palmer has given to the Engineering School of Colorado College, Colorado Springs, the sum of $12,000 to be used for additional equipment of the engineering laboratories.

The Texas Central has notified the State Railroad Commission of Texas that it will run sleeping cars of its own between Waco and Rotan, 286 miles, and that the rates for berths will be $1.50 lower and $1.00 upper.

On July 1 the American Express Co. is to supersede the United States Express on the lines of the Lake Shore & Michigan Southern west of Cleveland; and on August 1 the same change will take place on the Lake Erie & Western.

At Chicago June 20 the United States District Attorney, acting in behalf of the Interstate Commerce Commission, filed a suit against the Chicago, Indianapolis & Louisville to enjoin the road from exchanging passenger transportation for advertising in a magazine.

The Southern Pacific, the San Pedro, Los Angeles & Salt Lake, and the Nevada-California-Oregon railroads have brought suit in the United States District Court at Carson, Nev., enjoining the enforcement of the reduced rates ordered by the legislature of Nevada at its last session.

It is announced in Topeka that the railroad commissioners of Kansas are to order a general reduction of passenger fares in the state to 2 cents a mile. At present this rate is required in that state only in the case of mileage books. It is said that the railroads probably will not object to making the rate general and thus getting rid of the mileage books.

A press despatch from Washington June 24 reported that in a sleeping car arriving in that city that morning on the Pennsylvania Railroad every passenger's clothes and baggage had been rifled and all of the money taken therefrom, some of the men's garments being found afterward in the smoking car. The thieves seem to have escaped without discovery.

The New York 16-hour law, applying to railroad employees connected with the movement of trains in the state, the passage of which was reported last week, goes into effect March 4, 1908, the same date on which the similar Federal law goes into effect. The New York law does not apply to railroads under 30 miles long. The penalty for disobedience is a fine of $500 to $1,000.

The New England Gas & Coke Co., of Boston, is having built three new steam vessels to bring coal to its gas works at East Everett, near Boston, and announces that within a few months, or as soon as these vessels are finished, the company will sell bituminous coal to manufacturers on the lines of the Boston & Maine Railroad at prices decidedly lower than those now prevailing.

The Governor of Pennsylvania has approved an appropriation bill granting to the new railroad commission of that state for expenses for the next two years $150,000. The state has appropriated $200,000 for the improvement of the Delaware river front at Philadelphia and the deepening of the channel; $1,000,000 for highways, which doubles the amount available for that purpose in the state, and $500,000 for the purchase of forest lands.

At Hornell, N. Y., this week, it was stated that the Erie Railroad has been paying the International Association of Machinists $10,000 a year to keep the association from ordering a strike of the machinists in the railroad company's shops. This statement is given on the authority of General Manager Stuart, who is reported as saying that the receipted vouchers for the sums paid to the representatives of the association in order to keep the peace can be seen at the headquarters of the road in New York City.

At New York City last week Mr. Decker, Agent of the Interstate Commerce Commission, heard testimony in the complaint of the Commissioner of Immigration at New York City, Mr. Watchorn, concerning passenger fares charged to immigrants from Europe on railroads running out of New York. It appears that to Philadelphia and some other short-distance points the rate for immigrants riding in the ancient cars of immigrant trains is about the same as regular first-class fare, the former difference between the classes having been obliterated by the recent reduction in the first-class rate.

Early last Saturday afternoon a section of the New York Central's feed wire and transmission cables near 126th street was burnt out. The trouble was started by a short circuit in the feed wire cables which deliver current from the transforming stations to the third rail. The cables at this point are carried on top of the east girders of the viaduct. When the current was short circuited to the iron pipes which carry the cables, the metal was fused and the heat melted the pipes carrying the higher tension transmission cables, so that they also were short circuited. Before the current was turned off the blaze had spread over nearly two blocks, iron pipes, cables and even parts of the girders being melted.

M. N. Forney Is Married.

Under the many banterings which Mr. Forney has had from his friends concerning his rather prolonged celibacy, he has never said that he intended to remain a bachelor. A letter received from him last week begins as follows: "There is something of very grave import in my mind, which it is the purpose of this letter to communicate to you. It is that I have come here to Baltimore to be married, and it is expected and intended that the event will take place next week." The bride is Mrs. Annie V. Spear, of Baltimore, a friend of many years, and with all friends of Mr. Forney we join in hoping and believing that he is now achieving that happiness which he so fully deserves.

Colorado Railroad Commissioners.

The Governor of Colorado has announced the appointments of the three members of the new state railroad commission; the last commission went out of existence 20 years ago. The members are: Frederick J. Chamberlin, Denver, Managing Director of the Investment Securities Company, London; Halsted L. Ritter, of the law firm of Bonynge & Ritter, Denver, and Bulkeley Wells, formerly Adjutant-General of Colorado.

Disastrous Collisions at Hartford and Pittsford.

In a butting collision between a westbound passenger train and an eastbound train near Hartford, Conn., on the Highland division of the New York, New Haven & Hartford, last Sunday afternoon, eight laborers on the work train were killed and 35 or more injured, the victims being in a car at the head of the train, which was being propelled by an engine at the rear. One of the two main tracks at this point had been given up to the work train until a certain hour on Sunday evening, and it appears that the collision was due to some misunderstanding or misinterpretation of orders as to when the right of the work train expired.

In a butting collision between a passenger and a freight train on the single track line of the New York Central at Pittsford, N. Y., on the same day as the above, four passengers and one other person were killed and a dozen or more were injured.

Merits on the Atchison.

The Santa Fe Employees' Magazine continues to publish each month a list of the merit marks recorded on employees' records, and in the June issue has 2½ pages filled in this way. We have not the space for extended extracts, but we reprint the notes of a half dozen cases in which the reasons for granting the merit marks were somewhat unusual.

W. J. Russell, check clerk, five, for detecting error in routing on waybill and correcting it so as to give the company the long haul.

Conductor F. J. Thomas, Brakemen J. K. La Prade and M. M. Penrod, Engineer L. Morrison and Fireman Henslect, Albuquerque division, 20 each, for bringing to life engine that had broken blow-off cock. They took broken parts to private shop for repairs, borrowed a hose from the city fire department, refilled engine, fired up and brought their train forward.

J. S. Harlan, conductor, 15, for handling stock train in an emergency without brakemen, and putting in two brasses on the trip, thus avoiding a serious delay and claims.

W. G. Adkinson, engineer, and F. G. Viets, fireman, 10 each, for interest shown in thoroughly cleaning engine 221 which was selected for the Kansas City Commercial Club special.

A. C. Bentz, brakeman, 20, for excellent service in cutting wire and reporting accident to train No. 8 at Symons, May 3. His prompt action made it possible to get assistance, start wrecker and reduce delay to train.

C. E. Baker and W. W. McLarney, conductors, 10 each, for interest and energy displayed in repairing a Lidgerwood ballast unloader and getting it into shape for service during the night, so that it was ready for use the following morning.

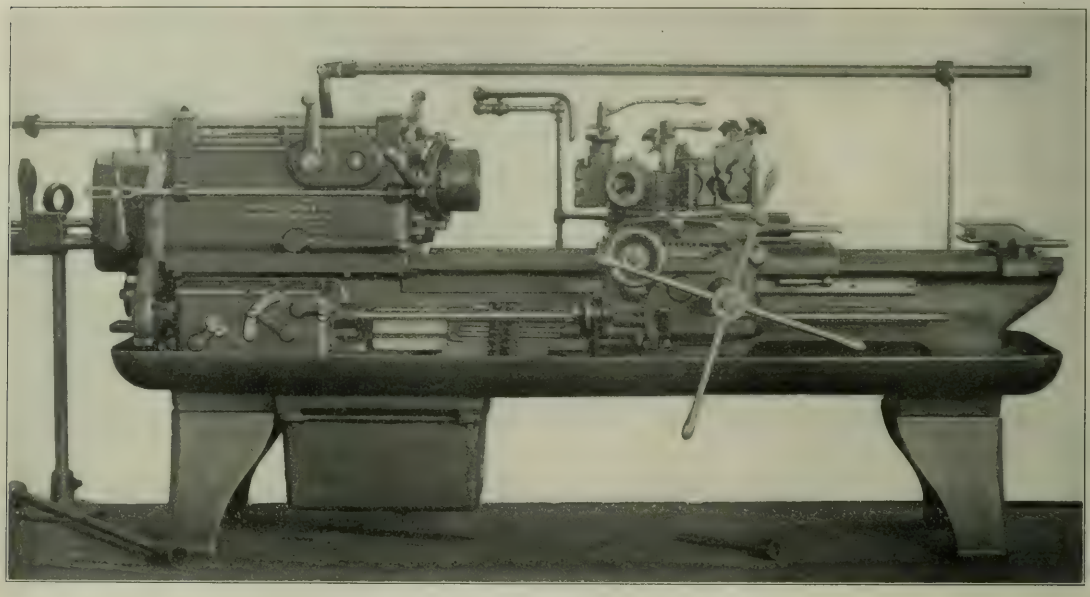
John G. Miller, engineer, 15, for prompt and energetic action upon discovery that switch was set wrong. A very serious derail-

ment to No. 10 was thus avoided and although the sun was full in his face, obscuring his vision, he discovered that the switch was wrong in time to stop his train.

C. W. Young, conductor, Western division, 10, for interest displayed in securing engine. Engine and telegraph failed but he used a roundabout long-distance telephone.

A New Open Turret Lathe.

The new Pratt & Whitney 2½ in. x 26 in. open turret lathe, shown in the accompanying photographs, is a universal machine suited to a great variety of work on bar material and forgings and castings, without continually requiring special appliances and expensive cutting tools. The machine has the flexibility and adaptability of an engine lathe. The rigidity, powerful spindle drive, quick changes of speeds and feeds, heavy cross feeding turret and numerous adjustable stops make the limits of error narrower and reduce the cost of work as compared with the ordinary turret or engine lathe.



Pratt & Whitney Open Turret Lathe.

It has a stiff head, with constant speed arranged for either direct-connected motor or countershaft drive by a single pulley. The turret is mounted on a slide, having both longitudinal and traverse movement driven by power or hand. The machine is recommended for bar work up to 2½ in. x 26 in., for castings up to 14 in. diameter, and for cylindrical operations on work within these dimensions. An unusually heavy spindle of special steel, with cylindrical bearings, runs in bronze split sleeves. The thrust of the spindle is against an independent upright, cast solid with the head, preventing any springing tendency under heavy end cutting strains. Provision is made for taking up wear of spindle and end thrust.

The relation of the spindle to the work is governed by levers operating friction clutches. It is impossible to connect more than one set of gears with the spindle and main driving shaft at the same time. The gears are wide and of extra heavy pitch; they run in oil. The head, which is stationary, is of box construction. Eight speeds are provided, and by using the two-speed countershaft this range may be doubled. All the controlling levers and connections are within easy reach of the operator. The spindle can be instantly stopped by the movement of any lever on the head stock.

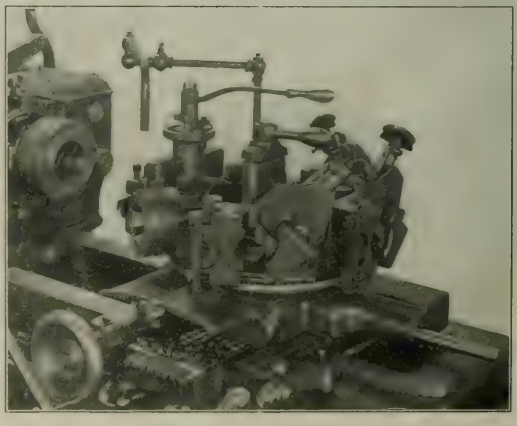
The rod chuck may be operated while the machine is running. The collet jaws are supported up to their outer end, which is particularly desirable in forming work from the cross slide. The complete chuck can be readily removed from the spindle when combination lathe chucks or special face plates for castings are to be substituted. A positive screw feeding device automatically feeds the rod forward to its stop. The bar may be round, square, hexagon or any irregular cross section, and need not necessarily be free from scale, as there are no delicate parts or complicated gearing to become clogged.

The follower bar allows short pieces of stock to be handled as conveniently as long bars and keeps such pieces concentric with the spindle. A stock stop for gaging the length of stock is provided, which, when not in use, is moved forward and swung upward, so as not to interfere with the turret tools. The turret revolves about a large conical stud held firmly in the cross slide.

The tools can be set accurately with rigid backing, so that the heaviest cuts can be taken without spring or backward movement. The tools are held in place by straps and are backed up by uprights cast solid with the turret. The locking bolt is directly under the cutting tool and is horizontal, so that it does not have the tendency of a vertical bolt to lift the turret from its seat.

Indexing can be done at all positions of the cross-slide; it is automatic, although the turret may be rotated to any position by hand. One of the most important features is the compound turret with power and hand feeds and adjustable stops conveniently located. The longitudinal turret slide travels on large raised "V's." It is provided with gibs its full length, and has a binder by which the slide can be firmly clamped to the bed at any point within its travel. The power longitudinal feed is positive in both directions, and has six changes, any of which can be instantly set by a lever movement.

There are six automatic longitudinal stops and six supplementary stops, which give two positions to each turret tool. If necessary, all 12 stops may be used for one or all tools in the turret, making it possible to effectively cover all requirements. The stops



Turret of Pratt & Whitney Lathe.

are held in a heavy steel bracket, which may be moved along the front of the bed and clamped where wanted. In case it is desired to run through a few special pieces of work, the automatic stops may be dispensed with and the supplementary stops used in their place without disturbing adjustments.

The distance from the axis of the spindle to the turret tool is altered by traversing the turret slide. This arrangement permits ample support for long bars and, if the machine is belt-driven, gives an unvarying belt tension. A motor can be mounted on the head without difficulty. The cross slide has both hand and power feed. There are six variations of the power feed in either direction. Eight distinct adjustable cross stops are provided, which may be used in any combination desired.

Bed and pan are made in one single casting and have "U" shaped cross webbing, insuring rigidity. There is plenty of room for oil and chips. Turret tools adapted to all usual requirements are furnished to order. The Niles-Bement-Pond Co., New York, is about to put this machine on the market.

Sir Thomas Shaughnessy Knighted by Japan.

Prince Fushimi, of Japan, has conferred on Sir Thomas Shaughnessy, President of the Canadian Pacific, the honor of second class of the Order of the Sacred Treasure, which is Japan's highest knighthood.

New Railroad Commission for Michigan.

The legislature of Michigan, on June 19, passed a bill providing for a railroad commission of three members, taking the place of the present single commissioner. The law also provides for reciprocal demurrage, and the commission is empowered to regulate freight rates. It may also require steam and electric railroads to deliver cars of freight to each other.

Stockholders, not Shippers, Are Oppressed.

I have no hesitancy in saying that no railroad fortune was ever made through enhancing rates, oppressing shippers, or withstanding the general tendency of rates to decrease. And what is more, every dishonest railroad fortune has been made, not by oppressing shippers, but through robbing the stockholders.—*Stuyvesant Fish.*

Medals for Railroad Heroism.

Railroad life saving medals have been awarded to Charles Arms, of Clarksville, Tenn., and Edgar E. George, of Parsons, Pa. Mr. Arms saved the lives of two mail clerks and a baggageman, who were in the wreck of Louisville & Nashville train 102, at Clarksville, Tenn., on September 29, 1906. The train ran through the open draw of the bridge over the Cumberland river, and the locomotive, mail and baggage cars dropped to the river 50 feet below. It was about 8 o'clock at night and dark. The river was in flood and full of driftwood. When the train fell into the river the two mail clerks and the baggageman, although terribly bruised and shaken, managed to break their way out of the cars and get on top, where they clung with all their remaining strength, shouting for aid, while the partly submerged cars were being rapidly swept down the river by the swift current. A number of persons were standing on the river bank when the accident happened; they saw the cars plunge into the river and heard the despairing cries of the mail clerks and baggageman for help, but did not go to their aid. At the time of the accident, Arms, who lives near, was in bed with malarial fever. He had been sick nearly four weeks. He heard the crash of the train as it fell. He immediately arose, and without waiting to fully clothe himself, made his way as rapidly as possible to the ferry landing. Here he jumped into a skiff and appealed to the bystanders for aid, offering $10, all the money he had, to any one who would go with him. No one would. In spite of attempts to dissuade him, Arms pushed off in the boat alone, and with cries of encouragement to the imperiled men, finally reached the cars and succeeded in taking them off and safely bringing them to shore. The medal was sent with an autograph letter of transmittal from President Roosevelt.

Edgar E. George saved the life of a Polish boy, whose foot had become fastened in a frog on the Delaware & Hudson track at Parsons, Pa. George and a number of other persons were on the station platform awaiting the approach of a fast passenger train when the screams of the lad attracted their attention. George immediately ran to the boy, hoping to extricate him. He made unsuccessful attempts to release the foot, and finding it impossible to do so before the train reached him, he seized the boy's body and, bending it down outside the rail, forced the imprisoned leg under the engine cylinders, oil boxes and car steps, which scraped the bodies of the two as the train passed. The engineer applied the emergency brake, but did not succeed in stopping until the locomotive and one car had passed over Mr. George and the boy. Mr. George's right hand was slightly cut and bruised. Beyond a badly strained foot and leg the boy was uninjured. Under the circumstances it was something of a miracle that both were not killed.

INTERSTATE COMMERCE COMMISSION RULINGS.

In an opinion by Commissioner Lane the case of Rau vs. the Pennsylvania and other roads is decided. The complainant ships bags from Newark, N. J., to Stanley, Luray and Greenville, Va., over the Pennsylvania, Cumberland Valley and Norfolk & Western roads, which are used in shipments of ground bark from Virginia to Newark, and on the bags 38 cents per 100 lbs. is charged, while on complainant's competitors' bags from Newark to Barboursville and Charlottesville, Va., via the Pennsylvania and Southern roads, a rate of 22 cents is in force, such difference in rates resulting from the use of different freight classifications. The Commission holds that the rate on bags from Newark to Stanley, Luray and Greenville should not exceed 22 cents.

Preference Given to Company's Truckmen.

In an opinion by Chairman Knapp, the Commission has decided the case of New York Team Owners' Association vs. Southern Pacific. The defendant employs a particular trucking firm to transport through shipments from railroad depots in and about New York City to its pier No. 25, in New York, and gives preference at the pier to the through traffic transferred by such trucking firm over traffic originating in New York and vicinity brought to the pier by other trucking firms. The pier is inadequate for the business and congestion and delay result. The pier is not closed at night until all waiting trucks are unloaded, and it is soon to be considerably enlarged. No instance of injury resulting to shippers or their traffic and no discrimination amounting to exclusion from the pier was shown. The Commission holds that such preference does not operate unduly or unreasonably against other truck owners, members of the complaining association.

TRADE CATALOGUES.

Mine and Quarry.—The current number of this quarterly magazine of the Sullivan Machinery Co., Chicago, is the first of Vol. II. It contains six interesting articles. The first, "The Panama Canal in April, 1907," was written especially for the magazine and treats the subject from the standpoint of its particular field. "Western Methods of Tunnel Driving," likewise written especially for this magazine, describes the methods used on the Ophelia tunnel in the Cripple Creek district of Colorado. Other articles are, "Economy in Quarrying Slate"; "Coal Mining at Bicknell, Ind.," a long, well-illustrated article giving the methods used by several of the big companies, which employ Sullivan devices; and "Mineral Prospecting at Cobalt." All the articles are illustrated.

Reinforced Concrete.—Part II. of "Trussed Concrete Illustrated" of the Trussed Concrete Steel Co., Detroit, Mich., Part I. of which has previously been noticed in these columns, illustrates the Kahn system of reinforced concrete as applied to mills and factories. It is prefaced by a brief discussion on essentials, first cost, maintenance, speed of erection, adaptability, etc., and the remaining thirty-odd pages show views of various mill and factory buildings built or under construction on this system, with a brief description. Trussed Concrete Bulletin No. 5, of this same company, is entitled "What Reinforced Concrete Is," the subject being discussed with particular reference to the principles and advantages of the Kahn trussed bar.

Burlington Convention Tours.—The Chicago, Burlington & Quincy, in connection with the other connecting roads concerned, has issued two folders showing the itinerary of two convention tours. One of these meetings is the annual convention of the Baptist Young People's Union of America at Spokane, Wash., July 4 to 7; the other, the convention of the National Educational Association at Los Angeles, Cal., July 8 to 12. The Burlington has been selected as the official route to these conventions by certain Chicago organizations. The photographs of scenes along the routes to these two western points are unusually successful.

Cranes and Foundry Equipment.—The Whiting Foundry Equipment Co., Harvey, Ill., has issued circular No. 76, "just to remind you" of some things the company does. The booklet indicates briefly the line of cranes and foundry equipment made, references being given in each instance to a more complete catalogue describing the device fully.

Velox Bronze.—A "reminder" sent by A. Gilbert & Sons Brass Foundry Co., St. Louis, Mo., calls attention to "Velox" bronze as a wearing metal for wearing parts of locomotives, cars, electric generators, etc.; also to the babbitt metal made by the company.

MANUFACTURING AND BUSINESS.

The report that the Evens & Howard Fire Brick Company, St. Louis, is concerned in a merger of St. Louis fire clay interests is without foundation.

The Passaic Steel Company, Passaic, N. J., has decided to stop making steel because of the high price of pig iron. The work of the mills is to be confined to bridge material and structural steel shapes.

William D. Ennis, who for the last two years has been making special investigations for the American Locomotive Company, New York, has been appointed Professor of Mechanical Engineering in the Polytechnic Institute of Brooklyn.

The Cleveland office of the Crocker-Wheeler Company, Ampere, N. J., has opened a sub-office in the Columbus Savings & Trust Co. building, Columbus, Ohio. The sub-office will be in charge of Charles W. Cross, formerly in the Cleveland office.

The Cutler-Hammer Manufacturing Company, Milwaukee, makers of electric motor controlling devices, has bought the Wirt Electric Company, Philadelphia, and will continue the making of battery charging rheostats, field rheostats and other apparatus heretofore made by the Wirt company.

The Bethlehem Steel Company has sold $2,500,000 6 per cent. 5-year notes guaranteed by the Bethlehem Steel Corporation, of which the first named company is a subsidiary. The proceeds of the notes will be used to pay for the completion of the new rail and structural steel plant being built at South Bethlehem, Pa.

The Northern Engineering Works, crane builders, Detroit, Mich., have recently shipped the following cranes for power station service: a 24-ton, 62-ft. span, for the Buffalo & Susquehanna Coal Mining Co., at Sagamore, Pa.; a 6-ton, 36 ft. span, for the Winchester & Washington City Railway, and a 5-ton 36-ft. span, for the Watertown Electric Light Co.

The Stone & Webster Engineering Corporation has recently ordered new equipment for the Pawtucket Electric Co., including four 520-h.p. B. & W. boilers equipped with Foster superheaters for 150 deg. superheat. The Virginia Passenger & Power Company, of Richmond, Va., has recently ordered some Allis-Chalmers turbines and B. & W. boilers equipped with Foster superheaters for 175 deg.

During the last two years the Allis-Chalmers Co., Milwaukee, has contracted to equip six electric traction lines, aggregating 318 miles of track, of which 150 miles is now finished and in daily operation. These six roads are: The Toledo, Port Clinton & Lakeside, the Cincinnati, Milford & Loveland Traction, the Winona Interurban, the Indianapolis, New Castle & Toledo, the Indianapolis, Crawfordsville & Western, and the Milwaukee Northern.

The Chicago Railway Equipment Company, Fortieth street and Princeton avenue, Chicago, has bought from the Chicago Junction Railway Company over 20 acres of land, bounded by Forty-fourth, Forty-sixth, Lincoln and Robey streets, with a portion extending west of Robey street. The ground has 600 ft. frontage on Forty-sixth street and 1,300 ft. on Lincoln street. The property cost about $200,000. A new plant is to be built here, on which probably $500,000 will be spent during the year.

H. A. McMoore, formerly with the Harlem Contracting Company, New York, has gone to the General Fireproofing Company, Youngstown, Ohio. Mr. McMoore will be in the reinforced concrete department, in particular charge of designing and estimating work in which the company's system is to be installed. A. A. Lane, who has been with the Taylor-Wilson Manufacturing Co., Pittsburg, for several years, will be office manager of the reinforced concrete department of the General Fireproofing Co.

Iron and Steel.

Negotiations are pending for light rails for electric lines in Cleveland aggregating about 8,000 tons.

The Harriman Lines are in the market for about 16,000 tons of rails for use on the Salt Lake extension.

The Cincinnati, Hamilton & Dayton has ordered 4,000 tons of rails from the Lackawanna Steel Company.

The Atchison, Topeka & Santa Fe has ordered 15,000 tons of rails from the Lackawanna Steel Company.

The Great Northern and the Northern Pacific have asked bids for about 21,000 tons of structural material for bridges.

The Bradley Contracting Co., which has the contracts for building part of the subway loop in the Borough of Manhattan, has ordered 4,000 tons of fabricated shapes from the American Bridge Company and 1,000 tons from Snare & Triest. The Carnegie Steel Company has an order for 5,000 tons of steel bars for the same work.

OBITUARY NOTICES.

M. H. Burkhalter, Superintendent of the McCloud River Railroad, died recently of heart failure while on a trip in the mountains.

William Findlay Shunk died on June 22 at his home near Harrisburg, Pa. Mr. Shunk was born at Harrisburg in 1830. After leaving Dickenson College he went into the United States Navy as a midshipman in 1846. After four years he left the Navy and began railroad work on the Pennsylvania in 1856. He was Assistant to the Engineer of the Lewisburg Center & Spruce Creek, now a part of the Pennsylvania; he was later for some years a clerk in the State Department, and also worked on Government surveys. Mr. Shunk's work from this time on was in connection with railroad construction. He was for a year Assistant Engineer of the Duchess & Columbia, now part of the Central New England, and then became Chief Engineer of the Connecticut Western, another Central New England line. In 1874 he was appointed Chief Engineer of the Six Elevated Railroad, serving in this position during an important period of the construction of the road, which is now part of the Metropolitan Railway. He was afterwards made Chief Engineer of the latter company, and in 1882 left to build the Southern Pennsylvania, now part of the Cumberland Valley. In 1887 he was appointed Chief Engineer of the Kings County Elevated in Brooklyn, the building of which he finished. He resigned in 1889, and in 1890 took charge of the survey of the Pan-American Railroad. The last railroad work which Mr. Shunk did was the building of the Guayaquil & Quito, of which he was Chief Engineer. He retired in 1902, and had since lived at Harrisburg. Mr. Shunk was the author of two well-known handbooks on Curves and Engineering.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Freight Claim Association.

At the annual meeting of this association in Denver, Col., June 20, 21 and 22, R. C. Richards, of the Chicago & North-Western, Chicago, Ill., was chosen President for the ensuing year. Next year's meeting will be held at Atlantic City, N. J., in the month of May.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Chesapeake & Ohio.—T. P. Fowler, President of the New York, Ontario & Western, and W. G. Oakman, Vice-President of the Interborough Rapid Transit Company, New York, have been elected Directors of the Chesapeake & Ohio, succeeding W. H. Newman and C. M. Depew of the New York Central & Hudson River.

Corvallis & Eastern.—J. P. O'Brien, Vice-President and General Manager of the O. R. R. & N., has been elected also President of the C. & E.; G. W. Talbot, General Manager and Treasurer of the C. & E., has been elected Vice-President and General Manager, and H. F. Connor, Secretary.

Interborough Rapid Transit Company.—See Chesapeake & Ohio.

Mexican Central.—John Albert Naugle, who was recently appointed Assistant to Vice-President Hudson, was born at Canton, Ind., in 1855. After a common school education, he began railroad work in 1869 as a newsboy on the Indianapolis & Vincennes, now part of the Vandalia. He learned telegraphy at Mooresville, Ind., and in three years was made agent and operator. After acting as agent at different places on several roads, he went to the Mexican International in 1884 as General Freight and Passenger Agent and Trainmaster. He was out of railroad work from 1888 to 1890, and then was appointed General Freight and Passenger Agent of the Sonora Railway and of the New Mexico & Arizona. In 1894 he was appointed also Assistant General Manager of both roads, where he remained until he took his present position with the Mexican Central a few weeks ago.



John A. Naugle.

New York Central & Hudson River.—See Chesapeake & Ohio.

New York, Ontario & Western.—See Chesapeake & Ohio.

Norfolk & Western.—Nicholas D. Maher, who will on July 1 become Second Vice-President and General Manager, was born in 1854 at Blairsville, Pa. He was educated at Mount St. Mary's College, and began railroad work in 1871 on construction and survey on the Virginia & Charleston. After two years he went into the office of Superintendent of Transportation of the Pennsylvania as a clerk, and the next year was made clerk in the General Superintendent's office. In 1883 he went to the Norfolk & Western as chief clerk to the General Manager. He was made Trainmaster of the Flat Top division of that road in 1889, and in 1890 was appointed Superintendent of the Pocahontas division. In 1901 he went to the Seaboard Air Line as General Superintendent at Portsmouth, Va., and two years later returned to the Norfolk & Western as General Superintendent. In the spring of 1904 he was appointed General Manager, the position he holds at present.



N. D. Maher.

Oregon Railroad & Navigation.—See Corvallis & Eastern.

Operating Officers.

Atchison, Topeka & Santa Fe.—D. Dugan has been appointed Superintendent of Terminals at Albuquerque, N. Mex.

Baltimore & Ohio.—J. Root, formerly chief despatcher at Cleveland, Ohio, has been appointed Assistant Trainmaster at that place.

Chicago, Milwaukee & St. Paul.—H. B. Earling, Assistant General Superintendent at Minneapolis, Minn., has been appointed General Superintendent of Western Lines, including the Pacific extension, with office at Butte, Mont.

R. P. Edson, Trainmaster at Mason City, Iowa, has been appointed Superintendent of the Western division. A. C. Peterson, Trainmaster at Mitchell, S. Dak., succeeds Mr. Edson.

Cleveland, Cincinnati, Chicago & St. Louis.—E. M. Costin, Trainmaster at Terre Haute, Ind., has been appointed Superintendent at Cleveland, Ohio, succeeding A. S. Ingalls, promoted. W. L. Lamport, Assistant Trainmaster at Terre Haute, succeeds Mr. Costin.

Erie.—J. C. Tucker, who recently resigned as Superintendent of the Rochester division on account of ill health, has been appointed General Inspector of Traffic, with office at Jersey City, N. J.

Hidalgo & Northeastern.—See National Lines of Mexico.

Interoceanic of Mexico.—See National Lines of Mexico.

National Lines of Mexico.—F. W. Baldwin, Superintendent of Transportation of the Interoceanic of Mexico, has been appointed General Superintendent in charge of the Interoceanic of Mexico, the Hidalgo & Northeastern, and the narrow-gage lines of the National Railroad of Mexico.

National Railroad of Mexico.—See National Lines of Mexico.

New York Central & Hudson River.—E. T. Hopkins has been appointed Trainmaster of the Richland district of the Rome, Watertown & Ogdensburg division. B. J. Wollaver, assistant chief despatcher of the Watertown district of the R., W. & O. division, has been appointed Assistant Trainmaster of that district.

Northern Pacific.—J. C. Roth has been appointed Assistant Superintendent of Transportation, with office at Tacoma, Wash. P. H. McCauley has been appointed Car Accountant, with office at St. Paul, Minn.

St. Louis & San Francisco.—H. F. Clark, Superintendent at Neodesha, Kan., has been appointed Superintendent at Sapulpa, Ind. T., succeeding R. V. Miller, resigned. Le Roy Kramer, Assistant to the Second Vice-President, succeeds Mr. Clark. George Geiger, who resigned as Superintendent of the Rio Grande Western last March, has been appointed Superintendent of the St. Louis & San Francisco, with office at Francis, Ind. T., succeeding J. W. Walton, recently appointed Superintendent of Transportation of the Missouri, Kansas & Texas of Texas.

Western & Atlantic.—Otto Best has been appointed to the new office of Superintendent of Terminals at Atlanta, Ga.

Traffic Officers.

Baltimore & Ohio.—J. W. Purner, commercial freight agent at New York, has been made also Acting General Eastern Freight Agent at New York.

New York & Ottawa.—H. K. Gays, Assistant General Passenger Agent, has been appointed General Passenger Agent, with office at Ottawa, Ont.

Engineering and Rolling Stock Officers.

Colorado Midland.—See Denver & Rio Grande.

Denver & Rio Grande.—W. H. Chambers, Assistant Master Mechanic of the Denver & Rio Grande at Helper, Utah, has been appointed to the new office of Master Mechanic at Grand Junction, Colo., of the Denver & Rio Grande, the Rio Grande Western and the Colorado Midland.

Erie.—W. E. Hebard has been appointed Engineer of the Buffalo division, with office at Buffalo, N. Y., succeeding W. B. Taylor, resigned.

Grand Trunk.—See Iowa Central.

Hidalgo & Northeastern.—See National Lines of Mexico.

Interoceanic of Mexico.—See National Lines of Mexico.

Iowa Central.—H. G. Kelley, Chief Engineer of the Iowa Central and of the Minneapolis & St. Louis, has resigned to go to the Grand Trunk, effective June 30.

Isthmian Canal Commission.—Joseph Ripley, Principal Assistant Engineer, has resigned, effective July 6, to go into private business in the United States.

Mexican International.—See National Lines of Mexico.

Minneapolis & St. Louis.—See Iowa Central.

National Lines of Mexico.—J. M. Reed, Chief Engineer of the National Railroad of Mexico, has been appointed Chief Engineer of Construction of the National Lines of Mexico. H. L. Cumming, Assistant Chief Engineer of the National Railroad of Mexico, has been appointed Assistant Chief Engineer of Maintenance of Way of the National Lines of Mexico in charge of maintenance of way of the Mexican International and of the standard gage lines of the National Railroad of Mexico. W. T. Ingram, Chief Engineer of the Interoceanic of Mexico, has been appointed Engineer of Maintenance of Way of the National Lines of Mexico in charge of maintenance of way of the Interoceanic of Mexico, the Hidalgo & Northeastern, and the narrow-gage lines of the National of Mexico.

National Railroad of Mexico.—See National Lines of Mexico.

Rio Grande Western.—See Denver & Rio Grande.

St. Louis, Iron Mountain & Southern.—P. Carroll, Division Engineer at De Soto, Mo., has been appointed Division Engineer at Little Rock, Ark., succeeding J. F. Peters, transferred to the Principal Assistant Engineer's office at St. Louis. E. C. Welch succeeds Mr. Carroll. J. A. Wright, roadmaster of the Valley division, has been appointed Division Engineer at Ferriday, La., succeeding J. A. Simmons, resigned.

LOCOMOTIVE BUILDING.

The Buffalo, Rochester & Pittsburg has ordered from the American Locomotive Company, for December delivery, 10 consolidation locomotives with cylinders 21 in. x 28 in.

The Norwood & St. Lawrence, as reported in our advance sheet of June 19, has ordered one simple mogul locomotive from the American Locomotive Company for October, 1907, delivery.

General Dimensions.

Type of locomotive	Mogul
Weight on drivers	110,000 lbs.
Weight, total	128,000 "
Diameter of Cylinders	19 in.
Stroke of pistons	26 "
Diameter of drivers	56 "
Boiler, type	Extended wagon top
" working steam pressure	180 lbs.
" heating surface, total	1,610 sq. ft.
" tubes, number	about 200
" " outside diameter	2 in.
" " length	12 ft. 2 "
Firebox, length	108 "
Firebox, width	40 "
Grate area	30 sq. ft.
Tank capacity	3,500 gals.
Coal capacity	6 tons

Special Equipment.

Couplers	Tower
Injector	Nathan
Safety valve	Coale
Sanding devices	Leach pneumatic
Sight-feed lubricators	Nathan
Spring	American Locomotive Co.
Steam gages	Ashcroft

CAR BUILDING.

O. F. Wasondorff, Lewiston, Montana, is said to be in the market for 30 dump cars.

The Atlantic, Quebec & Western is said to be in the market for freight equipment.

The Armour Car Lines, Chicago, have ordered 35 tank cars from the Bettendorf Axle Company.

The Morris & Company Tank Car Line, Chicago, has ordered 10 tank cars from the Bettendorf Axle Company.

The Las Vegas & Tonopah recently ordered three coaches and three baggage cars from the Pullman Company.

The Dead Stock Car Company, Chicago, is building at its own shops 100 stock cars, for which it is now buying material.

The Texas & Pacific, it is understood, has ordered 3,000 box cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The Mexican Plantation Company, Los Angeles, Cal., is said to have ordered 10 tank cars from the Pressed Steel Car Company.

The Penn & Franklin Street Railway, which is building a line from Wilkinsburg, Pa., to East Pittsburg, has ordered 10 closed cars from the St. Louis Car Company.

The Waterloo, Cedar Falls & Northern has ordered seven single truck closed cars from the McGuire Cummings Manufacturing Co., for October delivery. These cars will weigh 10 tons and measure 20 ft. long and 7 ft. 6 in. wide, inside measurements.

The Buffalo, Rochester & Pittsburg has ordered 500 50-ton all steel gondola cars from the Standard Steel Car Company for December delivery; 250 50-ton all steel gondola cars and 250 40-ton gondola cars, 41 ft. long, inside measurements, with 30-in. sides and drop ends, from the American Car & Foundry Company, for October delivery.

The Lake Shore & Michigan Southern is building 10 automobile baggage cars at its Collinwood shops. These cars will measure 60 ft. long and 9 ft. 8 in. wide, over sills, and 14 ft. 6 in. high, over all. The special equipment includes:

Brakes	Westinghouse
Draft rigging	Gould
Heating System	Gold
Light	Pintsch
Platforms	Gould
Wheels	Paige

RAILROAD STRUCTURES.

Buffalo, N. Y.—The principal roads entering Buffalo have submitted a plan to spend about $12,000,000 on a union passenger station and connections in that city on condition that the city shall widen certain streets, and shall spend $1,000,000 for new streets and approaches, and, furthermore, pay about 35 per cent. of the cost of eliminating grade crossings.

Cincinnati, Ohio.—The Cincinnati Southern, it is said, has decided to start preliminary work for the construction of a viaduct approach. This does not include laying tracks for the Front street terminals. Plans for the latter are under way.

Columbus, Ohio.—The City Council has passed an ordinance authorizing an issue of $1,000,000 in bonds to secure funds to be used for the elimination of grade crossings. The railroads interested are to pay an additional $1,000,000 towards the work.

Kansas City, Mo.—A special election is to be held next fall to allow the voters to decide whether the Kansas Terminal Railway Company shall be granted a 200-year franchise as agreed between the city officials and the railroads interested. The company is to build the proposed new union passenger station and passenger terminals at a cost of between $15,000,000 and $20,000,000. There will probably be considerable delay in disposing of bonds of the railroad companies sufficient to carry out the work. About $2,000,000 has already been contributed by the railroads for the right of way for the proposed belt line, and bonds cannot be issued until the franchise is granted by the municipality of Kansas City.

Laredo, Tex.—Plans, it is said, have been made by the National of Mexico to build a second bridge over the Rio Grande river here, to cost $500,000.

Logan, Ohio.—The Hocking Valley has given an order to the Mount Vernon Bridge Company for the structural steel to be used in its new shops. The buildings include a power house 60 ft. x 120 ft.; carpenter shops, 60 ft. x 120 ft.; office and store-rooms, 25 ft. x 50 ft.; pipe and tin shops, 30 ft. x 50 ft., and lumber driers, 40 ft. x 50 ft. The buildings will be of structural steel and brick and equipped with modern machinery. Contract for the main shop building is also let to the Mount Vernon Bridge Company.

McKeesport, Pa.—Contract is reported let by the McKeesport & Port Vue Bridge Company to the Dravo Construction Company for building a steel bridge over the Baltimore & Ohio tracks at Fifteenth avenue and Walnut street. The bridge, which is to carry street cars, is to cost $150,000.

McKees Rocks, Pa.—The Pittsburg & Lake Erie has bought 10 acres of ground near its shops at this place as a site for new buildings.

New Castle, Pa.—Local reports state that the Pennsylvania is planning to spend $250,000 for a new electric power plant and roundhouse here.

New York, N. Y.—The car barn of the Metropolitan Street Railway Company at 85th street was recently damaged by a recent fire; loss about $200,000.

St. Thomas, Ont.—The Pere Marquette has plans made for enlarging its division shops here, also to put up a new 24-stall roundhouse and remodel its old roundhouse into a car repair shop.

Shire Oaks, Pa.—The Pennsylvania Railroad has just finished a new roundhouse of concrete and cement, with a plaster superstructure, at this place, which is on the Monongahela division. Owing to the corrosion of steel from engine gases, the interior of the building is finished in wood. There are nine stalls.

Tucumari, N. Mex.—The El Paso & Southwestern, it is said, will abandon its shops at Santa Rosa and put up new ones at this place. A site has already been selected and land bought. When the shops are finished it is proposed to make this place a division point.

Wichita, Kan.—The Kansas City, Mexico & Orient, it is said, has bought land as a site for a new freight house to cost $30,000.

Winnipeg, Man.—Contract is reported let to S. Brown by the Canadian Northern for shops to cost about $210,000. The work includes a blacksmith shop 100 ft. x 144 ft., a planing mill 100 ft. x 144 ft., and a car repair shop 100 ft. x 192 ft.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Atchison, Topeka & Santa Fe.—An officer writes that work on the Western Oklahoma from Alston, Okla., southeast to Seiling, 32 miles, was stopped about two months ago, and the project abandoned, on account of adverse legislation in Oklahoma. (March 15, p. 379.)

Contracts are reported let by this company to A. Moore, of Newton, Kan., for reconstructing 36 miles of its road from Woodward, Okla., west towards Higgins, Tex.

Atlantic & Lake Superior.—See Atlantic, Quebec & Western.

Atlantic, Quebec & Western.—In connection with the recent sale to this company of the Atlantic & Lake Superior, plans have been made to establish a new Atlantic coast terminal at Gaspe, Que. The Atlantic & Lake Superior operates about 100 miles from the Intercolonial at Metapedia east to Paspebiac. It is intended to extend the road from Paspebiac northeast to Gaspe, approximately 75 miles. The Atlantic, Quebec & Western was incorporated last year to build from Gaspe west to Amqui, thence south to a point on the St. John river, about 260 miles. Charles Brien and Joseph Lavoie, of Gaspe, are directors. The offices of the company are in London, England. (March 15, p. 394.)

Baltimore & Ohio.—The old main line of this company between Relay, Md., and Washington Junction has been practically rebuilt during the past eight years and transformed from a line with many curves and steep grades to one of easy curvature and light grades. The distance has been considerably shortened and is now about 58 miles. The improvements cost over $3,000,000. The work involved straightening the line between Orange Grove and Ilchester by building an entire new line for seven-eighths of a mile and a double-track tunnel about a quarter of a mile long, arched throughout, also a new bridge over the Patapsco river and a county road on the west side of the river. The work west of Oella and at Union Dam, for about a mile, involved the construction of a double-track tunnel at Union Dam, over an eighth of a mile long. At Hollofields passenger sidings were built for east and westbound traffic, together with signal towers and interlocking. About 90 per cent. of the Alberton improvement is finished; this involves an entire change in alinement from a point west of Hollofields to a point near Davis station, about three miles. The present roadbed will be abandoned except for about a half mile east of Alberton, where it will be raised and straightened. At Henryton the tunnel was widened to the standard size and arched throughout. Between Sykesville and Gaither there was extensive straightening, and new tracks, an interlocking, two bridges and a 250-ft. tunnel were built. Between Morgan and Woodbine the work involved the construction of a double-track tunnel 285 ft. long. To reduce the grade over Parr's Ridge at Mt. Airy a new line was built between Watersville and Monrovia, 11 miles. Between Ijamsville and Frederick Junction, four miles, the grades were also lightened, and a coaling plant, water station, 13,000 ft. of passing sidings and interlocking tower and switches were constructed; also a double-track tunnel 210 ft.

long and five steel girder bridges. Grade improvements were also made between Frederick Junction and Buckeystown for a distance of one mile. To facilitate the movement of eastbound traffic a single-track detour line was built between Adamstown and Washington Junction, nearly six miles, an increase in distance of two miles over the old line, but reducing the grade from 39 ft. to 15.8 ft. per mile, enabling a full train of 2,500 tons to be moved with one locomotive between Brunswick Yard and Reel's Mills. This line is used entirely for heavy eastbound trains.

BILOXI GREAT NORTHERN.—Under this name a company is being organized in Mississippi to build a line from Biloxi north to a connection with the Mobile & Ohio at Bucatunna, 80 miles. W. M. Dukati is to be President; J. B. Chinn, Vice-President; W. Gorenflo, Treasurer, and I. Heidemheim, Secretary. W. L. Covel is also interested. The headquarters of the company will be at Biloxi.

BUFFALO, GENESEE & ROCHESTER (ELECTRIC).—The New York State Railroad Commission has granted a certificate of necessity to this company, which proposes to build a double track street railway from Depew, N. Y., to Rochester, 60 miles. The company will also take over the Buffalo & Depew, which is now in operation. The road will run through the towns and villages of Lancaster, Crittenden, Corfu, Batavia, LeRoy and Chili. The capital stock is $7,500,000. The commission has also consented to a mortgage for $5,000,000. (May 31, p. 759.)

BUFFALO & DEPEW (ELECTRIC).—See Buffalo, Genesee & Rochester.

CANADIAN PACIFIC.—Contracts are reported let to William Dixon and Gourley Hutchinson, of Dryden, Ont., for double-tracking the main line of this road between Wabigoon and Barclay, about 10 miles.

CENTRALIA & SANDOVAL (ELECTRIC).—Incorporated in Illinois to build an electric line from Centralia north parallel to the Illinois Central, to Sandoval, eight miles. The incorporators include: W. M. Warneck, G. D. Burroughs, of Edwardsville; F. Noleman and E. R. List, of Centralia, and F. E. Allen, of St. Louis.

ELKIN & ALLEGHENY.—This company, which proposes to build a line from Elkin, N. C., on the Southern Railway northwest to Marion, Va., on the Norfolk & Western, about 80 miles, is making surveys and securing the right of way. Grading, it is expected, will be started next month. J. W. Stevens, Chief Engineer, Elkin.

FREDERICK & MIDDLETOWN ELECTRIC.—See Frederick Interurban.

FREDERICK INTERURBAN (MD.).—This company was recently incorporated in Maryland as a consolidation of the Frederick & Middletown Electric Railway and the Jefferson & Braddock Heights, the latter having recently finished its line. The new company will operate the Myersville & Catoctin Railway now operated by the Frederick & Middletown, and will connect Frederick, Middletown, Braddock and Jefferson. The question of building an extension from Jefferson southwest to Brunswick is under consideration.

GRAND TRUNK PACIFIC.—Contracts are reported let to Treat & Johnson, of Winnipeg, for building 51 miles of line between Winnipeg and Portage la Prairie.

HORNELL, BATH & LAKE KEUKA (ELECTRIC).—A certificate of necessity has been granted this company by the New York Board of Railroad Commissioners to build an electric line from Hornell, N. Y., east to Bath, thence northeast via Hammondsport to Branchport, 50 miles. (March 15, p. 385.)

HUDSON BAY PACIFIC.—It is reported that this company has been organized in Seattle, Wash., with $100,000,000 capital, to build from Hudson Bay west to Port Simpson, on the Pacific coast. David B. May, Secretary, Seattle, Wash.

JEFFERSON & BRADDOCK HEIGHTS COMPANY (ELECTRIC).—See Frederick Interurban.

JOPLIN & PITTSBURG.—Incorporated in Missouri, with $5,000,000, to build 150 miles of railroad from Joplin, Mo., north and west, traversing Jasper county, Mo., and Crawford, Cherokee and Labette counties in Kansas. The incorporators include: Fred H. Fitch, Pittsburg, Kan.; H. W. Noble, Detroit, Mich.; D. L. Robinson, Buffalo, N. Y.; John W. W. Ground, William W. Calhoun and Thomas Kirwin, Carthage, and Joseph J. Heiman, John A. Prescott, R. E. Richardson, C. G. Hutchinson and E. C. Wright, Kansas City.

KALAMAZOO, LAKE SHORE & CHICAGO.—This company, it is said, will build a branch from Toquin, Mich., southwest to Pawpaw Lake, 4½ miles. New station and terminal yards are to be built at Kalamazoo and at South Haven.

KANSAS CITY, MEXICO & ORIENT.—Rights of way, it is reported, are being secured by this company for a proposed branch from Sentinel, in Washita County, Okla., southeast to Lawton, about 70 miles. The proposed route from Lawton is through Fort Sill reservation, thence following Medicine creek via Saddle mountain and Hobart to Sentinel. An extension of this branch from Lawton east to Sulphur, about 100 miles, is also projected.

LOUISVILLE & NASHVILLE.—It is said that the Louisville & Nashville will build a large freight yard 350 ft. wide and two miles long on land already bought, at Gentilly, La.; also an auxiliary yard. Work is to be started at once.

MILWAUKEE & NORTHERN (ELECTRIC).—Local reports state that this company and the Sheboygan Heat, Light & Traction Company have been consolidated under one management. This, it is said, indicates that the proposed electric line from Milwaukee via Port Washington to Sheboygan will be built.

NORTHERN EMPIRE.—Application is being made by this company to the Dominion Parliament for a charter to build a line from the international boundary, near Cardston, Alb., north through Lethbridge, Fort McMurray, Fort Vermilion and the Yukon territory to a point on the international boundary between Yukon territory and Alaska. J. B. T. Caron, Ottawa, is solicitor for the applicants.

PENSACOLA, ALABAMA & WESTERN.—Bids are wanted July 10, by the Interstate Contract Company, 224 Brent building, Pensacola, Fla., for grading 20 miles of line on the Andalusia division, also for 20 miles on the Atmore division, as noted on advertising page 22.

PERLA NORTHERN.—An officer writes that this company, which operates 18 miles of road from Perla, Ark., north via Magnet and Lonsdale to Whittington, is building with its own forces an extension northwest to a point not yet determined upon. From the southern terminus at Perla there is a branch running east to Gifford, and another branch is under construction from Perla southeast to a junction with the Wyandotte & Southeastern on the eastern boundary of Hot Springs County.

ST. JOSEPH & NODAWAY VALLEY.—Surveys reported made for this proposed line from St. Joseph, Mo., north via Savannah, Fillmore and Graham to Tarkio, in Atchison County, 78 miles. J. W. Brockett, Chief Engineer, St. Joseph, Mo.

ST. LOUIS & SAN FRANCISCO.—An officer writes that surveys are being made for a connecting line from Okmulgee, Ind. T., to Shawnee, Okla., approximately 70 miles. The line will be located in about 60 days, when bids will be asked for the work.

SALVATIERRA & WESTERN.—This company, which proposes to build a line from Salvatierra, in the state of Guanajuato, Mex., west to Puruandiro, in the state of Michoacan, about 50 miles, is making preliminary surveys. This line is to be built under a concession given to Andres Bermejillo, of Mexico City. Connection is to be made with the National of Mexico at Salvatierra. C. A. Malau is Chief Engineer.

SHEBOYGAN HEAT, LIGHT & TRACTION COMPANY.—See Milwaukee & Northern (Electric).

TERRE HAUTE & MEROM (ELECTRIC).—An officer writes that this Company, which was recently incorporated in Indiana, will let contracts within two or three months for building its proposed electric line from Terre Haute, Ind., south via Princeton, Middletown, Fairbanks and Graysville to Merom, about 35 miles. L. Brown, President, Fifth and Main streets, and J. Caswell, Chief Engineer, Terre Haute, Ind. (June 14, p. 879.)

TEXAS CENTRAL.—Announcement is made that this company will build a branch from Dublin, Tex., north to Thurber, about 30 miles, to reach extensive coal fields near that city. It is probable that the proposed branch will be extended further north to a connection with the Fort Worth & Denver City, either at Wichita Falls or Vernon, about 100 miles.

WASHINGTON ROADS (ELECTRIC).—According to local reports, Stone & Webster, of Boston, Mass., have bought the holdings and franchises of the Everett Electric Company. This purchase, it is said, insures the building of an electric line from Tacoma north to Vancouver, B. C.

WESTERN OKLAHOMA.—See Atchison, Topeka & Santa Fe.

RAILROAD CORPORATION NEWS.

BANGOR & AROOSTOOK.—This company has asked the Maine State Railroad Commission for permission to increase its capital stock from $1,550,000 to $2,342,000. The new stock is to be used to buy the capital stock of the Northern Maine Seaport Railroad & Terminal and that of the Schoodic Stream Railroad; both companies are now operated by the Bangor & Aroostook. The Northern Maine Seaport was recently built as an extension from La Grange, Me., south to Searsport, 54 miles, and the Schoodic Stream Railroad is a branch line connecting with the Bangor & Aroostook near Milo.

BOSTON & MAINE.—See New York, New Haven & Hartford.

BUFFALO & SUSQUEHANNA.—After July 1 this company will use the New York Central passenger station at Buffalo, entering the city over the Lake Shore tracks from Blasdell, two miles south.

At present the company uses the Erie passenger station, which it reaches over the Erie's line from Hamburg, 12 miles south. (Feb. 8, p. 196.)

Central of Georgia.—Adrian H. Joline, Chairman of the Richmond Terminal Company reorganization committee, announced on June 26 that the committee had sold the $5,000,000 capital stock of the Central of Georgia, which it held, to Oakleigh Thorne, President of the Trust Company of America, and Marsden J. Perry, of Providence, R. I. The proceeds of the sale will be paid to the Southern. It has been supposed that this stock was held in the interests of the Southern, but this has not hitherto been officially admitted.

Central New England.—The Newburgh, Dutchess & Connecticut, the Dutchess County Railway, and the Poughkeepsie & Eastern have been merged with the Central New England. The Central New England runs from Campbell Hall, N. Y., across the Hudson river at Poughkeepsie by its own bridge to Silvernails, 58 miles, with an 18-mile branch, and also leases and controls the Hartford & Connecticut Western, which runs from Hartford to Rhinecliff, 109 miles. It has heretofore leased the Dutchess County Railway, running from Poughkeepsie to Hopewell Junction, 12 miles, and the Newburgh, Dutchess & Connecticut, Dutchess Junction, N. Y., to Millerton, 59 miles. The Poughkeepsie & Eastern was bought by the New York, New Haven & Hartford last spring. It runs from Boston Corners to Poughkeepsie, 40 miles.

Chesapeake & Ohio.—Plans are under way for authorizing about $25,000,000 bonds. It is probable that they will not be issued for the present except as collateral for note issues. It is reported that about $6,000,000 notes may be sold soon.

Chicago & Eastern Illinois.—Speyer & Co. and Goldman, Sachs & Co. have formed a syndicate to underwrite an issue of 5 per cent. bonds, which is to be made to refund the $2,655,900 6 per cent. first mortgage bonds due December 1, 1907.

Chicago, Indiana & Southern.—See New York Central Lines.

Chicago, Indianapolis & Evansville.—A mortgage for $15,000,000 in favor of the Western Trust & Savings Bank, Chicago, and securing a bond issue of equal amount, has been filed in Indianapolis by the promoters of this road, which is projected to run from Chicago south to Evansville, Ind., through Indianapolis, with branches to Gary, South Bend and to Owensville, Ky.

Chicago Junction.—See New York Central Lines.

Cincinnati, Hamilton & Dayton.—The Receiver has been given permission to extend for one year the time for the payment of the $1,023,660 receivers' certificates falling due July 1, 1907. In asking for the extension, the Receiver said that a reorganization of the company's affairs was under way, and that through it the receivers' certificates would be paid in full before July 1, 1908.

Dutchess County Railway.—See Central New England.

Erie.—See Buffalo & Susquehanna.

Indiana Harbor (Belt).—See New York Central Lines.

Kansas City Southern.—Gross earnings for May were $866,468, an increase of $100,815; net earnings, less taxes, $350,205, an increase of $102,094. Gross earnings for 11 months ended May 31 were $8,414,456, an increase of $1,323,545; net earnings, less taxes, $3,261,182, an increase of $1,490,115.

Lake Shore & Michigan Southern.—See Buffalo & Susquehanna.

Long Island Railroad.—James H. Vandewater has applied to the Attorney-General of New York to bring action against the Long Island Railroad to have the franchises of the Jamaica & South Shore branch declared forfeited. It is contended that the branch, which is about 10 miles long, has been abandoned since 1879 and that only recently track-laying on its right of way was begun to prevent possible competition.

Missouri, Kansas & Texas.—Spencer Trask & Co., Mackay & Co. and the Mercantile Trust Company of St. Louis are offering jointly $2,500,000 general mortgage 4½ per cent. sinking fund bonds at 84½ and interest, yielding about 5.60 per cent. The bonds are part of an outstanding issue of $10,000,000 sold last year. The authorized issue is $20,000,000.

Mohawk Valley.—See Utica & Mohawk Valley.

Nantucket Central.—This 3-ft. gage road, 8½ miles long, running from Nantucket, Mass., to Siasconsett, has been sold by its owner, Delmont L. Weeks, of Boston, to a syndicate represented by Thomas J. Macey, of New York. The road is usually operated only for four months in the summer, and was not operated at all last year. The price paid is reported to be $12,000.

Newburgh, Dutchess & Connecticut.—See Central New England.

New York Central Lines.—New York Central interests have taken a lease, effective July 1, on the Chicago Junction Railway's belt line around Chicago from Whiting, Ind., to Franklin Park, Ill., 27 miles, and have also taken an option on this property. It is understood that there is no question but that the option will be exercised and the line ultimately turned over to some New York Central line, probably the Chicago, Indiana & Southern or the Indiana Harbor (Belt). In addition to the line referred to above, the Chicago Junction operates a branch from Chappell, Ill., to the Union Stock Yards, and leases and has trackage rights over other roads, but these lines are not included in the New York Central deal. The entire $2,200,000 capital stock of the Chicago Junction is owned by the Chicago Junction Railways & Union Stock Yards Company.

New York, New Haven & Hartford.—A bill restraining the consolidation of the Boston & Maine with this company until after the next Massachusetts Legislature can act has passed the lower house and now goes to the Senate. The bill provides that the New Haven shall not assume control of the Boston & Maine, nor shall anyone connected with the New Haven hold office on the Boston & Maine, nor vote any share of Boston & Maine stock until the next legislature takes action. See Central New England; also Old Colony.

Northern Maine Seaport.—See Bangor & Aroostook.

Northern Maine Seaport Railroad & Terminal.—See Bangor & Aroostook.

Old Colony Railroad.—The Governor of Massachusetts has signed a bill authorizing this company to buy the Boston & Providence, which runs from Boston, Mass., to Providence, R. I., 63 miles, including branches. It is leased to the N. Y., N. H. & H. through the Old Colony.

Pere Marquette.—The plan for reorganization includes, in addition to the details reported in the *Railroad Gazette* of June 21, the offering of part of the proposed issue of 5-year, 6 per cent. notes to common stockholders to the extent of 20 per cent. of their present holdings. The common stockholders are to exchange their holdings for an equal amount of new common stock plus an additional amount of new common stock equal to the par value of the notes for which they subscribe.

Philadelphia, Baltimore & Washington.—It is denied that the meeting of stockholders called for July 31 has any connection with a consolidation of Pennsylvania lines in Maryland.

Poughkeepsie & Eastern.—See Central New England.

St. Louis & San Francisco.—A meeting of the stockholders has been called for August 27 to authorize $115,000,000 general lien, 5 per cent. bonds of 1927, redeemable prior to May 1, 1922, at 102½ and interest, and afterwards at par and interest. Of the total amount, $67,818,000 will be reserved for refunding; $10,000,000 is to be issued during the next two years for additions and improvements, and the rest is to be issued only after June 1, 1909, as follows: for improvements and betterments, $27,182,000 at the rate of $2,500,000 a year until 1911, and after that at the rate of $3,000,000 a year; to refund future equipment notes, $5,000,000 to the extent of 6 per cent. of the face value of the notes; and for construction and new lines, $5,000,000. The new mortgage will be a first lien on the road built or acquired by the proceeds of the sale of the new bonds; also on 1,526 miles of road on which the bonds to be refunded now have a lien, and, subject to existing mortgages, on the 3,798 miles of road leased or controlled by the company. The stockholders will also be asked to authorize an increase in the capital stock from $100,000,000 to $200,000,000, a formality necessary because the Missouri laws require that the bonded debt shall not be greater than the capital stock.

Schoodic Stream Railroad.—See Bangor & Aroostook.

Southern.—See Central of Georgia.

Texas Central.—The suit brought by the Texas Railroad Commission for the cancellation of $650,000 outstanding bonds has been dismissed. The commission contended that the bonds were illegal because it had not consented to their issue on the ground that the value of the road on which the bonds were secured was less than the outstanding capital stock. (Nov. 1, 1906, p. 124.)

Texas & Pacific.—This company has sold to Blair & Co. $3,100,000 10-year, 5 per cent. equipment notes maturing in 20 equal semi-annual instalments, and $450,000 Louisiana division first mortgage bonds. The proceeds of the Louisiana division bonds will cover extensions completed in Louisiana.

Utica & Mohawk Valley (Electric).—This company, whose road runs from Utica, N. Y., to Rome and other points, 109 miles, has been given permission to increase its common stock from $6,250,000 to $7,500,000 to pay for work under way. The company is controlled by the Mohawk Valley Co.

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